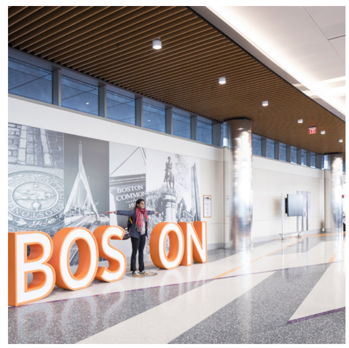
Boston-Logan International Airport



EDR

2016 Environmental Data Report

May 2018
EOEA #3247

SUBMITTED TO
Executive Office of Energy and
Environmental Affairs, MEPA Office

SUBMITTED BY
Massachusetts Port Authority
Strategic & Business Planning

PREPARED BY
vhb

IN ASSOCIATION WITH
Harris Miller Miller & Hanson, Inc
KB Environmental Sciences, Inc.
ICF

Boston-Logan International Airport




EDR

2016 Environmental Data Report

May 2018
EOEA #3247

SUBMITTED TO
Executive Office of Energy and Environmental Affairs, MEPA Office

SUBMITTED BY
Massachusetts Port Authority
Strategic & Business Planning

PREPARED BY
vhb

IN ASSOCIATION WITH
Harris Miller Miller & Hanson, Inc
KB Environmental Sciences, Inc.
ICF

Massachusetts Port Authority
One Harborside Drive
East Boston, MA 02128-2909
Telephone (617) 568-5000
www.massport.com

May 15, 2018

The Honorable Matthew Beaton, Secretary
Executive Office of Energy and Environmental Affairs
Attn: Anne Canaday, EEA 3247
100 Cambridge Street, Suite 900
Boston, Massachusetts 02114

Re: Boston-Logan International Airport 2016 Environmental Data Report - EEA #3247

Dear Secretary Beaton and Director Buckley:

The Massachusetts Port Authority (Massport), is pleased to submit this *2016 Environmental Data Report* (EDR). As outlined in our recent *Notice of Project Change* (NPC) and the NPC Certificate dated March 9, 2018, Massport requested Executive Office of Energy and Environmental Affairs (EEA) approval to substitute the planned *2016 Environmental Status and Planning Report* (ESPR) with a *2016 EDR*, due to changing circumstances and uncertain trends, as more fully described below.

As described in this EDR and the NPC, Logan Airport is in another phase of transition. Several factors lead to Massport's conclusion that 2016 was not the appropriate baseline for the next ESPR which will include forecasting of future operational and environmental conditions. These factors include (1) rapidly growing domestic and international passenger demand, (2) the formal introduction in early 2017 of transportation network companies (TNC) such as Uber and Lyft, and (3) use of the Federal Aviation Administration's (FAA) new noise and air quality model.

Accordingly, with EEA approval, Massport has prepared the *2016 EDR* as a continuation of our longstanding commitment to publish detailed cumulative analyses of environmental conditions. This includes detailed information on passenger activity levels and aircraft operations; ground access; planning activities; and updates on our mitigation programs. A few of the key activity influences and operational/environmental findings are summarized below.

- **Passenger Growth**. Passenger activity at Logan Airport has continued to grow faster than previous forecasts; both 2016 and 2017 achieved new passenger level peaks. This growth is being experienced across the U.S., but more prominently here in Boston due to a strong regional economy based primarily on business, education, healthcare, and tourism.

  While Logan has also experienced a growth in aircraft operations, passenger growth continues to far outpace the increase in aircraft operations. This trend of more passengers in fewer flights remains consistent with our recent experience, and it supports Massport's long-standing goals to reduce overall operating and environmental impacts at Logan Airport.

- **Ground Access**. Logan Airport, like many airports across the U.S., is experiencing a dramatic shift in ground access modes. TNCs such as Lyft and Uber did not exist a few years ago are becoming prominent providers of Logan Airport passenger ground access/egress. This new mode is already beginning to have a dramatic impact on how our passengers arrive and depart Logan Airport. TNCs formally began picking up at Logan Airport in February 2017; some early discussion of those effects is contained in this *2016 EDR*, but the forthcoming *2017 ESPR* will provide a better indication of future ground access mode share trends than was available for this EDR.

- **New FAA Noise and Air Quality Model**. The 2016 noise analysis marks the first time Massport has used the Federal Aviation Administration's (FAA) new Aviation Environmental Design Tool (AEDT). As described in the *2015 EDR*, AEDT does not incorporate a number of the Logan Airport-specific model adjustments incorporated in the legacy Integrated Noise Model (INM). Therefore, until the 2016 analysis, when some broader adjustments to AEDT were made by FAA, Massport had deferred its use in the annual EDRs. The *2016 EDR* uses AEDT for the first time.

  Similarly, AEDT is now used for the detailed air quality analyses. As with other model changes, AEDT has many new emission factors that influence the annual results. For that reason, this EDR presents 2016 air quality findings using both the legacy EDMS (*Emissions and Dispersion Modeling System*) model and AEDT and discusses year-to-year differences based on operational levels and model differences.

In consideration of the adjusted filing sequence and schedule and in accordance with the NPC Certificate, the *2016 EDR* strives to provide a broader context of these evolving factors and also provides available updates on recent and ongoing Logan Airport projects and longer-range planning considerations. This includes the Terminal E Modernization Project, which is now in final design, and the Logan Airport Parking Project and its role in Massport strategies to reduce drop-off/pick-up trips which cause unnecessary vehicle miles traveled and associated emissions.

The EDR provides an update on the status of those and other ongoing Logan Airport projects, planning and environmental initiatives as well as previewing planned and potential new projects and programs. This EDR also contains the detailed annual data reporting on Logan Airport activity, planning, ground access, noise, air quality, sustainability, water quality, and environmental mitigation tracking. Where relevant, we also discuss evolving topics since filing of the *2015 EDR*. In coordination with the MEPA Office and the MA Department of Energy Resources, this EDR also includes several new greenhouse gas (GHG) reporting metrics.

EDR Content and Structure

The *2016 EDR* responds to the Secretary's Certificate on the *Boston-Logan International Airport 2015 Environmental Data Report*, as amended in the Secretary's March 2018 Certificate on the NPC. The document reports on the status of airport operations, environmental conditions, and Massport milestones achieved since 2015 and provides updates on more recent significant Logan Airport planning activities. The *2016 EDR* also updates 2016 conditions for the following categories:

- Passenger levels, aircraft operations, aircraft fleets, and cargo volumes;
- Planning, design, and construction activities at Logan Airport;
- Regional transportation statistics and initiatives;
- Key environmental indicators (Ground Access, Noise Abatement, Air Quality/Emissions Reduction, and Water Quality/Environmental Compliance and Management);
- Status of Logan Airport project mitigation; and
- Sustainability initiatives.

The *2016 EDR* includes the Secretary's Certificate on the *Boston-Logan International Airport 2015 EDR* and *2018 NPC* and associated comment letters. Recent certificates received on the *Terminal E Modernization Project Environmental Notification Form* and *Draft* and *Final Environmental Impact Reports* are also included. In addition to the distribution list and supporting technical appendices (included in the attached CD), a proposed scope for the *2017 ESPR* is included as Appendix C.

Review Period, Distribution, and Consultation

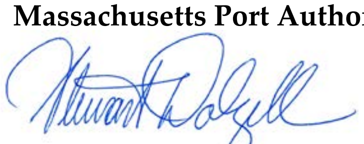
A 30-day public comment period for the *2016 EDR* will begin on May 23, 2018, the publication date of the next Environmental Monitor, and will end on June 22, 2018. The distribution list included as Appendix D indicates which listed parties will receive a digital and/or printed copy of this *2016 EDR*. As with the recent EDRs, ESPRs and other Massport environmental filings, this *2016 EDR* is presented in its entirety on Massport's website (http://www.massport.com/massport/about-massport/project-environmental-filings/).

A public information meeting on the *2016 EDR* is scheduled for Tuesday June 12, 2018 at 6:00 PM in the Cathy Leonard-McLean Community Room on the 1st floor of the Logan Airport Rental Car Center. Additional copies of the *2016 EDR* may be obtained by calling (617) 568-3546 or emailing mgove@massport.com during the public comment period.

We look forward to your review of this document and to consultation with the MEPA Office and other reviewers in the coming weeks. Please feel free to contact me at (617) 568-3524, if you have any questions.

Sincerely,

Massachusetts Port Authority



Stewart Dalzell, Deputy Director
Environmental Planning & Permitting,
Strategic & Business Planning Department

cc: G. Carr, F. Leo, E. Becker, M. Kalowski, M. Gove/Massport

Table of Contents

List of Appendices

List of Tables

List of Figures

This Page Intentionally Left Blank.

1

Introduction/Executive Summary

Introduction

The Massachusetts Port Authority (Massport) is pleased to continue its practice of providing an extensive, almost three-decade record of Boston-Logan International Airport (Logan Airport or Airport) environmental trends, development planning, operations and passenger levels, and Massport's mitigation commitments in this *Logan Airport 2016 Environmental Data Report (EDR)*. Logan Airport, owned and operated by Massport, is New England's primary international and domestic airport. This *2016 EDR* is one in a series of annual environmental review documents submitted to the Secretary of the Executive Office of Energy and Environmental Affairs (EEA) in accordance to the Massachusetts Environmental Policy Act (MEPA)[1] Office since 1979 to report on the cumulative environmental effects of Logan Airport's operations and activities. Logan Airport is the first airport in the nation for which an annual environmental report card on airport activities was prepared, and Massport continues to be a leader in environmental reporting.

Approximately every five years, Massport prepares an Environmental Status and Planning Report (ESPR), which provides a historical and prospective view of Logan Airport. EDRs, prepared annually in the intervals between ESPRs, provide a review of environmental conditions for the reporting year compared to the previous year. Over the long-term, environmental impacts associated with Logan Airport have been decreasing, as reported on each year in the EDR/ESPR filings. This *2016 EDR* follows the *2015 EDR* and reports on 2016 conditions.

Annual Environmental Data Reports and Environmental Status and Planning Reports since 1991.

Following the *2015 EDR*, the next annual report was originally scheduled to be a *2016 ESPR*. With prior approval of the EEA Secretary, Massport has prepared an EDR for 2016. In the past few years, passenger demand trends for air travel have been rapidly increasing, and the air carrier landscape is changing. Additionally, ground transportation at Logan Airport has also changed rapidly with the introduction of transportation network companies (TNCs) such as Uber and Lyft. Due to these rapid changes, 2016 does not serve as a reasonable baseline for prediction of longer-range impact assessment. Therefore, Massport will

1 Massachusetts General Laws Chapter 30, Sections 61-62H. MEPA is implemented by regulations published at 301 Code of Massachusetts Regulations (CMR) 11.00 (the "MEPA Regulations").

prepare a *2017 ESPR,* which will include an updated future forecast and a better understanding of future ground transportation options to and from Logan Airport, after a full year of data have been collected.

The scope for this document was established by the Secretary's Certificate dated February 17, 2017, as amended on March 9, 2018, which is included in Appendix A, *MEPA Certificates and Responses to Comments*. This *2016 EDR* fulfills all the requirements laid out in the Secretary's 2018 Certificate. This *2016 EDR* includes reporting on the following categories and provides detailed responses to comments on the Secretary's Certificate. Future year forecasts and impact assessments will be provided in the *2017 ESPR*.

This *2016 EDR* updates and compares the data presented in the *2015 EDR*, and presents the following information for 2016:

- Activity Levels (including aircraft operations, passenger activity, and cargo volumes)
- Airport Planning (including activities underway and upcoming projects)
- Logan Airport's Role in the Regional Transportation Network
- Ground Access to and from the Airport
- Noise Abatement
- Air Quality/Emissions Reduction
- Water Quality/Environmental Compliance
- Mitigation Commitments
- Sustainability and Resiliency

To enhance the usefulness of this *2016 EDR* as a reference document for reviewers, this report also presents historical data on the environmental conditions at Logan Airport dating back to 1990, in instances where historical information is available.

This *2016 EDR* includes a Spanish translation of the Executive Summary. This translated version is included after the English-version of the Executive Summary.

EEA # 3247

Submitted By

Massachusetts Port Authority
One Harborside Drive, Suite 200S
East Boston, MA 02128

Stewart Dalzell, Deputy Director
Strategic & Business Planning
(617) 568-3524

Michael Gove, Project Manager
Strategic & Business Planning
(617) 568-3546

Logan Airport Planning Context

Logan Airport plays a key role in the metropolitan Boston and New England passenger and freight transportation networks. The Airport boundary encompasses approximately 2,400 acres in East Boston and Winthrop, including approximately 700 acres underwater in Boston Harbor. Logan Airport, shown in **Figures 1-1** and **1-2**, is one of the most land-constrained airports in the nation, and is surrounded on three sides by Boston Harbor.

Logan Airport is close to downtown Boston and is accessible by two public transit lines, five direct bus lines, and a well-connected roadway system. Massport also provides Logan Express bus service to and from Logan Airport for air passengers and employees from park-and-ride lots in Braintree, Framingham, Woburn, and Peabody. The airfield comprises six runways, approximately 15 miles of taxiway, and approximately 240 acres of concrete and asphalt apron. Logan Airport has four passenger terminals (Terminals A, B, C, and E), each with its own ticketing, baggage claim, and ground transportation facilities. Massport continues to evaluate and implement enhancements to Logan Airport's security, operational efficiency, and accessibility to and from the Boston metropolitan area, while carefully monitoring the environmental effects of Logan Airport operations.

In 2016, over 17,000 people were employed at Logan Airport. This included approximately 1,200 Massport airport staff and administrative employees. The Massachusetts Department of Transportation (MassDOT) Aeronautics Division's *Massachusetts Statewide Airport Economic Impact Study Update* found that in 2014, Logan Airport supported approximately 132,000 direct and indirect jobs and contributed nearly $13.3 billion annually to the local economy; this includes all on-Airport businesses, construction, visitor, and multiplier impacts.[2]

In 2016, Logan Airport was the 17th busiest U.S. commercial airport by number of commercial passengers, and the 18th busiest U.S. commercial airport by aircraft movements.[3] Boston is an important domestic and international destination, and air carriers seek to expand international service at Logan Airport based on current and anticipated passenger demand. New international service in the last five years alone has contributed more than $1.3 billion per year to the local economy and $49 million in new incremental tax revenue through income and sales. [4]

Logan Airport fulfills a number of roles in the local, New England, and national air transportation networks. It is the primary airport serving the Boston metropolitan area, the principal New England airport for long-haul services, and a major U.S. international gateway airport for transatlantic services.

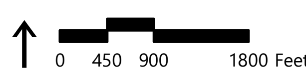
---

2 Massachusetts Aeronautics Commissions. 2014. *Massachusetts Statewide Airport Economic Impact Study*. https://www.massdot.state.ma.us/portals/7/docs/airportEconomicImpactSummary.pdf.

3 Airports Council International. September 2017. *Worldwide Airport Traffic Report*.

4 InterVISTAS. 2015. Economic Impact of Recent International Routes.

FIGURE 1-1 Aerial View of Logan Airport | **2016 Environmental Data Report**



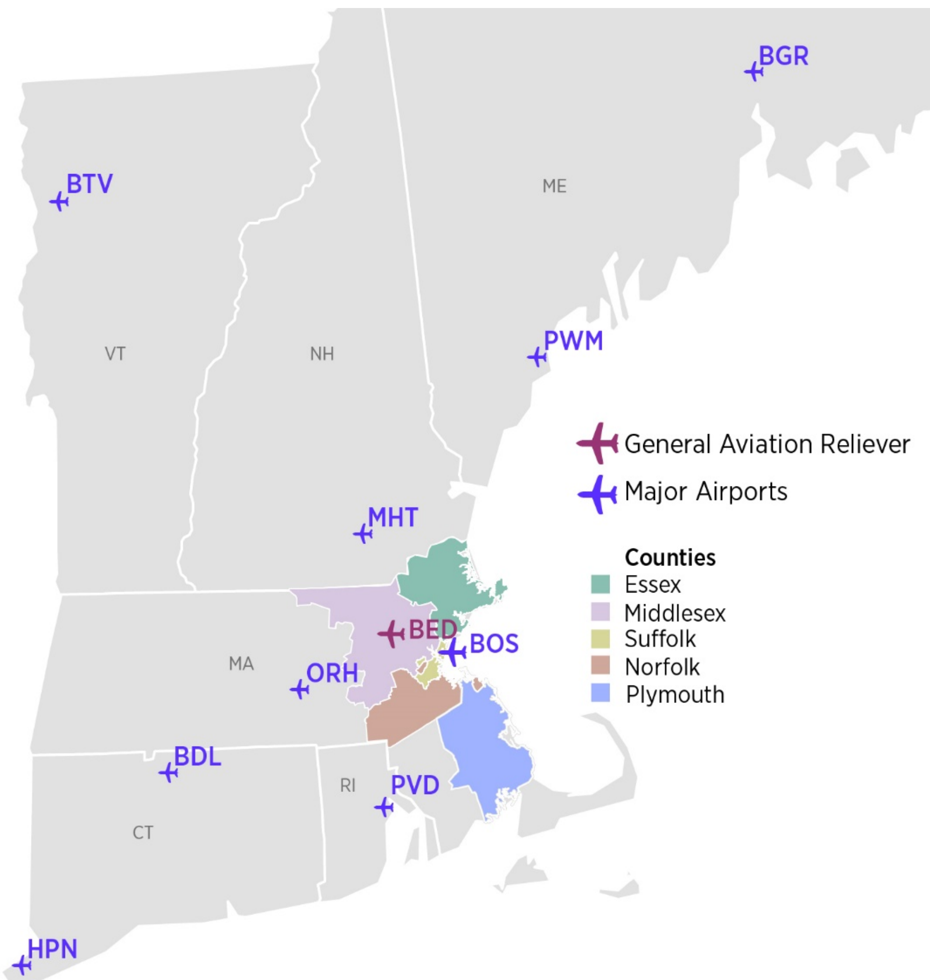
Source: USGS 2015

FIGURE 1-2 Logan Airport and Environs | **2016 Environmental Data Report**

Logan Airport is a Regional Economic Driver

Logan Airport plays an important role in the New England area and is the largest airport in the six-state region (see **Figure 1-3**). Located in Massachusetts, which is home to 14.8 million residents, the Airport draws passengers from across New England, with its primary catchment area consisting of five Massachusetts counties: Essex, Middlesex, Norfolk, Plymouth, and Suffolk (which includes the City of Boston). According to the most recently available statistics, 4.4 million people reside in this five-county area (see **Table 1-1**).

Figure 1-3 Boston Logan International Airport Catchment Area



Notes: BDL – Bradley International Airport; BED – Lawrence G. Hanscom Field; BGR – Bangor International Airport; BOS – Boston-Logan International Airport; BTV - Burlington International Airport; HPN – Westchester County Airport; MHT - Manchester-Boston Regional Airport; PVD - T. F. Green Airport; PWM – Portland International Jetport

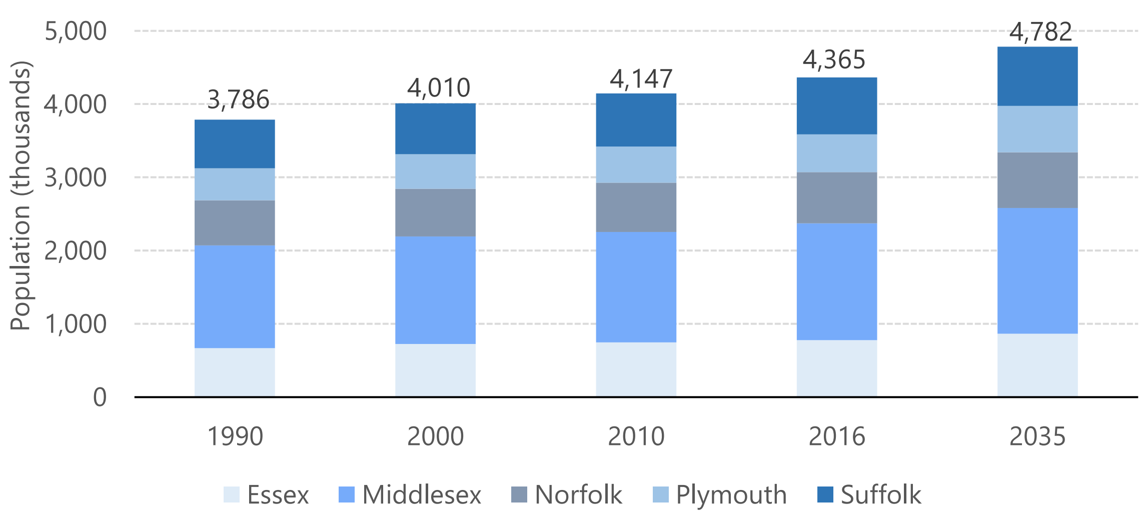
Table 1-1 Population of Logan Airport Primary Catchment Area, 1990, 2000, 2010, 2016

	Population (thousands)				Compound Annual Growth Rates		
County	**1990**	**2000**	**2010**	**2016**	**1990-2000**	**2000-2010**	**2010-2016**
Essex	671	725	746	780	0.8%	0.3%	0.8%
Middlesex	1,399	1,467	1,507	1,591	0.5%	0.3%	0.9%
Norfolk	617	651	672	699.	0.5%	0.3%	0.6%
Plymouth	436	474	495	516	0.8%	0.5%	0.7%
Suffolk	663	693	725	780	0.4%	0.5%	1.2%
Boston Catchment Area	**3,786**	**4,010**	**4,146**	**4,366**	**0.6%**	**0.3%**	**0.9%**
Massachusetts	6,023	6,361	6,565	6,825	0.5%	0.3%	0.6%
New England	13,230	13,950	14,468	14,798	0.5%	0.4%	0.4%
United States	249,623	282,162	309,347	324,161	1.2%	0.9%	0.8%

Source: Complete Economic and Demographic Data Source (CEDDS), Woods & Poole Economics, Inc., 2017.

The role of Logan Airport is expected to continue its dominance since the population of the catchment area has grown faster (0.9 percent) than the population of the United States (0.8 percent), Massachusetts (0.6 percent), and New England (0.4 percent) since 2010 (see **Table 1-1**). The catchment area population is projected to increase at an average rate of 0.5 percent each year over the next 19 years (see **Figure 1-4**).

Figure 1-4 Logan Airport Primary Catchment Area Population Growth, 1990, 2000, 2010, 2016, 2035



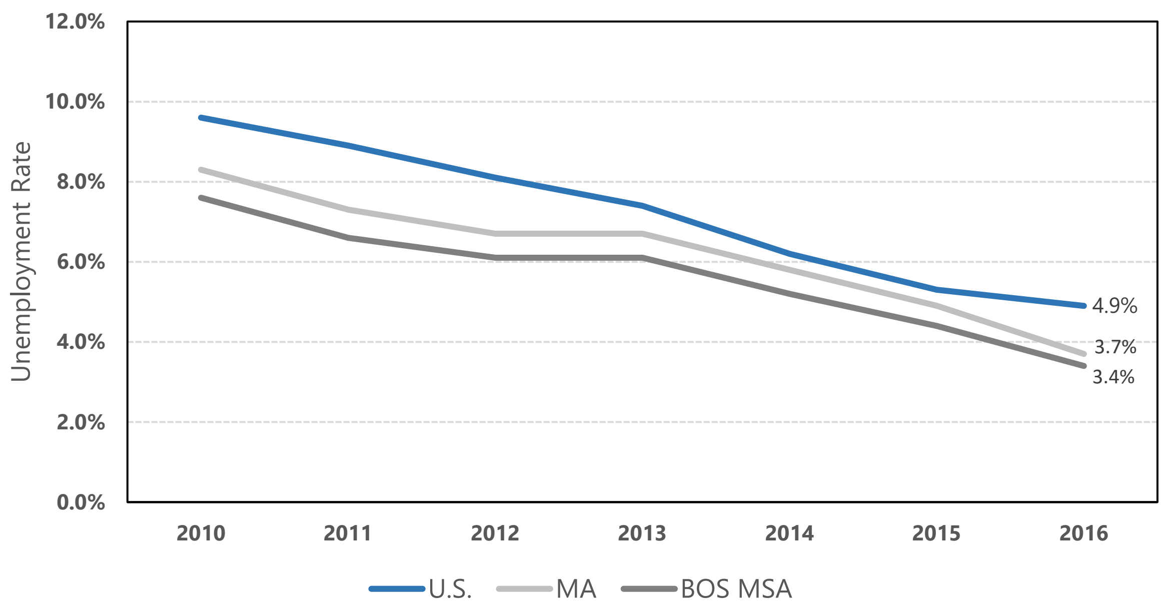
Source: Complete Economic and Demographic Data Source (CEDDS), Woods & Poole Economics, Inc., 2017.

Logan Airport's Regional Market

The area surrounding Logan Airport has demonstrated strong economic growth over the last 10 years, reflecting the interdependent relationship between the regional economy and Logan Airport. The robust regional economy drives passenger and cargo demand, both inbound and outbound, for the Airport. Similarly, the Airport's air service enables businesses to serve customers outside of New England as well as tourists who use services provided by local businesses.

The Boston metropolitan area is home to a broad range of industries, with healthcare and social assistance, educational services, and professional, scientific, and technology services (which include Boston's growing biotech industry) accounting for the largest share of employees.[5] In 2016, Boston was declared the "#1 city in the U.S. for fostering entrepreneurial growth and innovation."[6] The contribution of innovation and business start-ups is also evident in the latest 2017 year-to-date economic growth estimates and reflects trends in increased employment and high-tech industries. The outlook for the state is good. In the third quarter of 2017, the Commonwealth of Massachusetts avoided the dampening effect of Hurricanes Harvey and Irma that affected much of the United States, growing by 5.9 percent.[7] Forecasts of Commonwealth gross domestic product (GDP) for the fourth quarter of 2017 indicate continued growth of approximately 3.3 percent.

Figure 1-5 Unemployment Rate Comparison: United States, Massachusetts and Boston MSA, 2010-2016



Source: U.S. Bureau of Economic Analysis, 2017.

---

5 U.S. Census Bureau via DataUSA. Boston-Cambridge, Newton, MA-NH Metro Area profile. wwww.datausa.io.

6 U.S. Chamber of Commerce Foundation and 1776. 2016. *Innovation That Matters*.

7 MassBenchmarks, The Benchmarks Bulletin, October 27, 2017. Note that MassBenchmarks is a joint program of the University of Massachusetts Donahue Institute and the Federal Reserve Bank of Boston.

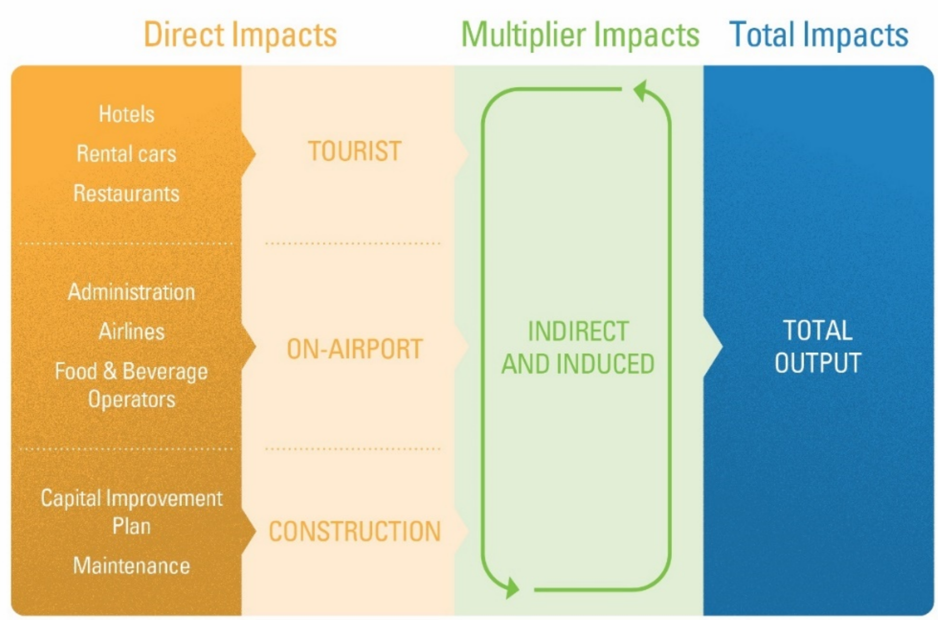
Another reflection of the strength of the Airport's regional market is its relatively low unemployment rate. The Boston metropolitan area has consistently maintained a lower unemployment rate than that of the Commonwealth and the entire country (see **Figure 1-5**). In 2016, the Boston MSA had an unemployment rate of 3.4 percent, which is lower than the rate in the Commonwealth (3.7 percent) and the country (4.9 percent). Even during the economic downturn years of 2008-2010, Boston and the Commonwealth experienced unemployment rates below the national average.

The Airport not only serves a growing population, but a high earning one as well. Per capita income in 2016 was $64,617 (2009 U.S. dollars) in the Airport's primary service area, 10.9 percent higher than the Commonwealth and 44.8 percent higher than the national average.

Logan Airport's Regional Economic Impacts

Logan Airport and the airport industry are a major economic driver in the state and region. The *Massachusetts Statewide Airport Economic Impact Study Update,* completed by MassDOT in 2014,[8] estimates that aviation contributes $16.6 billion in output to the Massachusetts economy annually (see **Table 1-2**); of this output, 80.7 percent of this is due to Logan Airport alone.[9] Total output includes on-Airport businesses, construction, visitor, and multiplier effects (see **Figure 1-6**).[10]

Figure 1-6 Airport Economic Impacts



8 MassDOT. 2014. *Massachusetts Statewide Airport Economic Impact Study Update*. http://www.massdot.state.ma.us/portals/7/docs/airportEconomicImpactSummary.pdf.

9 *Ibid*.

10 Multiplier effects refer to the recirculation of money in the local economy after initially being spent by the Airport, its tenants, or tourists. This recirculation increases the overall impact of the Airport's operation in the local economy.

On-Airport business output includes airport administration, airlines, concessionaires, and other companies that operate at Logan Airport. Implementation of the Capital Improvement Plan (as discussed in Chapter 3, *Airport Planning*). The visitor impacts represent the expenditure on hotels, rental cars, restaurants, and attractions of tourists arriving at the Airport. Millions of people travel to Massachusetts, particularly to the City of Boston, every year to enjoy the rich historic and cultural heritage, attend cultural or sporting events, conduct business, visit recreational areas, and attend conferences at one of the City's convention centers. Over 1.8 million overseas visitors and 25 million domestic visitors[11] traveled to the state in 2016.[12]

In addition to direct effects, Logan Airport generates multiplier effects in the surrounding region that consist of two categories: 1) the expenditure of Airport tenants; and 2) the re-spending of wages by Airport employees. As a result, money spent at the Airport is re-circulated in the local economy multiple times. Airport tenants or businesses operating at the Airport purchase goods and services locally (such as delivery services and food ingredients). The annual wages and benefits (approximately $4.3 billion) of the more than 132,000 regional employees (see **Table 1-2**) supported by the Airport are re-spent in the local community as employees purchase daily necessities.

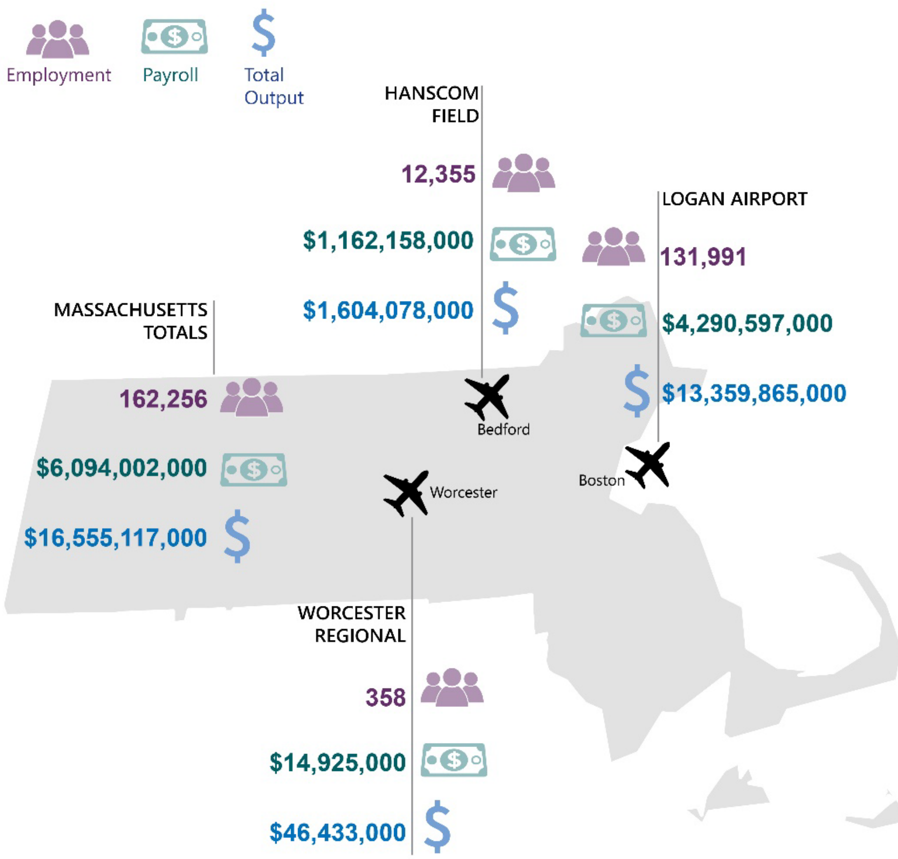
The arrival of international visitors has been aided by the growth in non-stop international service at the Airport, operated by new, foreign-based carriers using cleaner and quieter wide-body aircraft. In 2016, international visitors spent $2.8 billion in the Commonwealth, a 3.1-percent increase from 2015, on public transportation, rental cars, food, lodging, entertainment, and retail (see **Table 1-3**). International visitors supported 19,300 jobs in 2016 with $636.9 million in payroll and benefits.

---

11 Includes residents and non-residents.

12 Massachusetts Office of Travel and Tourism. https://www.massvacation.com/travel-trade/getting-around/stats-reports/.

Figure 1-7 Total Economic Impact of Massachusetts Airports



Source: MassDOT, Massachusetts Statewide Airport Economic Impact Study Update, 2014.

Notes: "Massachusetts Totals" refers to the total economic output of all Massachusetts airports.

Table 1-2 Economic Impact of Massachusetts Airports, 2013[13]

Per Capita Income (2009 USD)			
Airport	**Employment**	**Payroll (thousands of dollars)**	**Output (thousands of dollars)**
Boston Logan	131,991	$4,290,597	$13,359,865
Worcester Regional	358	14,925	$46,433
Hanscom Field	12,355	$1,162,158	$1,604,078
Massport Subtotal	*144,704*	*5,467,680*	*$15,010,376*
MA Commercial Service Airports	**157,790**	**$5,924,898**	**$16,039,049**
MA GA Airports	**4,466**	**$169,104**	**$516,068**
MA Total	**162,256**	**$6,094,002**	**$16,555,117**

Source: MassDOT, Massachusetts Statewide Airport Economic Impact Study Update, 2014

Note: Most recent data available. At the time of this study, Worcester Regional Airport did not have jetBlue Airways service for a full year. Hanscom Field figures include military activity.

Table 1-3 International Travel Impact on Massachusetts

Impact Type	**2015**	**2016**	**Annual Growth**
Direct Travel Expenditure (millions USD)	$2,748.5	$2,833.7	3.1%
Travel Generated Payroll (millions USD)	$609.2	$636.9	4.5%
Direct Travel Generated Employment (thousands of jobs)	18.9	19.3	1.8%
Travel Generated Tax Revenue (millions USD)	$435.2	$463.1	6.4%

Source: US Travel Association for Massachusetts Office of Travel and Tourism, Economic Impact of Travel on Massachusetts Counties 2016, October 2017.

Massport Partnerships

Massport has a long-standing commitment to being a good neighbor. Working in concert with government, community, and civic leaders throughout Massachusetts and New England, Massport is an active participant in efforts that improve the quality of life for residents living near Massport's facilities.

Massport employees participate in a number of community activities. In the spring, Massport employees participate in the City of Boston's annual neighborhood Boston Shines clean-up. At Thanksgiving, Massport employees provide food donations to three community programs, which serve more than 500 families and individuals each month. In the fall, children ages 4 to 17 are provided with a new backpack filled with school supplies and new clothes at the start of the school year. In 2016, Massport provided financial support to over 60 community organizations including: Boys & Girls Clubs, the Codman Square and South Boston Health Centers, and several youth and recreational organizations. Massport offers

13 Latest available published information.

several scholarship opportunities for graduating high school seniors. For a full list of Massport's partnership efforts go to: http://www.massport.com/massport/community/community-partners/.

East Boston Foundation

Created by Massport in 1997 at the request of the community, the East Boston Foundation has provided nearly $10 million in financial support for 85 community programs that benefit children, adults, and seniors, from sports and recreation to education, training, and child care. The East Boston Foundation Board of Trustees are committed to financial stewardship, recognizing the evolving needs of the community, and enhancing the quality of life for all East Boston residents.

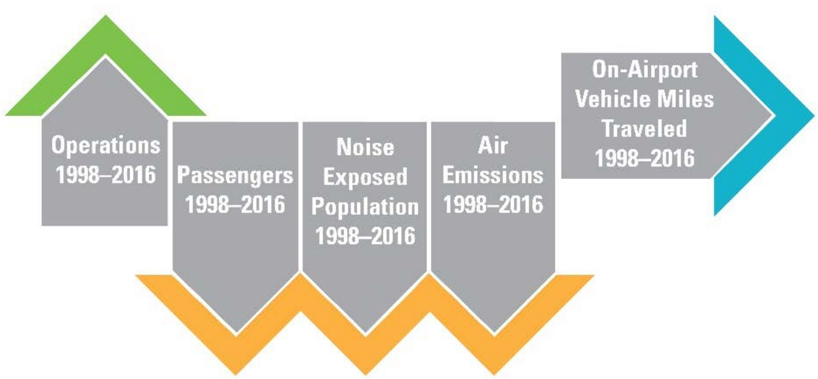
Massport Means Business

Massport is taking steps to create more business opportunities at Logan Airport for East Boston companies. In 2016, Massport, the East Boston Chamber of Commerce, and East Boston Main Streets co-hosted the *MASSPORT MEANS BUSINESS* initiative to learn more about doing business with Massport. Massport's mission is to ensure that East Boston businesses have every opportunity to thrive by partnering with us to serve our passengers, airlines, security, and maintenance needs.

2016 Highlights and Key Findings

This section provides a brief overview of key findings, by chapter, at Logan Airport in 2016 (see **Figure 1-8**). Additional information concerning Airport activities is provided in subsequent chapters. This section will also highlight Massport's efforts to further sustainability through specific projects and initiatives with a sustainability leaf and summarizes Massport's sustainability program.

Figure 1-8 Summary of 2016 EDR Key Findings



Activity Levels

Logan Airport continues to be an important origin and destination (O&D)[14] airport both nationally and internationally. The Airport is also one of the fastest growing major U.S. airports, in terms of number of passengers, over the past several years.[15] There has been growth in both domestic and international passenger numbers. Additional trends in new aircraft technology, allowing for smaller and more fuel-efficient aircraft on international routes, are also expected to continue to benefit mid-size O&D markets like Boston. Notable 2016 highlights and key findings on passenger activities, aircraft operations, and cargo volumes include:

- In 2016, U.S. passenger traffic grew by 3.8 percent, whereas Logan Airport experienced a passenger growth of 8.5 percent, more than double during the same period.[16]
- Overall, Logan Airport served 55 non-stop international destinations in 2016, compared to 47 in 2015.[17]
- From 2000 to 2016, the annual number of passengers at Logan Airport increased by 30.9 percent, while the annual number of aircraft operations decreased by 19.8 percent (see **Figure 1-9**).
- The total number of air passengers increased by 8.5 percent to 36.3 million in 2016, compared to 33.4 million in 2015 (see **Figure 1-10**). The 2016 passenger level represents a new record high for Logan Airport.

14 "Origin and destination" traffic refers to the passenger traffic that either originates or ends at a particular airport or market. A strong O&D market like Boston generates significant local passenger demand, with many passengers starting their journey and ending their journey in that market. O&D traffic is distinct from connecting traffic, which refers to the passenger traffic that does not originate or end at the airport but merely connects through the airport en route to another destination.

15 Between 2010 and 2016, Logan Airport was the eighth fastest growing airport in the U.S. in terms of domestic O&D traffic (U.S. DOT O&D Survey).

16 ACI North American Airport Traffic Summary. 2016. http://www.aci-na.org/content/airport-traffic-reports.

17 IATA Innovata Schedules. http://www.iata.org/publications/srs/Pages/innovata.aspx.

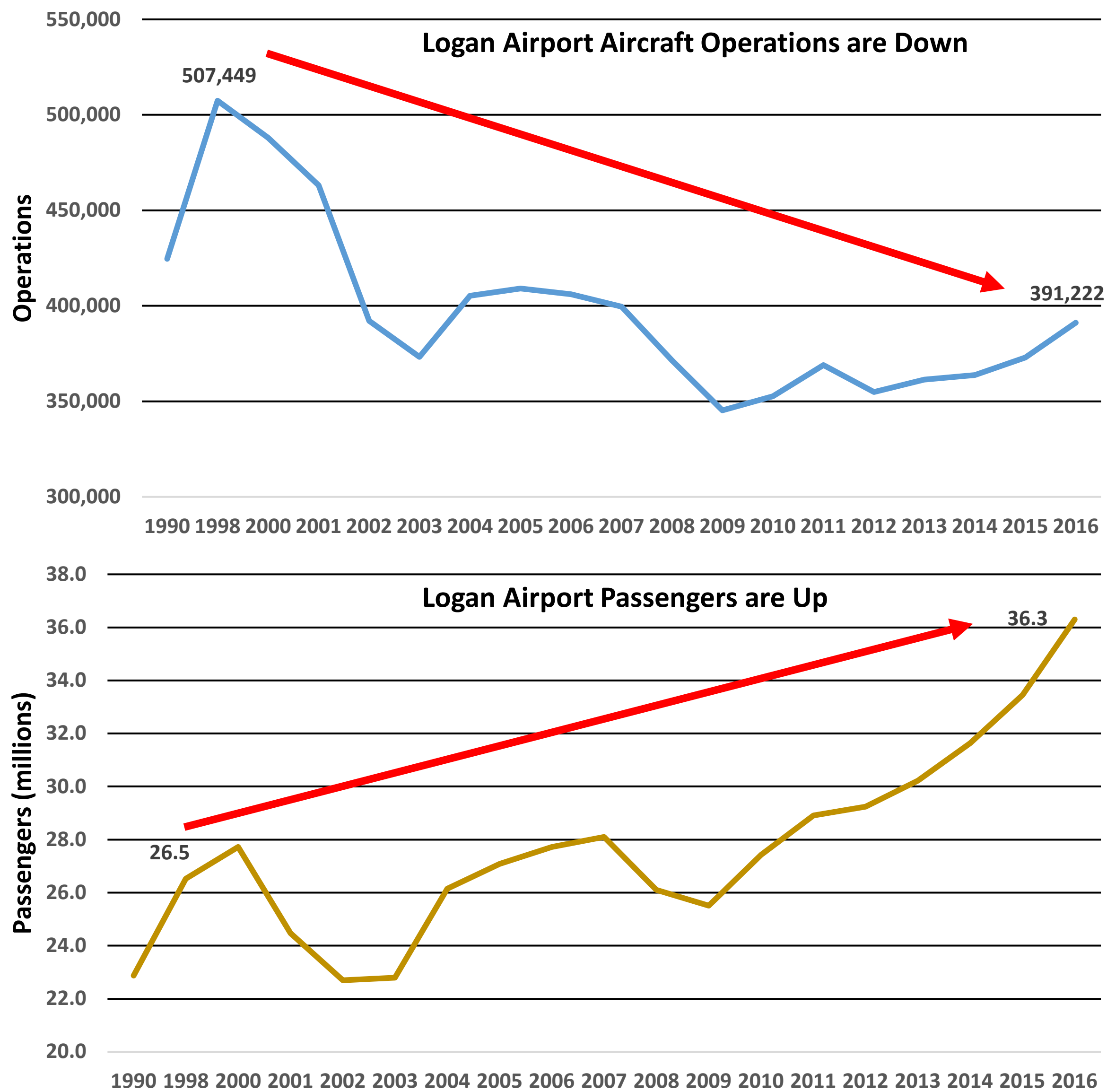
Figure 1-9 Logan Airport Annual Passenger and Operations, 1990, 1998, 2000, 2015, 2016

- While the numbers of both domestic and international passengers are increasing, international passenger demand continues to increase at a faster rate than domestic passenger demand. Total international passengers at Logan Airport increased from 5.5 million in 2015 to 6.6 million in 2016, a 19-percent increase. Annual domestic passengers' activity levels increased from 27.8 million in 2015 to 29.6 million in 2016,[18] a 6.4-percent increase. The strong international passenger growth was driven by the economic attractiveness of the metropolitan Boston region and the strength of Boston as an O&D market.

---

18 Excluding GA passengers.

Figure 1-10 Logan Airport Annual Passenger Activity Levels and Operations, 1990, 1998, 2000-2016



Source: Massport
Note: 1998 represents the historic peak in terms of aircraft operations for Logan Airport.

- In response to regional demand for international service, new non-stop services were introduced by a number of foreign airlines including Air Berlin, Norwegian Air Shuttle, Qatar Airways, Scandinavian Airlines, and TAP Air Portugal. New international destinations from Logan Airport in 2016 included Dusseldorf, London Gatwick, Doha, Copenhagen, and Lisbon.

- The total number of aircraft operations at Logan Airport increased from 372,930 in 2015 to 391,222 in 2016, a 4.9-percent increase. Despite the increase, aircraft operations at Logan Airport remained well below the 487,996 operations in 2000 and the historical peak of 507,449 achieved in 1998. In 1998, Logan Airport served 26.5 million air passengers, compared to 36.3 million air passengers in 2016, which saw 116,227 fewer operations.
- Passenger aircraft operations accounted for 90.4 percent of total aircraft operations in 2016. While domestic operations remain the largest share of commercial operations,[19] international operations have grown steadily at Logan Airport. In 2016, scheduled domestic operations increased by 2.6 percent while scheduled international operations increased by 17.9 percent.
- International passengers made up approximately 18 percent of total Airport passengers in 2016.
- JetBlue Airways and Delta Air Lines continued to expand services at Logan Airport, increasing their total operations by 6.9 percent and 6.4 percent respectively in 2016. As Logan Airport's largest carrier, JetBlue Airways accounted for 23.4 percent of total passenger aircraft operations and 26.8 percent of total passengers in 2016.
- General Aviation (GA) operations, which accounted for 7.9 percent of total operations in 2016, increased by 9.3 percent from 2015.[20] The 30,780 GA operations in 2016 remain below the 35,233 GA operations that Logan Airport handled in 2000. Hanscom Field, Logan Airport's reliever airport, handled 120,891 GA operations in 2016.[21]
- Air carrier efficiency continued to increase, with the average number of passengers per aircraft operation at Logan Airport increasing from 89.7 in 2015 to 92.8 in 2016. The increasing number of passengers per flight reflects a shift away from smaller aircraft and rising load factors as airlines continue to focus on capacity control and improvements in efficiency.
- Total air cargo volume[22] at Logan Airport totaled 640 million pounds in 2016, compared to 606 million pounds in 2015. Approximately 44 percent of Logan Airport's cargo was carried by passenger airlines as belly cargo, while 56 percent was carried by all-cargo carriers such as FedEx and UPS. Dedicated air cargo operations increased from 6,059 in 2015 to 6,680 in 2016, a 10.2-percent increase.

19 Commercial operations include passenger aircraft operations and a small number of all-cargo aircraft operations.
20 General Aviation (GA) is defined as all aviation activity other than commercial airline and military operations.
21 Hanscom Field, a full-service GA airport, plays a critical role as a corporate reliever for Logan Airport.
22 Air cargo includes express/small packages, freight, and mail.

While this annual report was originally scheduled to be a *2016 ESPR,* and with prior approval of the Secretary of EEA, Massport has prepared an EDR for 2016. In the past few years, passenger demand trends for air travel have been rapidly increasing and the air carrier landscape is changing. Additionally, ground transportation at Logan Airport has also changed rapidly with the introduction of TNCs, such as Uber and Lyft.[23] Due to these rapid changes, 2016 does not serve as a reasonable baseline for prediction of longer-range impacts.

As part of the ESPR process, Massport typically prepares passenger, operations, and cargo activity forecasts. It is expected that Logan Airport will reach 40 million annual passengers by 2019. Given this continued faster than expected passenger growth, Massport will be updating the Logan Airport long-term passenger forecast in the *2017 ESPR* to reflect recent growth at Logan Airport, revised expectations for the local/national/international economy, and latest industry trends. Preliminary review suggests that future Logan Airport passenger levels could reach about 46 million annual passengers. The *2017 ESPR* will provide more detailed information and updated forecast numbers to 2030/2035. Additional information is provided in Chapter 2, *Activity Levels*.

Airport Planning

Logan Airport facilities have been accommodating recent increases in activity and operations on the airside, but the terminal, roadways, and parking facilities are strained by the increase in passengers. The 2016 reporting year was marked by construction of several projects focused on enhancing the passenger experience, accommodating increases in passenger activity levels, and improving ground access. Recent progress on planning initiatives and individual projects at Logan Airport are described below. Chapter 3, *Airport Planning,* describes the status of all planning projects.

Terminal and Airside Projects

- **Terminal E Renovation and Enhancements Project**. To accommodate regular service by wider and longer Group VI aircraft at Terminal E, this project included interior and exterior improvements. The project reconfigured three existing gates to accommodate Group VI aircraft (including the Airbus A380 and Boeing 747-8 primarily used by international air carriers). An addition to the west side of Terminal E allowed passenger holdrooms to accommodate the larger passenger loads associated with larger aircraft. The project also included modifications to the airfield to meet required FAA safety and design standards to accommodate the larger aircraft. An Environmental Assessment (EA) was filed, and FAA issued a Finding of No Significant Impact (FONSI) on July 29, 2016. Construction was completed in early 2017.
- **Terminal E Modernization Project.** The Terminal E Modernization Project will add the three gates approved in 1996 as part of the International Gateway West Concourse project (EEA #9791), but never constructed, and an additional four gates to Terminal E. The building will be aligned to

23 Drop-off/pick-up modes can include private vehicles, taxis, and black car services. For example, if an air passenger is dropped off when s/he departs on an air trip and is picked-up upon their return, that single air passenger generates a total of four ground-access trips: two for the drop-off trip (one inbound to Logan Airport, one outbound from Logan Airport) and two for the pick-up trip (one inbound to Logan Airport, one outbound from Logan Airport). The air passenger may be dropped off and picked up in a private vehicle or in a taxi, TNCs, or black car that may not carry a passenger during all segments of travel to and from Logan Airport.

function as a noise barrier between the airside operations and the community. New passenger handling and passenger holdrooms are being planned, as well as possible additional Federal Inspection Services (FIS) and Customs and Border Protection facilities to supplement the existing FIS areas in Terminal E. A connection between Terminal E and the Massachusetts Bay Transportation Authority (MBTA) Blue Line Airport Station will be constructed to improve passenger convenience. This connection is currently being studied, and various approaches are under consideration. Consideration is given to constructing an Automated People Mover (APM), which ultimately would connect the MBTA Blue Line Station to all the terminals. The APM concept is in the very early stages of feasibility assessment, and will be more definitive as the Terminal E Modernization Project design progresses.

The Terminal E Modernization Project will occupy a portion of the North Cargo Area (NCA) and will include terminal gates, aircraft parking, hangars, and cargo facilities. Massport filed an Environmental Notification Form (ENF) in October 2015 and a joint federal Draft Environmental Assessment (EA)/state Draft Environmental Impact Report (EIR) in July 2016. Massport filed the Final EA/EIR on September 30, 2016. On November 10, 2016, FAA issued a FONSI. On November 14, 2016, FAA issued a Record of Decision (ROD) on the project, stating that Massport can now update the Airport Layout Plan (ALP) with the proposed Terminal E Modernization Project. (For convenience, Massport has provided the Secretary's Certificates on the ENF and Draft EA/EIR, with responses to those comments, in Appendix A, *MEPA Certificates and Responses to Comments,* of this *2016 EDR*.) The project, including the MBTA connection, is in the design phase and initial construction will likely begin in 2018. Future ESPRs and EDRs will provide updates as final design and construction proceed.

- **Terminal C to E Airside Connector.** The Terminal C to E Airside Connector provides a greater post-security connectivity between terminals and to improve flexibility for airlines. In addition, the Terminal C to E Connector provides a post-security connection between Terminals C and E on the Departures level. The Connector provides improved passenger circulation within the post-security concourse(s), additional holdroom space at Terminal E, reconfigured office space, concessions and concessions support, and a new consolidated location for escalators and stairs. The project was completed in May 2016.
- **Terminal B Optimization Project.** Similar to the recent renovations and improvements at Terminal B, Pier A, Massport is upgrading its facilities on the Pier B side to meet airlines' needs and to enhance the passenger traveling experience. Improvements include an enlarged ticketing hall, improved outbound bag area and claim hall, expanded concession areas, and expanded holdroom capacity at the gate. The project will consolidate American Airlines' operations to one pier of the terminal (now operating on two different sides of the terminal). All Pier B gates will be connected post security, the project will also consolidate checkpoint operations for better passenger throughput and improved passenger experience. Massport prepared a Draft EA in May 2017 and a Final EA in June 2017. On June 29, 2017, FAA issued a FONSI. Final design is now complete and construction is underway. Construction is expected to be complete in early 2019.
- **Terminal C Building, Roadway, and Curb Enhancements.** Massport is currently evaluating multifaceted enhancements that would enhance Terminal C facilities and provide a post-security connector between Terminal B and C; replace aging roadways serving the terminal; and improve the operation of the Terminal C curb. The enhancements also include replacement of the existing

canopy on the Departures level. The project would enhance Logan Airport's ability to efficiently accommodate current and future passenger volumes by bringing the terminal facilities up-to-date and improving access, egress, and drop-off/pick-up operations.

- **Hangar Projects.** Architectural design commenced in December 2010 for two hangar upgrades in the North Cargo Area (NCA). The renovated JetBlue Airways hangar opened in 2012. The American Airlines hangar, formerly occupied by Northwest Airlines, was refurbished in 2013. Demolition of the former American Airlines hangar (Hangar 16) commenced in 2014 and was completed in August 2016.

Enhanced Ground Access

A series of recent ground access improvement projects have been designed to yield substantial environmental benefits, particularly in the areas of ground access efficiencies and associated air quality emissions reductions on-Airport and in East Boston, as documented below:

- **The Rental Car Center (RCC) Southwest Service Area (SWSA) Redevelopment Program (EEA 14137).** The RCC is fully operational and the full benefits of the project began to be realized in 2014. Consolidation of rental car operations and associated shuttle bus service into a single coordinated shuttle bus fleet operation resulted in customer service improvements, reduced on-Airport vehicle miles traveled (VMT), with associated emission reductions, and stormwater system enhancements. Rental car and bus operations began in the centralized facility in September 2013. The remaining quick-turnaround areas, permanent taxi pool, bus, limousine pools, and the SWSA edge buffers were completed in 2014. Consolidated bus operations continue to reduce on-Airport VMT and associated emissions. The RCC was awarded Logan Airport's first Gold Certification in Leadership in Energy and Environmental Design (LEED®) in 2016. The status of mitigation efforts for the RCC is provided in Chapter 9, *Project Mitigation Tracking*.
- **Logan Airport's new bus fleet**, comprising 22 compressed natural gas (CNG) buses and 32 clean diesel/electric buses, has fully replaced the entire fleet of diesel rental car shuttle buses now that the RCC is fully operational. One additional new CNG bus was put into service in 2016, increasing the total from 21 to 22 buses. The new consolidated bus fleet has improved operational efficiency and reduced shuttle frequency from 100 to 30 buses per hour.
- **The LEED-Silver Green Bus Depot** serves as Logan Airport's on-Airport maintenance facility for Massport's new clean-fuel bus fleet. By shifting the bus maintenance operations out of the community, Massport is reducing bus traffic in East Boston and Chelsea.
- **The Martin A. Coughlin Bypass** reduces commercial traffic through East Boston by providing a direct link, along a former rail corridor, from Logan Airport's North Service Area (NSA) to Chelsea for Airport-related vehicle trips.
- **The Economy Parking Garage** simplified and reduced on-Airport circulation by consolidating multiple overflow parking lots throughout the Airport into a single location served by a single shuttle route. Overall traffic circulating throughout the Airport has decreased, resulting in significant operational and environmental benefits.

- **West Garage Parking Consolidation Project.** Massport consolidated 2,050 temporary parking spaces as an addition to the West Garage and at the existing surface lot between the Logan Office Center and the Harborside Hyatt. The West Garage addition is located on the site of the existing Hilton Hotel parking lot. Construction of these spaces constituted all the remaining spaces permitted under the Logan Airport Parking Freeze.[24] The project commenced in the spring of 2016 and was completed in late 2016.
- **Logan Airport Parking Project.** As one element of its comprehensive ground transportation strategy, Massport proposed the phased construction of 5,000 new on-Airport commercial parking spaces at Logan Airport in two locations. The goal of the Logan Airport Parking Project is to reduce the number of air passengers choosing more environmentally harmful drop-off/pick-up modes, which generate up to four vehicle trips instead of two (see below for a detailed description). The construction of additional commercial parking spaces at Logan Airport was predicated on a regulatory change, that has been adopted by the Massachusetts Department of Environmental Protection (MassDEP) to amend the existing Logan Airport Parking Freeze. In response to Massport's 2016 request to consider an amendment to the Logan Airport Parking Freeze (to increase the commercial parking freeze limit by 5,000 spaces), MassDEP conducted a stakeholder process, which was followed by a public process to amend the Parking Freeze regulation. MassDEP issued the amended regulation on June 30, 2017, approving the requested parking increase. On December 5, 2017, the U.S. Environmental Protection Agency (EPA) proposed a rule approving the revision of the Massachusetts State Implementation Plan (SIP) incorporating the amended Logan Airport Parking Freeze Cap. EPA approved the proposed rule on March 6, 2018, and the rule went into effect April 5, 2018. For additional information, see Chapter 5, *Ground Access to and from Logan Airport.* Massport initiated a parallel process with EEA by filing an ENF for new parking facilities on March 31, 2017. On May 5, 2017, EEA issued its Certificate on the ENF, establishing the Scope for the required Draft EIR. Initiation of concept design for the parking facilities and preparation of a Draft EIR commenced in late 2017. The Draft EIR will provide additional details on the number of spaces per location and planned construction phasing. As outlined in the ENF, Massport has identified two potential sites for the new parking: Economy Garage (shown as 7a in **Figure 3-1**) and Terminal E Surface Lot (shown as 7b in **Figure 3-1**).
- **Convenience and Filling Station/Taxi Pool/TNC Lot Relocations**. Construction of the Terminal E Modernization Project includes the relocation of the existing on-airport gas station to the intersection of Tomahawk Drive and Jeffries Street on Massport property (Southwest Service area). Chosen by the community-based Logan Impact Advisory Group, it provides community benefits such as a convenience space for a local vendor, landscaping and beatification enhancements, and traffic-congestion reductions. Another part of the design phase involved Massport further evaluating transportation and land-uses in this area in an effort to mitigate vehicular congestion along Tomahawk Drive associated with the growing TNC mode. As a result, it was determined that the TNC Pool Lot would be relocated to the existing taxi pool at Porter Street because this would minimize Tomahawk Drive traffic and congestion. Similarly, the existing taxi pool lot will be returned to the Blue Lot between the Logan Office Center and the Hyatt Hotel. By relocating the TNC Pool Lot and the number of TNCs servicing the Airport, greater

24 310 Code of Massachusetts Regulations and 40 CFR 52.1120

operational flexibility and additional routing options are available that will allow Massport to reduce TNC impacts along Tomahawk Drive.

- **Braintree Logan Express Acquisition.** In 2015, Massport acquired the property on which the Braintree Logan Express site is located, furthering its commitment to providing high-occupancy vehicle (HOV) access from key regional nodes. The Braintree Logan Express service had a ridership of 655,158 annual passenger trips in 2016, representing 36 percent of the entire Logan Express system ridership. Approximately half of the Braintree Logan Express riders are Logan Airport employees. The Braintree site is approximately 20 acres (14 acres of usable land area) and has approximately 1,800 lined spaces.
- **Mid-life Rebuild of Eight Silver Line Buses.** Eight Silver Line buses, connecting the Airport to South Station, are owned by Massport and are operated by the MBTA with Massport paying operating costs for the SL1 route. In 2016, Massport funded an approximate $6 million mid-life rebuild of these eight buses. The mid-life rebuild will extend the useful life of each vehicle by approximately eight years. This will allow the MBTA to maintain reliability and quality of operations along the Silver Line today while starting the procurement process to acquire new vehicles in the future.

Community Park and Open Space Projects

Massport has committed up to $15 million for the planning, construction, and maintenance of four Airport edge buffer areas and two parks along Logan Airport's perimeter. These buffers have now been completed and include the Bayswater Buffer, Navy Fuel Pier Buffer, SWSA Buffer Phase 1, and the SWSA Buffer Phase 2. These areas are located on Massport-owned property along Logan Airport's perimeter boundary and are intended to provide attractive landscape buffers between Airport operations and adjacent East Boston neighborhoods. The buffer design occurs in consultation with Logan Airport's neighbors and other interested parties in an open community planning process. In addition to the Airport edge buffers, Massport has been working with community leaders to provide more recreation opportunities to local residents, such as the 3.3 miles of the East Boston Greenway Connector and Piers Park with community boating facilities and views of downtown Boston. Over the past 10 years, Massport has invested $50 million to develop, maintain, and secure 33 acres of green space in East Boston for walking, playing, biking, and other forms of passive recreation.

- **Piers Park Phase II.** A Request for Proposals for design of Piers Park Phase II was issued in June 2017. Piers Park Phase II will add 4.2 acres of green space to the existing Piers Park on the East Boston waterfront. The Phase II site is located adjacent to the Phase I site, along Marginal Street in East Boston. The conceptual design of the Phase II site envisions a fully accessible park with a central lawn area, basketball and volleyball courts, and bicycle and rollerblade tracks. The park is expected to offer landscape features similar to those in the Phase I Park, including brick paved walkways, site furniture, lighting, and plantings. A new 1,200-square foot community/sailing center, located on the waterfront, is designed to replace the existing Sailing Center building while providing additional meeting spaces for the community.

- **Piers Park Phase III.** Piers Park Phase III is conceived as a 3.8-acre addition of greenspace to the existing Piers Park on the East Boston waterfront. The site is located adjacent to the Phase II site, along Marginal Street in East Boston. Piers Park Phase III is an early-stage planning concept that Massport has proposed to external developers. Massport issued a Request for Proposals for design of Piers Park Phase III in February 2018. Depending on responses to Massport's Request for Proposals, the project may be advanced by another entity.
- **Bremen Street Park and Dog Park.** In September 2016, Massport officially opened the Bremen Street Dog Park (and Bremen Street Park in 2008) on the corner of Bremen and Porter Streets in East Boston. This recreational area allows for all types and sizes of dogs to use the 22,655-square foot space located on the corner of Bremen and Porter Streets in East Boston.
- **The Narrow-Gauge Connector.** The spring 2016 completion of the 1/3-mile long Narrow-Gauge Connector project represents the final portion of the East Boston Greenway, which joins the East Boston Greenway Connector, that Massport completed in 2014, with the Massachusetts Department of Conservation and Recreation's Constitution Beach. This project makes it possible for pedestrians and bicyclists to travel from Jefferies Point, through Bremen Street Park and the new East Boston Library, to Wood Island Marsh, and finally to Constitution Beach with only two roadway crossings. There are pedestrian and bike counters along the Greenway Connector, and in 2016, there were 43,787 trips recorded.

Planning Initiatives

- **Sustainability and Resiliency Planning.** See section below titled *Sustainability and Resiliency at Logan Airport* for detailed information.
- **Runway Incursion Mitigation and Comprehensive Airfield Geometry Analysis**. As FAA began to close out its comprehensive nationwide runway safety area improvements program in 2016, its safety focus shifted to analysis of the airfield geometry. The multi-year Runway Incursion Mitigation (RIM) program identifies, prioritizes, and develops strategies to help airports across the U.S. enhance airfield safety. In January 2016, Massport issued a Request for Proposals to study airfield geometry at Logan Airport. The study commenced in December 2016 and is expected to be completed by December 2018. As of this filing, the study has conducted an airfield geometry and design standards analysis, aviation activity forecast, baseline safety risk assessment, and developed a simulation model of airfield operations for baseline existing conditions. Future EDRs and ESPRs will provide updates on this initiative and those efforts are likely to require permitting under state or federal regulations.
- **Automated People Mover Concept.** Massport is considering several potential options for an Automated People Mover (APM). This APM could provide a robust connection between the MBTA Airport Station and all terminals, the Southwest Service Area facilities, and other areas on-Airport. The feasibility of constructing such a system and the operating parameters that would be required are currently being evaluated.

Regional Transportation

Logan Airport and a system of 10 other commercial service, reliever, and GA airports[25] (regional airports) anchor the New England region. Together, these 11 airports accommodate nearly all of New England's commercial[26] air travel demand (see **Figure 1-11**). Logan Airport serves as a major domestic O&D market and acts as the primary international gateway for the region. Amtrak rail service, which connects Boston to the New York/Washington D.C. metropolitan areas to the south and Portland, ME to the north, also serves the region.

Figure 1-11 New England Regional Transportation System

- For the second year, the total number of annual air passengers using New England's commercial service airports (Logan Airport plus the regional airports) represented a record high; the total number of annual air passengers increased by 6.4 percent, from 48.8 million air passengers in 2015 to 51.9 million air passengers in 2016.
- In 2015, the previous historical peak from 2005 (48 million regional air passengers) was exceeded with 48.8 million air passengers. Nationally, U.S. passenger traffic exceeded pre-recession levels in 2014. It continued to show strong growth and reached a new peak in 2016.
- The increase in the region's passenger traffic is driven by continued growth at Logan Airport and other regional airports. Bradley International Airport, T.F. Green Airport, Burlington International Airport, Portland International Jetport, Bangor International Airport, and Portsmouth International Airport also experienced increases in passenger traffic.
- Of the 51.9 million passengers using New England's commercial service airports in 2016, 69.9 percent of passengers (36.3 million) used Logan Airport compared to 68.6 percent (33.5 million) in 2015.[27]

---

25 Commercial Service Airports are publicly owned airports that have at least 2,500 passenger boardings each calendar year and receive scheduled passenger service. Reliever Airports are airports designated by FAA to relieve congestion at Commercial Service Airports and to provide improved GA access to the overall community. GA Airports are public-use airports that do not have scheduled service or have less than 2,500 annual passenger boardings.

26 Commercial airline service is defined as air transportation offered by air carriers for compensation or hire. In contrast, GA refers to all aviation activity other than commercial airline and military operations.

27 Based on airport passenger statistics from 1985 to 2016.

- The number of passengers at T.F. Green Airport increased by 2.4 percent in 2016 compared to 2015. In 2017, with the addition of service from Frontier Airlines and Norwegian Air Shuttle, passenger counts increased by nearly 8 percent or approximately 285,000 passengers.
- The number of passengers at Bradley International Airport increased by 2.1 percent in 2016 compared to 2015. In 2017, the number of passengers increased by over 6 percent. This growth marks the fifth straight year of passenger traffic growth between 2012 and 2017 (see **Table 4-2**).
- In effect, Logan Airport, T.F. Green Airport, and Manchester-Boston Regional Airport act as a system, with significant numbers of passengers choosing the most convenient airport in terms of access, airfares, and available air services depending on their individual air travel needs.[28]
- Worcester Regional Airport is an important aviation resource that accommodates corporate GA activity and commercial airline service. Massport has continued to invest in Worcester Regional Airport by modernizing the airport to serve better the commercial airline travel demands of the central Massachusetts region.
  - Together with the City of Worcester, Massport is investing $100 million over the next 10 years to revitalize and grow commercial operations at Worcester Regional Airport. As a result of this collaboration, Worcester Regional Airport has experienced consecutive growth since 2013 as JetBlue Airways has served nearly 500,000 passengers.
  - Massport completed Worcester's Category III Instrument Landing System improvements to elevate operational and safety conditions to a level equal to that of all other commercial airports in New England. This project significantly improves Worcester Regional Airport's all-weather reliability, a long-standing impediment to greater utilization of this airport.
- Located in Bedford, MA, approximately 20 miles northwest of Logan Airport, Hanscom Field is New England's premier facility for business/corporate aviation and serves a critical role as a GA reliever airport for Logan Airport. Hanscom Field is a full-service GA airport that accommodates a wide variety of GA activities, including corporate aviation, private flying, commuter air services, charters, and light cargo.
- While the overall regional passenger activity levels have increased, aircraft operations activity levels have declined significantly since 2000, as part of ongoing trends of larger aircraft size, higher aircraft load factors, and reduced service in less profitable markets. Total aircraft operations in the region declined from 1.6 million in 2000 to approximately one million in 2016.
- The region is also served by rail service (provided by Amtrak) that connects Boston to the New York and Washington D.C. metropolitan areas to the south and Portland, ME to the north, as well as by an extensive highway system. In 2016, the total number of rail passengers traveling on the Northeast Corridor was 2.6 million[29] compared to air passengers of 36.3 million at Logan Airport.

---

28 Federal Aviation Administration. 2006. *New England Regional Airport System Plan (NERASP)*.

29 FY 2016 Boston rail passengers consist of South Station, Back Bay, Route 128, Mass. Amtrak. *National Fact Sheet FY 2016*.

- System-wide Amtrak ridership was 31.3 million one-way trips in fiscal year (FY) 2016, an increase of 400,000 over the previous year.[30] In FY 2016, the Northeast Corridor (NEC) carried 11.9 million passengers on its Acela Express and Northeast Regional services, up 2 percent from the prior year. Acela Express accounted for nearly 3.5 million passengers, while the Northeast Regional accounted for 8.4 million passengers. Overall NEC ridership reached a new record in 2016, surpassing 2015 record levels. Amtrak's share of the Northeast total passenger market has increased substantially since the introduction of Acela Express service in 2000.
- Massport has continued to engage in a number of interagency planning efforts at both local and regional levels.

Additional information is provided in Chapter 4, *Regional Transportation*.

Ground Access to and from Logan Airport

Massport has a comprehensive strategy to diversify and enhance ground transportation options for passengers and employees. The ground transportation strategy is designed to provide a broad range of HOV, transit, and shared-ride options for travel to and from Logan Airport and to minimize vehicle trips, by providing convenient transit, shuttle, bicycle, and pedestrian connections to the Airport. The strategy also aims to provide parking on-Airport for passengers choosing to drive or with limited HOV options. Massport's strategy aims to limit impacts to the environment and community, while providing air passengers and employees with many alternatives for convenient travel to and from Logan Airport.

Massport is implementing a multi-pronged trip reduction strategy to limit impacts to the environment and to reduce the number of private vehicles that access Logan Airport and, in particular, the associated environmentally undesirable drop-off/pick-up modes, which generate up to four vehicle trips instead of two.[31] Massport continues to invest in and operate Logan Airport with a goal of maintaining and increasing the HOV mode share – the number of passengers and Airport employees arriving by transit or other HOV/shared-ride modes. Logan Airport continues to rank at the top of U.S. airports in terms of HOV/transit mode share, with current HOV mode share just over 30 percent.[32] Measures implemented by Massport to increase HOV use include a blend of initiatives related to pricing (incentives and disincentives), service availability, service quality, marketing, and traveler information. Because of the different demographics of Logan Airport air passenger travelers, no single measure alone will accomplish the goal to increase the HOV mode share.

---

30 Amtrak. November 2016. Amtrak Media Center. https://media.amtrak.com/2016/11/amtrak-delivers-strong-fy-2016-financial-results/.

31 Drop-off/pick-up modes can include private vehicles, taxis, and black car services. For example, if an air passenger is dropped off when s/he departs on an air trip and is picked-up upon their return, that single air passenger generates a total of four ground-access trips: two for the drop-off trip (one inbound to Logan Airport, one outbound from Logan Airport) and two for the pick-up trip (one inbound to Logan Airport, one outbound from Logan Airport). The air passenger may be dropped off and picked up in a private vehicle or in a taxi, TNCs, or black car that may not carry a passenger during all segments of travel to and from Logan Airport.

32 According to the *2016 Logan Airport Air Passenger Ground-Access Survey*, 30.5 percent of air passengers accessing Logan Airport used HOV modes of travel.

Key findings on ground access conditions and activity levels include:

- Since 2000, the highest average weekday vehicle miles traveled (VMT) estimated at Logan Airport was in 2007. Although 2007 air passenger levels have grown by 29.1 percent, the 2016 daily VMT estimates remain about 4.4 percent lower than 2007 levels.
- Current annual average daily traffic (AADT) and annual average weekday daily traffic (AWDT) values are approximately 5.4 percent higher than in 2015, which was lower than the approximately 8.5 percent growth in air passenger levels. VMT increased by approximately 4.8 percent from 2015 to 2016. Although daily traffic volumes on the airport roadway system have been increasing, it is important to contrast this increase with historical air passenger growth. Airport gateway[33] traffic volume is growing at a significantly lower rate than air passenger growth, reflecting Massport's decade long commitment to improving and supporting HOV access to the Airport.
- Pursuant to Massachusetts state law, *An Act Regulating Transportation Network Companies* (Bill H.4570), and Massport Rules for Safe and Efficient operation of TNCs at Logan Airport, beginning in February 2017, in cooperation with state regulators, Massport began allowing TNCs to pick-up arriving passengers via a TNC Pool Lot.[34] This is a service that is being tracked for reporting in 2017.
- Beginning with the *2017 ESPR*, Massport will introduce a new definition for HOV that takes into account vehicle occupancies of taxi, livery (black car limousine), and TNC modes.[35] Under the current system, Massport counts all taxis as non-HOV and all black car limousines as HOV, regardless of the number of passengers transported. Massport is currently also classifying TNCs as non-HOV, regardless of the number of passengers transported. Beginning with the *2017 ESPR*, Massport will use a new HOV definition, where vehicle occupancies of taxis, livery services, and TNCs that exceed one air passenger per vehicle will be defined as HOV. With this new definition, Massport has committed to a goal of 35.5 percent HOV by 2022 and 40 percent by 2027.
- Massport continues to offer a pilot program, Back Bay Logan Express, which provides frequent, direct, express bus service from the City of Boston. This service has been valuable in providing an alternative to air passengers and employees who were impacted by the temporary, two-year Government Center Station closure (a key connection to the Blue Line and Logan Airport), and it provides a new transit alternative from the Back Bay/Hynes Convention Center area to the Airport. Ridership in 2016 for the Back Bay Logan Express totaled 216,329 passengers (compared to 290,796 passengers in 2015), an average of about 600 riders per day. The ridership decreased by about 33 percent for the second half of the year (July through December), which may be attributed to the reopening of the MBTA Government Center Station.
- Eight Silver Line buses, connecting the Airport to South Station, are owned by Massport and are operated by the MBTA with Massport paying operating costs for the Silver Line SL1 route. In 2016, Massport funded an approximate $6 million mid-life rebuild of these eight buses. The mid-life

33 Airport gateways are defined as access points to/from Logan Airport, which primarily include the Route 1A roadway ramps, the Interstate-90 Ted Williams Tunnel ramps, and Frankfort Street/Neptune Road.

34 An Act Regulating Transportation Network Companies. https://malegislature.gov/Bills/189/House/H4570.

35 A transportation network company (TNC) is a company that uses an online-enabled platform to connect paying passengers with drivers who provide transportation from their own non-commercial vehicles. TNCs have emerged as a new option mode of transportation with automobile drop-off and pick-up at Logan terminals. The *2016 Logan Airport Air Passenger Ground-Access Survey* and future documents will analyze trends associated with TNCs.

rebuild will extend the useful life of each vehicle by approximately eight years. This will allow the MBTA to maintain reliability and quality of operations along the Silver Line today while starting the procurement process to acquire new vehicles in the future.

- Total on-Airport commercial parking exits declined by 0.2 percent in 2016. Slower growth in overall parking may be a result of customers choosing alternate modes due to the known issue of constrained parking on the Airport and, especially for residents originating within Route 128, the emergence of TNCs as a reliable and cost-effective alternative.
- The inadequate supply of parking causes air passengers to circulate on Airport roadways to find parking. In overflow conditions, cars are diverted or moved to non-garage parking areas, including overflow lots, some of which are located off-Airport. Not only does parking demand activity above capacity lower customer service levels, it also increases on-Airport roadway vehicle emissions related to circulating traffic. Diversions[36] and valeting[37] have become a regular occurrence at Logan Airport. Massport continued to be in full compliance with the Logan Airport Parking Freeze in 2016.
- Massport continues to manage parking supply, pricing, and operations to promote the use of transit/HOV/shared-ride options and to reduce the amount of diversions/valeting. Massport strives to meet these goals without increasing the number of drop-off/pick-up trips experienced due to a constrained parking supply. These policies supported growth since 2015 in transit and shared-ride alternatives, especially for Logan Express park-and-ride and private bus services.

Additional information is provided in Chapter 5, *Ground Access to and from Logan Airport*.

Noise Abatement

Massport strives to minimize the noise effects of Logan Airport operations on its neighbors through a variety of noise abatement programs, procedures, and other tools. At Logan Airport, Massport implements one of the oldest and most extensive noise abatement programs of any airport in the nation. Massport's comprehensive noise abatement program includes a dedicated Noise Abatement Office; a state-of-the-art Noise and Operations Monitoring system; residential and school sound insulation programs; time and runway restrictions for noisier aircraft; ground run-up procedures; and flight tracks designed to optimize over-water operations (especially during nighttime hours[38]).

Since Logan Airport's peak operations year in 1998, the number of daily aircraft operations have declined by 23 percent (from 1,390 operations per day in 1998 to 1,069 operations per day in 2016[39]) due to the industry-wide trend of increasing passenger loads. In 2016, jet operations made up 86 percent of operations compared to 55 percent in 1998, reflecting a change in the aircraft fleet mix. Passenger volumes continue to increase at a higher rate than aircraft operations. In 2016, the overall number of air passengers was up by 36.7 percent compared to 1998, and 8.5 percent since 2015. This trend reflects an

36 Diversions are the operational practice of sending vehicles desiring to park at a specific facility to another facility (on- or off-Airport) due to the initial facility being full.

37 Valeting is an operational practice where attendants park vehicles for travelers, typically due to the desire of maximizing the number of vehicles parked at a facility or on-Airport.

38 Nighttime hours are defined as 10:00 PM to 7:00 AM.

39 Note that 2016 was a leap year and has 366 days.

increase in the use of larger aircraft in the fleet, airline consolidation, and increased aircraft load factors[40] on the part of airlines.

Noise conditions for 2016 were assessed primarily through computer modeling, supplemented by the analysis of measured noise levels from Logan Airport's noise monitoring system. This *2016 EDR* marks the transition from FAA's legacy analysis software, the Integrated Noise Model (INM), to its next-generation software, the Aviation Environmental Design Tool (AEDT). Massport developed a suite of customized adjustments for use with INM, necessary for accurate modeling of the unique Logan Airport environment, and has been working with FAA since 2015 to implement equivalent methods in AEDT. FAA has responded to Massport's request. FAA did not approve two adjustments: over-water noise propagation and hill effects. FAA did approve the use of 2016 weather data and Logan Airport-specific aircraft stage length adjustments. Consistent with previous practice, Massport presents AEDT modeling results as the primary model in this *2016 EDR*. INM results are provided for comparison only for 2016 and future filings will present only AEDT results.

Research efforts that address potential improvements in AEDT modeling are underway for terrain improvements and were recently concluded for acoustically reflective surfaces. The results of these studies, if and when they are implemented in AEDT, will add capabilities previously addressed by Logan Airport's over-water and hill effect adjustments.

Operations, Fleet Mix, and Runway Use

- Annual aircraft operations in 2016 increased from 372,930 operations in 2015 to 391,222 in 2016 (a 4.9-percent increase). Compared with the 1998 peak of 507,449 operations, 2016 had 22.9 percent fewer operations. At the same time, passenger volumes are at their highest, increasing from 33,449,580 passengers in 2015 to 36,288,042 in 2016 (an increase of 8.5 percent).
- Overall commercial traffic increased from 344,764 to 360,400 (a 4.2-percent increase) compared to 2015. In 2016 there was a continued shift of operations away from the smaller Regional Jet (RJ) aircraft to larger air carrier aircraft on many routes, increasing the number of passengers carried per operation.
- Among commercial jet operations at Logan Airport, 18 percent were by aircraft that already satisfy the newly enacted Stage 5 limits.[41] When considering all types of aircraft, 97 percent met the Stage 4 noise limits. Of the remaining 3 percent, only three operations in 2016 were performed by aircraft retrofitted to satisfy Stage 3 standards; all other commercial jet operations were performed by aircraft originally certificated to Stage 3 or better.[42] As of January 1, 2016, all Stage 2 aircraft are prohibited by FAA from operating within the contiguous United States, and there were no Stage 2 operations at Logan Airport for 2016.

40 Load Factor refers to the number of passengers as a percentage of total seats operated at the airport.

41 In October 2017, FAA established deadlines for Stage 5 certification for new aircraft. Large aircraft (over 121,000 lbs maximum takeoff weight) must satisfy Stage 5 limits if entering service after December 31, 2017, and smaller aircraft entering service after December 31, 2020 must satisfy these limits.

42 Jet aircraft currently operating at Logan Airport are categorized by FAA into the two groups: Stage 3 and Stage 4. The designation refers to a noise classification specified in Federal Aviation Regulation (FAR) Part 36 that sets noise emission standards based on an aircraft's maximum certificated weight. Generally, the heavier the aircraft, the more noise it is permitted to make within the limits established by FAR Part 36.

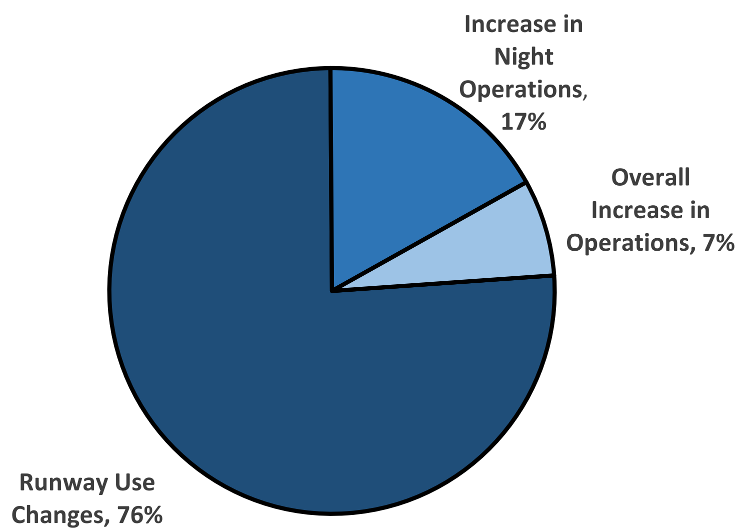
- The 2016 Flight Track Monitoring reports in Appendix H, *Noise Abatement,* show that 99 percent of shoreline crossings (locations where aircraft which have departed over the water pass back over land) were by aircraft flying above 6,000 feet, the same percentage as 2015. This results in lower day-night average sound level (DNL) exposure levels to communities under those flight paths.

Noise Levels and Population

- Differences between measured and modeled values have narrowed in recent years as both the noise monitoring and modeling processes have been refined. For 2016, these differences have increased moderately with the change to AEDT for modeling.
- The 2016 contours are smaller in area coverage than the 2000 contours in most areas as a result of quieter engines and fewer flights, although the contour has expanded in portions of Eagle Hill in East Boston.

Changes in operations at Logan Airport influencing noise exposure for 2016 versus 2015 are discussed below and shown in **Figure 1-12**.

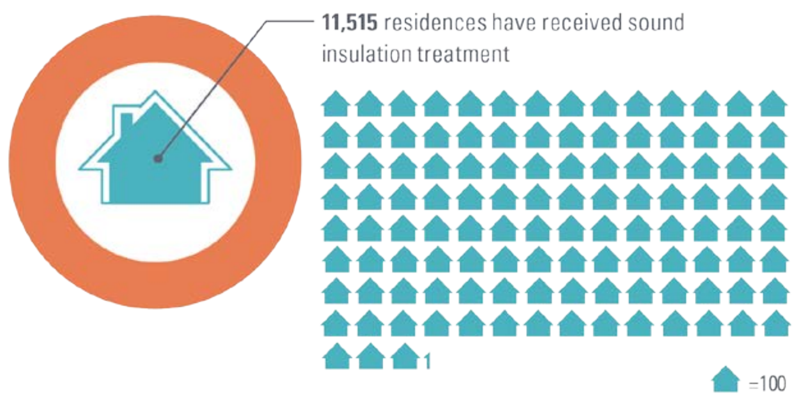
Figure 1-12 Reason for increase in Number of People Exposed to DNL Values Greater than or Equal to 65 dB (2015 INM to 2016 INM)



Note: When comparing the 2015 INM contour to the 2016 INM contour, there is an increase in noise exposed population. However, when comparing 2015 INM (the official 2015 model) and 2016 AEDT (the official 2016 model) there is a decrease in the noise exposed population.

- Runway use changes from 2015 to 2016 were the largest factor influencing noise exposure in 2016. The one-month closure of Runway 4L-22R for resurfacing caused air traffic to shift to Runway 15R-33L and Runway 9-27, and these changes in runway use are reflected in the contour changes.

  - East Boston is affected by start-of-takeoff roll (SOTR) noise from Runway 15R and departure overflights from Runway 33L, both of which had increases in departures;
  - Increases in departures from Runway 9 and Runway 27 had the effect of expanding the noise contour over Winthrop near Deer Island; and
  - Other changes in the contour were in nonresidential or offshore areas, but these were similarly affected by runway use changes.
- An additional factor influencing noise contour changes in 2016 was an increase in nighttime operations, from 50,786 in 2015 to 55,499 in 2016. Due to the 10-dB penalty applied to modeled nighttime operations, these operations have a disproportionate effect on the contour.
- Noise exposed population in 2016 was below the peak levels reached in 1990 and was less than in the year 2000 when 17,745 people were exposed to DNL levels greater than or equal to DNL 65 dB. Population exposed to these noise levels for 2016 was calculated to be 16,985 using the legacy INM model, and 7,450 using the next-generation AEDT model.
- Massport is a national leader in sound insulation mitigation. To date, in the vicinity of Logan Airport, Massport has provided sound insulation for a total of 11,515 residential units, and will continue to seek funding for sound insulation for properties that are eligible and whose owners have chosen to participate.
- Almost all residences exposed to levels greater than or equal to DNL 65 dB in 2016 have been eligible in the past to participate in Massport's residential sound insulation program (RSIP).



- In 2016, Massport received 38,045 noise complaints from 83 communities, compared to 17,685 in 2015 from 84 communities. It is important to note that the number of individual complainants rose from 1,903 in 2015 to 2,260 in 2016. The increase in complaints continues to be primarily related to the FAA's RNAV departure procedures, which concentrate flight tracks along narrower corridors. As has been Massport's practice, all complaints were forwarded to FAA.

FAA Reporting and Update

- In 2015, FAA required the use of its AEDT as a replacement for its legacy tool, the INM, for noise analyses requiring FAA approval. Prior to this, FAA had approved adjustments specific to Logan Airport to be used with INM, and Massport has been working with FAA to develop analogous adjustments to implement in AEDT. Massport chose to continue use of the INM for the *2015 EDR* while these discussions progressed, since FAA approval is not required for the EDR. In August 2017, FAA provided formal concurrence for some proposed adjustments but declined to concur with others. The memoranda related to this decision are included at the end of this chapter and in

Appendix H, *Noise Abatement*. Further details are provided below in the section on AEDT modeling.

- On October 7, 2016, Massport and FAA signed a Memorandum of Understanding (MOU) [43] to frame the process for analyzing opportunities to reduce noise through changes or amendments to Performance Based Navigation (PBN), including RNAV. Massport has been working with the FAA and others to develop test projects that are designed to help address the concentration of noise from PBN. This cooperation is a first-in-the-nation project between FAA and an airport operator to better understand the implications of PBN and evaluate strategies to address community concerns.
- The FAA's ROD (August 2002) approving construction of the unidirectional Runway 14-32 required that FAA, Massport, and the Logan Airport Community Advisory Committee (CAC) to jointly undertake a study to enhance existing and/or develop new noise abatement measures to further reduce noise impacts. The primary focus of the Boston-Logan Airport Noise Study (BLANS) was to determine viable ways to reduce noise from aircraft operations to and from Logan Airport without diminishing airport safety and efficiency.[44] The RNAV departure portions of Phase 1 of the project, first implemented in 2010, continued to be used in 2016.
    - During Phase 2 of the BLANS, the Logan Airport CAC voted to abandon the Preferential Runway Advisory System (PRAS) because it had not achieved the intended noise abatement. Although PRAS is not an active program, Massport continues to report on runway use relative to PRAS goals.
    - Phase 3 of BLANS is a series of tests of a potential Runway Use Program, which began in November 2014 and ended in November 2015.
    - The BLANS project ended in 2016 without the development of a new Runway Use Program. A final report for the program was issued in March 2017.[45]
- In May 2015, FAA announced that it had begun a nationwide study to re-evaluate the method for measuring effects of aircraft noise (DNL).[46] This is a multi-year study to update the scientific evidence on the relationship between aircraft noise exposure and its effects on communities around airports. FAA has been evaluating survey and noise data from 20 airports across the country and will then analyze the results to determine whether to update its methods for determining exposure to noise. Results of this study are expected by summer 2018. Future EDRs and ESPRs will provide updates, as available.

As shown in **Figure 1-13**, the 2016 DNL 65 dB contour is smaller than previous years including the 1998 DNL contour and 1990 DNL contour. Additional information is provided in Chapter 6, *Noise Abatement*.

---

43 Massport. October 7, 2016. *Massport and FAA Work to Reduce Overflight Noise.* https://www.massport.com/news-room/news/massport-and-faa-work-to-reduce-overflight-noise/.

44 For more information, visit the BLANS website at www.bostonoverflightnoisestudy.com/index.aspx.

45 For more information, see the BLANS final report at http://bostonoverflight.com/docs/blans-phase-3-final-report.pdf

46 Federal Aviation Administration. Press Release – FAA to Re-Evaluate Method for Measuring Effects of Aircraft Noise. https://www.faa.gov/news/press_releases/news_story.cfm?newsId=18774.

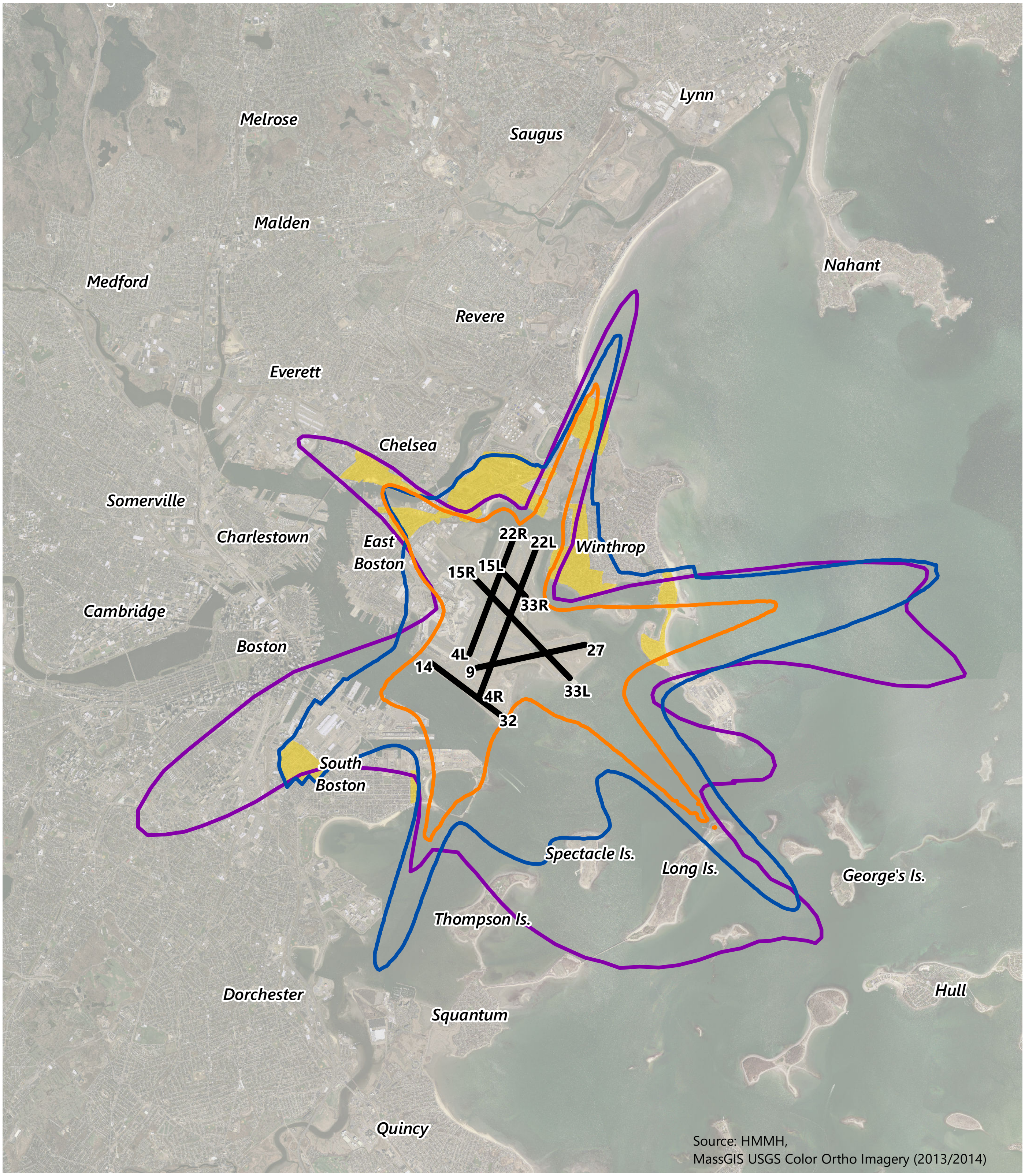


FIGURE 1-13 DNL 65 dB Contour Comparison with Historical Contour

2016 Environmental Data Report

2016 DNL Contour (AEDT 2c)
1998 DNL Contour
1990 DNL Contour
Sound Insulation Areas

0 2500 5000 10000 Feet

Air Quality/Emissions Reduction

As reported in previous EDRs, total air emissions from all sources associated with Logan Airport are considerably less than they were a decade ago. This long-term downward trend is consistent with Massport's longstanding objective to accommodate the demands of increasing passenger and cargo activity levels with reduced emissions. When compared to 2015, the changes in air emissions in 2016 are slightly up. The changes are associated with the upturn in aircraft operations. Massport is also committed to reducing VMT and associated emissions on Massport-controlled ground transport facilities (such as roadways and curbsides, parking facilities, and vehicle staging areas), as well as reducing VMT by airport users traveling to and from the Airport. Chapter 5, *Ground Access to and from Logan Airport* provides detailed information on Massport's ground access and parking management strategy.

Each year, Massport models the changes in air emissions for Airport-related activities. For the purposes of this assessment, the air quality modeled results are also a function of other important model input parameters including:

- Aircraft fleet mix characteristics;
- Airfield taxi/delay times;
- Ground service equipment (GSE) usage, including aircraft auxiliary power units (APUs);
- Motor vehicle traffic volumes; and
- Stationary source operations such as the Central Heating and Cooling Plant, snow melters, and emergency generators.

The following is a synopsis of these model inputs and updates for this *2016 EDR*:

- As of 2015, FAA requires aircraft-related assessments to be conducted using its new simulation tool for noise and air emissions, AEDT, for National Environmental Policy Act (NEPA) projects and soundproofing eligibility. For 2016, air quality modeling was performed with the latest version of FAA's AEDT to compute emissions from Logan Airport specific aircraft, APUs, and GSE. Modeling was also completed using the legacy model, FAA's Emissions and Dispersion Modeling System (EDMS), for comparison purposes. Massport will use AEDT for upcoming EDRs and ESPRs.
- Key inputs into the air emissions inventory include aircraft operations and average aircraft taxi/delay times. Aircraft operations increased 4.9 percent in 2016, from 195,611 landing and take offs (LTOs)[47] in 2016 compared to 186,465 LTOs in 2015. Average aircraft taxi/delay times decreased by about 30 seconds (25.3 minutes in 2016 versus 25.9 minutes in 2015). Although there was an increase in LTOs in 2016, aircraft operations and taxi times remained well below 2000 historic peak levels.[48] There were 243,998 LTOs in 2000 and the corresponding aircraft taxi times were about 27 minutes.

---

47 An LTO is defined as one landing/take-off cycle; it includes both the arrival and the departure. In Chapter 2, *Activity Levels,* the operation count is defined differently and counts one operation as either an arrival (landing) *or* a departure (take-off). Thus, there are 391,222 operations in 2016 (195,611 LTOs) and 372,930 operations in 2015 (186,465 LTOs).

48 See Chapter 2, *Activity Levels* for additional information on aircraft operations in 2016 and long-term trends.

- GSE emission factors in the AEDT database (derived from EPA's OFFROAD model) decreased in 2016 when compared to 2015 as this model also takes into account fleet modernization from year to year. Model input data are based on an updated on-site GSE time-in-mode survey conducted in June 2017 at the Airport. These data are combined with the most recent information regarding GSE fuel use (e.g., gasoline, diesel, CNG, liquid petroleum gas [LPG], and electric) from the Logan Airport Vehicle Aerodrome Permit Application documentation.[49] Compared to 2015, 2016 APU operating times increased by approximately 7.7 and 5.8 minutes for narrow body air carriers and large commuter aircraft, respectively. This change is primarily attributed to the updated 2017 time-in-mode survey, which provides a representation of actual APU operating times. The 2017 GSE time-in-mode survey can be found in Appendix I, *Air Quality/Emissions Reduction*.
- Motor vehicle emission factors were obtained from the newest version of the EPA's Motor Vehicle Emission Simulator model (MOVES2014a) and were combined with the MassDEP-recommended motor vehicle fleet mix data, operating conditions, and other Massachusetts-specific input parameters.
- Another important model input parameter is on-Airport VMT, which increased by approximately 4.8 percent in 2016 compared to 2015. The increase in VMT is largely associated with the 8.5-percent increase in passengers from 33.4 million in 2015 to 36.3 million in 2016 (see Chapter 5, *Ground Access to and from Logan Airport* for additional information).
- Natural gas usage by stationary sources (such as boilers and snow melters) decreased by 7.3 percent in 2016, when compared to 2015 (from 463 million cubic feet in 2015 to 429 million cubic feet in 2016). Diesel fuel usage by other snow melters also decreased in 2016 (from 381,581 gallons in 2015 to 90,850 gallons in 2016). These changes were largely attributable to a milder winter in 2016 compared to 2015.
- Fuel throughput of Jet A and gasoline increased by 21.6 percent and 4.9 percent, respectively, in 2016, when compared to 2015. These changes were mostly due to the increase in the number of aircraft operations and motor vehicles trips/VMT in 2016.

Based upon these model input parameters, the modeling results of the 2016 air emissions inventory for Logan Airport are summarized below. As shown in **Table 1-4**, AEDT computes somewhat higher aircraft-related emissions of volatile organic compounds (VOCs), oxides of nitrogen (NO_X), and carbon monoxide (CO) in comparison to EDMS model results. However, for particulate matter $(PM)_{10/2.5}$ estimates, the results are reversed with EDMS producing more modeled emissions than AEDT.

49 All vehicles and equipment (including GSE) that operate on the airfield must obtain a Logan Airport Vehicle Aerodrome Permit. The application form for this permit was modified in 2007 to request the fuel-type information (e.g., gasoline, diesel, CNG, LPG, and electric).

Table 1-4 AEDT/EDMS Total Emissions Inventory Comparison

Model	Pollutant (kg/day)			
	VOC	**NOx**	**CO**	**$PM_{10}/PM_{2.5}$**
2015 EDMS	1,188	4,262	7,243	98
2016 EDMS	1,242	4,696	7,328	106
2016 AEDT	1,280	5,300	7,350	96
% Difference between 2016 EDMS and 2016 AEDT	**3.0%**	**12.9%**	**0.3%**	**(9.4%)**
% Difference between 2015 EDMS and 2016 AEDT	**7.7%**	**24.4%**	**1.5%**	**(2.0%)**

Source: Massport, KBE.
Note: Negative numbers are shown in ( )

- Total modeled emissions of VOCs increased by 7.7 percent in 2016 to 1,280 kilograms (kg)/day, compared to 1,188 kg/day in 2015, which is still well below 1990 and 2000 levels. The increase in VOC emissions is primarily influenced by the increase in emissions from other sources, which include stationary and fueling sources and an increase in aircraft-related VOC emissions due to modeling differences between EDMS and AEDT.
- Total modeled NO_x emissions increased by 24.4 percent in 2016 to 5,300 kg/day, compared to 4,262 kg/day in 2015. The increase in 2016 is still well below 1990 and 2000 levels. The increase in NO_x emissions is influenced by the increase in aircraft operations in 2016 and largely due to modeling differences between EDMS and AEDT.
- Total modeled CO emissions increased by 1.5 percent in 2016 to 7,350 kg/day, compared to 7,243 kg/day in 2015; emissions in 2016 were still well below 1990 and 2000 levels. The change in CO emissions is influenced by the increase in aircraft operations; however, this was offset by a decrease in motor vehicle emissions factors in 2016.
- Total modeled $PM_{10}/PM_{2.5}$ emissions decreased by 2.0 percent in 2016 to 96 kg/day, compared to 98 kg/day in 2015. The decrease in $PM_{10}/PM_{2.5}$ emissions is primarily influenced by model differences for aircraft emissions in AEDT.
- For nine consecutive years, Massport has voluntarily prepared a greenhouse gas (GHG) emissions inventory for the Logan Airport EDR. In 2016, total GHG emissions grew by approximately 2.8 percent. As reported in past year's EDRs, Logan Airport-related GHG emissions in 2016 comprised less than 1 percent of statewide totals.
- In response to the March 9, 2018 Secretary's Certificate on the *2016 EDR Notice of Project Change*, Massport has augmented its GHG reporting to show normalized GHG emissions and building energy use data (see Chapter 7, *Air Quality/Emissions Reduction*). Normalizing the data shows that Logan Airport is operating more efficiently over time, serving more passengers in larger building footprint with less energy.

- GHG emissions per passenger (Scopes 1 and 2) have decreased by over 34 percent from 2007 to 2016.
- Logan Airport's energy use intensity, which is a measure of building-only energy consumption per square foot, has decreased by over 23 percent from 2007 to 2016.
- Building GHG emissions per square foot has decreased by over 43 percent from 2007 to 2016.

Additional information is provided in Chapter 7, *Air Quality/Emissions Reduction*.

Water Quality/Environmental Compliance and Management

Massport's approach to environmental management and compliance is a key component of its commitment to sustainability and responsible stewardship at Logan Airport (refer to the following section of this chapter for details). Through monitoring and documentation, environmental performance is assessed, allowing policies and programs to be developed, implemented, evaluated, and continuously improved.

Massport is responsible for ensuring compliance with applicable state and federal environmental laws and regulations. Massport promotes appropriate environmental practices through pollution prevention and remediation measures. Massport also works closely with Airport tenants and Airport operations staff in an effort to improve compliance. The following summarizes the key water quality and compliance findings for 2016.

- The most recent International Organization for Standardization (ISO) 14001 Environmental Management System certification audit took place in June 2014, and a certificate was issued in July 2014. This certificate is valid through July 2017. Massport holds regular meetings to adhere to regulatory requirements and improve environmental performance beyond compliance.
- Massport's Stormwater Pollution Prevention Plan (SWPPP) addresses general stormwater pollutants and also addresses deicing and anti-icing chemicals, potential bacteria, fuel and oil, and other potential sources of stormwater pollutants.[50]
- In 2016, approximately 98.6 percent of stormwater samples were in compliance with standards (see **Table J-15** in Appendix J, *Water Quality/Environmental Compliance and Management* for more details). Due to the large size of the drainage areas and relatively low concentration of pollutants, it is not always possible to trace exceedances to specific events. Where a known event such as a spill is reported, Massport routinely checks the drainage system for impacts from the event and takes corrective actions if necessary.
- Out of 204 samples (including: oil and grease, total suspended solids (TSS), and pH at North, West, Porter Street, and Maverick Street Outfalls), 201 were at or below National Pollutant Discharge Elimination System (NPDES) permit limits.

50 The 2016 Annual Certificates of Compliance were submitted to EPA and MassDEP on December 21, 2016, for Massport and the co-permittees.

  - One outfall sample, out of a total of 23 samples, at the Maverick Street Outfall exceeded the regulatory limit of the NPDES Permit for TSS. The TSS exceedance at the Maverick Street Outfall was reported in November 2016.
  - One outfall sample, out of a total of 11 samples, at the Maverick Street Outfall and one sample, out of a total of 11 samples, at the North Outfall was measured outside of the regulatory limits of the NPDES permit for pH. The pH exceedance at the Maverick Street Outfall was reported in March 2016 and the pH exceedance at the North Outfall was reported in April 2016, as required.
- In 2016, there were 14 oil and hazardous material spills that required reporting to MassDEP, five of which involved the storm drainage system.[51] All spills were adequately addressed with no adverse impacts to water quality.
- In accordance with the Massachusetts Contingency Plan (MCP), Massport continues to assess, remediate, and bring to regulatory closure areas of subsurface contamination. Massport is working towards achieving regulatory closure of the remaining Logan Airport MCP sites associated with known releases, as well as addressing sites encountered during construction. (see **Table 8-4** in Chapter 8, *Water Quality/Environmental Compliance and Management* for more information about updates and progress made for all MCP sites.)

Chapter 8, *Water Quality/Environmental Compliance and Management* provides additional information.

51 State environmental regulations require that oil spills of 10 gallons or more in volume be reported to MassDEP.

Sustainability and Resiliency at Logan Airport

Massport is committed to a robust sustainability program. Sustainability has redefined the values and criteria for measuring organizational success by using a "triple bottom line" approach that considers economic, ecological, and social well-being. Applying this approach to decision-making is a practical way to optimize economic, environmental, and social capital. Massport is taking a broad view of sustainability that builds upon the triple bottom line concept, and considers the airport-specific context.

Figure 1-14 EONS Approach to Sustainability

Consistent with the Airports Council International - North America's (ACI-NA) definition of Airport Sustainability[52] (see **Figure 1-14**), Massport is focused on a holistic approach to managing Logan Airport to ensure Economic viability, Operational efficiency, Natural resource conservation, and Social responsibility (EONS). Massport is committed to implementing environmentally sustainable practices Airport- and Authority-wide, and continues to make progress on a range of initiatives. The following sections summarize many of the long-term and multifaceted sustainability initiatives undertaken by Massport, which individual chapters of this *2016 EDR* more fully describe, where appropriate. **Figure 1-15** highlights some of Massport's recent sustainability initiatives.

Figure 1-15 Recent Sustainability Highlights

52 Airports Council International (ACI). Airport Sustainability: A Holistic Approach to Effective Airport Management. Undated. http://www.aci-na.org/static/entransit/Sustainability%20White%20Paper.pdf.

Logan Airport Sustainability Management Plan (SMP)

Massport is committed to reducing local environmental impacts without sacrificing service level; Massport's robust sustainability program is indicative of this commitment. In 2013, Massport was awarded a grant by FAA to prepare a SMP for Logan Airport. The Logan Airport SMP planning effort began in May 2013 and was completed in April 2015. The Logan Airport SMP takes a broad view of sustainability including economic vitality, operational efficiency, natural resource conservation, and social responsibility considerations. The Logan Airport SMP is intended to promote and integrate sustainability Airport-wide and to coordinate on-going sustainability efforts across Massport. The Logan Airport SMP developed a framework and implementation plan, with metrics and targets, designed to track progress over time. Massport is currently advancing a series of short-term initiatives to help reach its goals (see **Table 1-5**) in the areas of energy and greenhouse gas emissions; community, employee, and passenger well-being; resiliency; materials, waste management, and recycling; and water conservation. The Logan Airport SMP is available online at: https://www.massport.com/massport/business/capital-improvements/sustainability/sustainability-management/.

The Logan Airport Annual Sustainability Report, first published in April 2016, provides a progress summary of sustainability efforts at Logan Airport based on Massport's sustainability goals and targets established in the Logan Airport SMP. A copy of the Annual Sustainability Report can be found at: http://www.massport.com/media/2363/logan-annual-sustainability-report-2016.pdf.

Logan Airport Sustainability Goals

As part of the Logan Airport SMP, Massport set goals to improve Logan Airport's performance in ten sustainability categories: (1) energy and GHG emissions; (2) water conservation; (3) community, employee, and passenger well-being; (4) materials, waste management, and recycling; (5) resiliency; (6) noise abatement; (7) air quality improvement; (8) ground access and connectivity; (9) water quality/stormwater; and (10) natural resources. **Table 1-5** describes each goal, as the *Logan Airport SMP* defines them. Massport reports its progress towards achieving each goal, including changes in related performance, in sustainability reports. Massport released its first sustainability report in 2016. Since the publication of the *2015 Logan Airport SMP*, Massport has continued expanding its sustainability initiatives, which an increased focus on implementing resliency measures to protect Maritime and Logan Airport operations, cirital infrastructure, and workforce. The lastest Annual Sustainability and Resiliency Report highlights Massport's progress towards improving sustainability and enhancing resiliency at its facilities and is available on Massport's website at: http://www.massport.com/massport/business/capital-improvements/sustainability/sustainability-management/.

Table 1-5 Logan Airport Sustainability Goals and Descriptions

Sustainability Category	Goal	Sustainability Category	Goal
Energy and Greenhouse Gas (GHG) Emissions	Reduce energy intensity and GHG emissions while increasing portion of Logan Airport's energy generated from renewable sources.	Water Conservation	Conserve regional water resources through reduced potable water consumption.
Community, Employee, and Passenger Well-being	Promote economically prosperous and healthy communities and passenger and employee well-being.	Materials, Waste Management, and Recycling	Reduce waste generation, increase the recycling rate, and utilize environmentally sound materials.
Resiliency	Become an innovative model for resiliency planning and implementation among port authorities.	Noise Abatement	Minimize noise impacts from Logan Airport's operation.
Air Quality Improvement	Decrease emissions of air quality criteria pollutants from Logan Airport sources.	Ground Access and Connectivity	Provide superior ground access to Logan Airport through alternative and HOV travel modes.
Water Quality/Stormwater	Protect water quality and minimize pollutant discharges.	Natural Resources	Protect and restore natural resources near Logan Airport.

Sustainability in Planning, Design, and Construction

The following sections outline Massport's sustainability achievements in the planning, design, and construction of its projects.

Leadership in Energy and Environmental Design (LEED®)-Certified Facilities at Logan Airport

The United States Green Building Council's (USGBC) LEED rating system is the most widely recognized third-party green building certification system in North America. Massport is striving to achieve LEED certification for all new and substantial renovation building projects over 20,000 square feet. Most recently, in 2017, the Terminal E New Large Aircraft Wing (Terminal E Renovation and Enhancements Project) received LEED Gold certification for Commercial Interiors. Other recent examples of LEED-certified buildings at Logan Airport are the new RCC and the Green Bus Depot (see **Figure 1-16** and **Table 1-6**). The new RCC in the SWSA began construction in 2010 and was completed in 2013. Massport is very proud that the RCC obtained Logan Airport's first LEED Gold certification in 2015. The LEED-Silver Green Bus Depot shifted bus maintenance operations on-Airport from an off-Airport location, which reduced bus trips and unnecessary emissions on congested neighborhood roadways. Further details are available in Chapter 3, *Airport Planning*.

Figure 1-16 LEED-Certified Facilities at Logan Airport

Signature Flight Support General Aviation Facility, LEED Certified (2008)

Terminal A, LEED Certified (2006)

Rental Car Center, LEED Gold Certified (2015)

Green Bus Depot, LEED Silver Certified (2014)

Terminal E New Large Aircraft Wing, LEED Gold Certified (2017)

Sustainable Design Standards and Guidelines and LEED Certification

For smaller building projects and non-building projects, Massport uses its *Sustainable Design Standards and Guidelines* (SDSG) to incorporate sustainability. The SDSG, revised and reissued in March 2011, provides a framework for sustainable design and construction for both new construction and rehabilitation projects. The SDSG applies to a wide range of project-specific criteria, such as site design, project materials, energy management and efficiency, air emissions, water management quality and efficiency, indoor air quality, and occupant comfort. Massport has used the new standards to guide over $200 million in capital projects Authority-wide between fiscal years 2010 to 2013, including over $30 million for maritime projects. In addition to SDSG, Massport strives to attain LEED certification for eligible projects. In 2014, the Green Bus Depot was certified as LEED Silver, and in 2015, the RCC was certified as LEED Gold.

Table 1-6 Leadership in Energy and Environmental Design (LEED)-Certified Facilities at Logan Airport

Terminal A (LEED Certified) Completed 2005/2006

- First airport terminal in the world to be LEED Certified
- Priority curb locations for high occupancy vehicles (HOV) and bicycles
- Retrofitting with solar panels on the Terminal A roof
- Stormwater filtration
- Reflective roof
- Water use reduction features
- Natural daylighting paired with advanced lighting technologies for energy efficiency
- Use of recycled and regionally sourced materials
- Measures to enhance indoor air quality

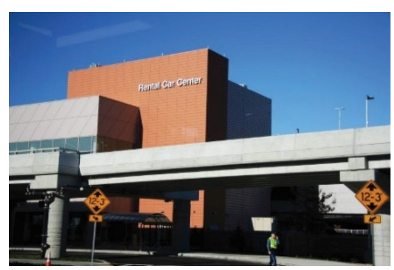
Signature Flight Support General Aviation Facility (LEED Certified) Completed 2007/2008

- Mechanisms to reduce water use
- Natural day lighting with advanced lighting technologies for energy efficiency
- Window glazing and sunshades to maximize daylight and minimize heat build-up
- Recycled and regionally sourced materials
- Measures to enhance indoor air quality

Green Bus Depot (LEED Silver) Completed 2014

- Rooftop solar panels
- Water and energy saving features
- Vehicle miles traveled (VMT) reduction
- New shuttle fleet including 50 clean diesel/electric hybrid buses and CNG buses
  Sustainably grown, harvested, produced, and transported building materials

Rental Car Center (RCC) (LEED Gold) Completed 2013



- Green building materials
- Rooftop solar panels
- Bike and pedestrian access and connections
- Natural day lighting and advanced lighting technologies for energy efficiency
- Use of recycled and regionally sourced materials
- Enhanced indoor air quality
- Plug-in stations for electric vehicles and other alternative fuel sources such as E-85 (ethanol)
- Rental car fleets which include hybrid/alternative fuel/low emitting vehicles
- Pedestrian connections
- Bicycle facilities and employee showers/changing
- Water reclamation for vehicle wash water, and use of stormwater for non-potable uses such as vehicle washing and landscaping irrigation
- VMT reduction

Table 1-6 Leadership in Energy and Environmental Design (LEED)-Certified Facilities at Logan Airport (Continued)

Terminal E New Large Aircraft Wing (LEED Gold - Commercial Interiors) Completed 2017

- Reduces heat island effect by providing a reflective white roof and a light color concrete tarmac
- Low-flow water fixtures and water closets
- Efficient light fixtures and efficient heating, ventilation, and air conditioning (HVAC) system
- Use or renewable energy sources
- Recycled and regionally sourced materials
- Enhanced indoor air quality
- Solar-thermal domestic hot water system to heat 100 percent of the wing's domestic water needs

Climate Change and Resiliency Planning

As the Boston area will continue to experience increased temperatures, more frequent extreme weather events, and higher sea level due to climate change,[53] Massport understands the importance of preparing for impacts in order to protect and enhance its critical infrastructure, operational assets, and workforce. Through robust planning and regional collaboration, Massport strives to continue its leadership role in resiliency planning among port authorities, the airport industry, and the Boston region.

At the end of 2013, Massport initiated a Disaster and Infrastructure Resiliency Planning (DIRP) Study for Logan Airport, the Port of Boston, and Massport's waterfront assets in South and East Boston. The DIRP Study includes a hazard analysis, modeling sea-level rise and storm surge, and projections of temperature, precipitation, and anticipated increases in extreme weather events. The DIRP Study provides recommendations regarding short-term strategies to make Massport's facilities more resilient to the likely effects of climate change. In 2014, the study was completed and implementation of adaptation initiatives began in late 2014.

In addition to the DIRP Study and its related initiatives, Massport has completed an Authority-wide risk assessment, as part of its strategic planning initiative; issued a Floodproofing Design Guide; and has developed a resilience framework to provide consistent metrics for short- and long-term planning and protection of its critical facilities and infrastructure. Beyond physical resiliency, Massport is also focused on incorporating social and economic resilience into its long-term operational and capital planning. Massport's Floodproofing Design Guide was published in November 2014 and updated in April 2016.

Operational aspects of resiliency strategy include the development of Flood Operations Plans for Logan Airport and Massport maritime facilities. These plans were introduced in 2015 and included the planned deployment of temporary flood barriers to protect up to 12 locations of critical infrastructure in the event of severe weather. Additional locations have been permanently enhanced to prevent flooding. The flood operations plans are evaluated annually to enhance their effectiveness and to adapt to evolving requirements and past experiences.

53 City of Boston. 2016. *Climate Ready Boston*. https://www.boston.gov/sites/default/files/climatereadyeastbostoncharlestown_finalreport_web.pdf.

Tabletop planning exercises simulating a hurricane scenario and cross-functional workshops have been conducted to further refine plans and train staff. Finally, the design flood elevation that resulted from the original DIRP study in 2015 was updated as a result of enhanced storm modeling that was made available to Massport through MassDOT. Adjustments to the prioritized resiliency recommendations were made to accommodate the revised flood elevation.

Massport reports on progress towards resiliency goals in its Logan Airport Annual Sustainability Reports. Additional information about Massport's resiliency initiative is available at: http://www.massport.com/massport/business/capital-improvements/sustainability/climate-change-adaptation-and-resiliency/resiliency-and-climate-change/.

Logan Airport Environmental Review Process

This *2016 EDR* is part of a well-established, state-level environmental review process that assesses Logan Airport's cumulative environmental impacts. The process provides a context against which individual projects at Logan Airport meeting state and federal environmental review thresholds are evaluated on a project-specific basis. The Airport-wide and project-specific environmental review processes are described below.

Historical Context for the Logan Airport EDR/ESPR

In 1979, the Secretary of EEA issued a Certificate requiring Massport to define, evaluate, and disclose every three years the impact of long-term growth at the Airport through a Generic Environmental Impact Report (GEIR). The Certificate also required interim Annual Updates to provide data on conditions for the years between GEIRs. The GEIR evolved into an effective planning tool for Massport and provided projections of environmental conditions so that the cumulative effects of individual projects could be evaluated within a broader context.

EEA eliminated GEIRs following the 1998 revisions to its MEPA regulations. However, the Secretary's Certificate on the 1997 Annual Update[54] proposed a revised environmental review process for Logan Airport resulting in Massport's preparation of subsequent EDRs/ESPRs. The more comprehensive ESPRs provide a long-range analysis of projected operations, passengers, and cumulative impacts, while EDRs are prepared annually to provide a review of environmental conditions for the reporting year compared to the previous year. The EDR/ESPR process was developed to allow individual projects at Logan Airport to be considered and analyzed in the broader, Airport-wide context. As stated in the introduction to the *1999 ESPR*, "while the Logan ESPR and EDRs provide the broad planning context for projects proposed for Logan Airport and future planning concepts under consideration by Massport, no specific projects can be built solely on the basis of inclusion and discussion in the *1999 ESPR."* It continues to state that projects that meet MEPA or NEPA review thresholds must undergo those processes, as needed. In short, the EDRs/ESPRs provide a planning context which complements the individual project-specific filings.

54 Certificate of the Secretary of the Executive Office of Environmental Affairs on the Logan Airport 1997 Annual Update, issued on October 16, 1998.

In the last several years, aircraft operations and passenger activity levels and associated environmental effects have remained well below levels previously analyzed for Logan Airport. Thus, the forecasted aviation growth presented in the *2004 ESPR*, the predicate upon which the ESPR schedule was initially established, has not occurred. Accordingly, with the approval of the Secretary, Massport prepared *2009* and *2010 EDRs* in lieu of the ESPR originally planned for 2009. The *2011 ESPR*, filed in early 2013, reported on calendar year 2011 and updated passenger activity level and aircraft operations forecasts. The *2012/2013 EDR* presented conditions for both calendar years 2012 and 2013. The *2014 EDR and 2015 EDR* presented conditions for calendar years 2014 and 2015.

This *2016 EDR* provides a comprehensive, cumulative analysis of the effects of all Logan Airport activities based on actual passenger activity and aircraft operation levels in 2016, and presents environmental management plans for addressing areas of environmental concern. Massport proposes to prepare a *2017 ESPR* to report on activity levels and environmental conditions for that year and projections through 2035, and anticipates publishing this report by early 2019. Where appropriate, Massport will continue to identify and address any longer-term aviation and environmental trends in both EDRs and ESPRs. As directed in the Secretary's Certificate on the Terminal E Modernization Project ENF, the EDR/ESPR will continue to be the forum to address cumulative, Airport-wide impacts.

Project-Specific Review

While this Airport-wide review provides the broad planning context for proposed projects and future planning concepts, certain Airport projects are also subject to a project-specific, public environmental review process when they meet state environmental review thresholds. When required, Massport and Airport tenants submit ENFs and EIRs pursuant to MEPA. Similarly, where NEPA[55] environmental review is triggered, projects are reviewed under the NEPA environmental review process.

Organization of the *2016 EDR*

The remainder of this *2016 EDR* includes:

- **Spanish Executive Summary,** provides a translated version of the Executive Summary included after the English-version of Chapter 1, *Introduction/Executive Summary*.
- **Chapter 2, *Activity Levels***, presents aviation activity statistics for Logan Airport in 2016 and compares activity levels to the prior year. The specific activity measures discussed include air passengers, aircraft operations, fleet mix, and cargo/mail volumes.
- **Chapter 3, *Airport Planning***, provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2016. It also describes known future planning, construction, and permitting activities and initiatives.
- **Chapter 4, *Regional Transportation***, describes activity levels at New England's regional airports in 2016 and updates recent regional planning activities.

55 42 USC Section 4321 et seq. The Federal Aviation Administration (FAA) implements NEPA through FAA Order 1050.1E, Environmental Impacts: Policies and Procedures, Federal Aviation Administration, United States Department of Transportation, Effective Date: March 20, 2006.

- **Chapter 5*, Ground Access to and from Logan Airport***, reports on transit ridership, roadways, traffic volumes, and parking for 2016.
- **Chapter 6, *Noise Abatement***, updates the status of the noise environment at Logan Airport in 2016 and describes Massport's efforts to reduce noise levels.
- **Chapter 7, *Air Quality/Emissions Reduction***, provides an overview of Airport-related air quality in 2016 and efforts to reduce emissions.
- **Chapter 8, *Water Quality/Environmental Compliance and Management***, describes Massport's ongoing environmental management activities including National Pollutant Discharge Elimination System (NPDES) compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan (MCP), and tank management.
- **Chapter 9, *Project Mitigation Tracking***, reports on Massport's progress in meeting its MEPA Section 61[56] mitigation commitments for specific Airport projects.

MEPA Appendices: These include the Secretary of EEA's Certificate on the *2015 EDR*, comment letters received on the *2015 EDR* and responses to those comments, Secretary Certificates on the annual reports issued for reporting years 2011 through 2015, a list of reviewers to whom this *2016 EDR* was distributed, and a proposed scope for the *2017 ESPR*. Also included in this section are the Secretary's Certificates on the Terminal E Modernization Project ENF, Draft EA/EIR, Final EA/EIR, and the Secretary's Certificate on the Logan Airport Parking Project ENF.

Appendix A – MEPA Certificates and Responses to Comments[57]
Appendix B – Comment Letters and Responses
Appendix C – Proposed Scope for the 2017 ESPR
Appendix D – Distribution List

Technical Appendices:[58] These include detailed analytical data and methodological documentation for the various environmental analyses presented in and conducted for this *2016 EDR*.

Appendix E – Activity Levels
Appendix F – Regional Transportation
Appendix G – Ground Access
Appendix H – Noise Abatement
Appendix I – Air Quality/Emissions Reduction
Appendix J – Water Quality/Environmental Compliance and Management
Appendix K – 2016 and 2017 Peak Period Pricing Monitoring Report
Appendix L – Reduced/Single Engine Taxiing at Logan Airport Memoranda

---

56 Massachusetts General Law, Chapter 30, Section 61 (M.G.L. c. 30, § 61) states that all agencies must review, evaluate, and determine environmental impacts of all projects or activities and shall use all practicable means and measures to minimize damage to the environment. For projects requiring an Environmental Impact Report, Section 61 Findings will specify all feasible measures to be taken to avoid or mitigate environmental impacts, the party responsible for funding the mitigation measures, and the anticipated implementation schedule for mitigation measures.

57 The Secretary's Certificates on the Terminal E Modernization Project Environmental Notification Form, Draft EA/EIR and Final EA/EIR are included in Appendix A. For convenience, Massport has responded to comments that relate to the EDR and ESPR.

58 Technical appendices are available on Massport's website at www.massport.com.

This Page Intentionally Left Blank.

Introducción/Resumen Ejectivo

(Spanish Executive Summary)

This Page Intentionally Left Blank.

1

Introducción/Resumen Ejecutivo

Introducción

Mediante este *Informe de datos medioambientales (Environmental Data Report, EDR) del Aeropuerto Logan* del 2016, la Autoridad Portuaria de Massachusetts (Massport) se complace en continuar con la práctica (de casi tres décadas) de proveer un registro exhaustivo sobre las tendencias medioambientales, la planificación de las mejoras, los niveles de operaciones y de pasajeros del Aeropuerto Internacional de Boston-Logan y los compromisos de mitigación ambientales de Massport. El Aeropuerto Logan, operado y propiedad de Massport, es el principal aeropuerto de vuelos internacionales y domésticos de la zona de Nueva Inglaterra. Este *EDR de 2016* es parte de una serie de documentos de revisión medioambiental entregados anualmente desde 1979 al secretario de la Oficina Ejecutiva de Energía y Asuntos Medioambientales (Executive Office of Energy and Environmental Affairs, EEA) en cumplimiento con la Oficina de la Ley de Políticas Medioambientales de Massachusetts (Massachusetts Environmental Policy Act, MEPA)[1] para informar los efectos medioambientales acumulados de las operaciones y de las actividades del Aeropuerto Logan. El Aeropuerto Logan es el primer aeropuerto del país para el que se confeccionó una tarjeta de informe medioambiental anual sobre las actividades aeroportuarias y Massport continúa siendo líder en informes medioambientales.

Aproximadamente, cada cinco años, Massport confecciona un informe de estado medioambiental y de planificación (Environmental Status and Planning Report, ESPR) que brinda un panorama histórico y prospectivo del Aeropuerto Logan. Los EDR, que se confeccionan anualmente en los intervalos entre los ESPR, brindan una revisión de las condiciones medioambientales para el año que se informa en comparación con el año anterior. Con el paso del tiempo, los impactos medioambientales asociados con el Aeropuerto Logan han ido disminuyendo, según se informa todos los años en las presentaciones de los EDR/ESPR. Este *EDR 2016* sigue al *EDR 2015* e informa sobre las condiciones de 2016.

Informes de datos medioambientales anuales e informes del estado medioambiental y de planificación desde 1991.

Después del *EDR de 2015*, se programó originalmente que el próximo informe anual fuera un *ESPR 2016. Sin embargo,* con la aprobación previa de la Secretaría de la

1 Capítulo 30 de las leyes generales de Massachusetts, secciones 61-62H. La MEPA se implementa mediante las reglamentaciones publicadas en el Código de Normas de Massachusetts (Code of Massachusetts Regulations, CMR) 301 11.00 (las reglamentaciones MEPA).

EEA, Massport preparó un EDR para 2016. En los últimos años, las tendencias de demandas aéreas de pasajeros han aumentado rápidamente y el panorama de las compañías aéreas está cambiando. Adicionalmente, el transporte terrestre en el Aeropuerto Logan también ha cambiado rápidamente con la introducción de las empresas de red de transporte (TNC), como Uber y Lyft. Debido a estos rápidos cambios, el 2016 no sirve como base razonable para la predicción para la evaluación de los impactos a largo plazo. Por lo tanto, al terminar la recopilación de datos por un año completo, Massport confeccionará un *ESPR 2017,* que incluirá una actualización de la proyección a futuro y un mejor entendimiento de las opciones de transporte terrestre futuro desde y hacia el Aeropuerto Logan.

El alcance de este documento se estableció mediante la certificación del secretario con fecha del 17 de febrero de 2017, y enmendado el 09 de marzo de 2018, para incluir en el Apéndice A, *Certificados y Respuestas a los Comentarios de la MEPA.* Este *EDR 2016* cumple con todos los requisitos establecidos en la certificación del secretario de 2018. Este *EDR 2016* incluye datos de las siguientes categorías y provee respuestas detalladas a los comentarios de la certificación del secretario. Las proyecciones para los próximos años y las evaluaciones del impacto se proporcionarán en el *ESPR 2017*.

Este *EDR 2016* actualiza y compara los datos presentados en el *EDR 2015*, y presenta la siguiente información para 2016.

- Niveles de Actividad (incluyendo las operaciones de las aéreas, movimiento de pasajeros y los volúmenes de carga)
- Planificación Aeroportuaria (incluyendo las actividades que están en curso y los proyectos programados)
- Rol del Aeropuerto Logan en la red de Transporte Regional
- Acceso Terrestre desde y hacia el Aeropuerto
- Disminución del Ruido
- Calidad del Aire y Reducción de las Emisiones Atmosféricas
- Calidad del Agua/Cumplimiento Medioambiental
- Compromisos de Mitigación Ambiental
- Sustentabilidad y Resiliencia

Para mejorar la utilidad de este *EDR 2016* como documento de referencia para los revisores, este informe también presenta datos históricos sobre las condiciones medioambientales en el Aeropuerto Logan desde 1990, en las instancias en que hay información histórica disponible. Los datos históricos se incluyen en los apéndices técnicos (solo en CD).

Este *EDR de 2016* incluye una traducción al español del resumen ejecutivo. Esta versión traducida se incluye después de la versión en inglés del resumen ejecutivo.

EEA Nº 3247

Presentada por

Massachusetts Port Authority
(Autoridad Portuaria de Massachussetts)
One Harborside Drive, Suite 200S
East Boston, MA 02128

Stewart Dalzell, Sub-Director
Planificación Estratégica y de Negocios
(617) 568-3524

Michael Gove, Director de Proyectos
Planificación Estratégica y de Negocios
(617) 568-3546

Contexto de la Planificación del Aeropuerto Logan

El Aeropuerto Logan cumple una función clave en las redes de transporte de pasajeros y de mercadería del área metropolitana de Boston y de la zona de Nueva Inglaterra. Los límites del aeropuerto abarcan aproximadamente 970 hectáreas en el sector Este de Boston y Winthrop, incluidas aproximadamente 283 hectáreas submarinas en el puerto de Boston. El aeropuerto de Boston, que se muestra en la **Figura 1-1** y **1-2**, es uno de los aeropuertos con terreno más limitado del país y está rodeado en tres laterales por el puerto de Boston.

El Aeropuerto Logan está cerca del centro de Boston y se le puede tener acceso por dos líneas de transporte público, cinco líneas de autobuses directas y un sistema de carreteras bien conectadas. Massport también presta el servicio de autobuses Logan Express desde y hacia el Aeropuerto Logan para los pasajeros aéreos y para los empleados desde los estacionamientos de las estaciones de transporte público, localizadas en Braintree, Framingham, Woburn y Peabody. El aeropuerto comprende de seis pistas, aproximadamente 24 ,14 Km de pistas aéreas y aproximadamente 97 hectáreas de plataformas de cemento y asfalto. El Aeropuerto Logan tiene cuatro terminales de pasajeros (Terminales A, B, C y E), cada una con sus propias instalaciones de emisión de boletos, reclamo de equipaje y transporte terrestre. Massport sigue evaluando e implementando mejoras en el Aeropuerto Logan, en la seguridad, en la eficacia operativa y en el acceso desde y hacia el área metropolitana de Boston, mientras controla atentamente los efectos medioambientales de las operaciones del Aeropuerto Logan.

En 2016, se contrataron más de 17.000 personas en el Aeropuerto Logan. Esto incluyó aproximadamente 1200 miembros del personal y empleados administrativos del aeropuerto Massport. En la *Actualización del estudio del Impacto Económico del Aeropuerto Estatal de Massachusetts* (*Massachusetts Statewide Airport Economic Impact Study Update)* de la División Aeronáutica del Departamento de Transporte de Massachussets (Massachusetts Department of Transportation, MassDOT) se observó que, en 2014, el Aeropuerto Logan sustentó aproximadamente 132.000 puestos de trabajo directos e indirectos, y aportó cerca de US$ 13,3 mil millones anuales a la economía local, esto incluye todos los negocios del aeropuerto, la construcción, los visitantes y los efectos multiplicadores.[2]

En 2016, el Aeropuerto Logan fue el aeropuerto comercial Nº 17 con mayor actividad en los EE. UU. según la cantidad de pasajeros comerciales y el Nº 18 con mayor actividad de movimientos de aeronaves [3] de los EE. UU. Boston es un destino internacional y nacional muy importante y las aerolíneas buscan expandir el servicio internacional en el Aeropuerto Logan en función de la demanda de pasajeros actuales y prevista. El nuevo servicio internacional ha aportado, solo en los últimos cinco años, más de US$ 1,3 mil millones por año a la economía local y US$ 49 millones en nueva recaudación incremental fiscal a través de ingresos y ventas. [4]

El Aeropuerto Logan cumple con un número de funciones en las redes de transporte aéreo local, nacional y de la zona de Nueva Inglaterra. Es el principal aeropuerto del área metropolitana de Boston, el principal aeropuerto de la zona de Nueva Inglaterra para los servicios de larga distancia y una gran puerta de entrada internacional a los EE. UU. para los servicios transatlánticos.

2 Comisión Aeronáutica de Massachussets (Massachusetts Aeronautics Commissions). 2014. *Estudio del impacto económico del aeropuerto estatal de Massachusetts* https://www.massdot.state.ma.us/portals/7/docs/airportEconomicImpactSummary.pdf.

3 Consejo Internacional de Aeropuertos. Septiembre de 2017 *Worldwide Airport Traffic Report.*

4 InterVISTAS. 2015. Impacto económico de las rutas internacionales recientes.

FIGURA 1-1 Vista Aérea del Aeropuerto Logan | **2016 Environmental Data Report**

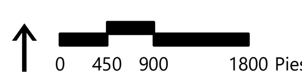


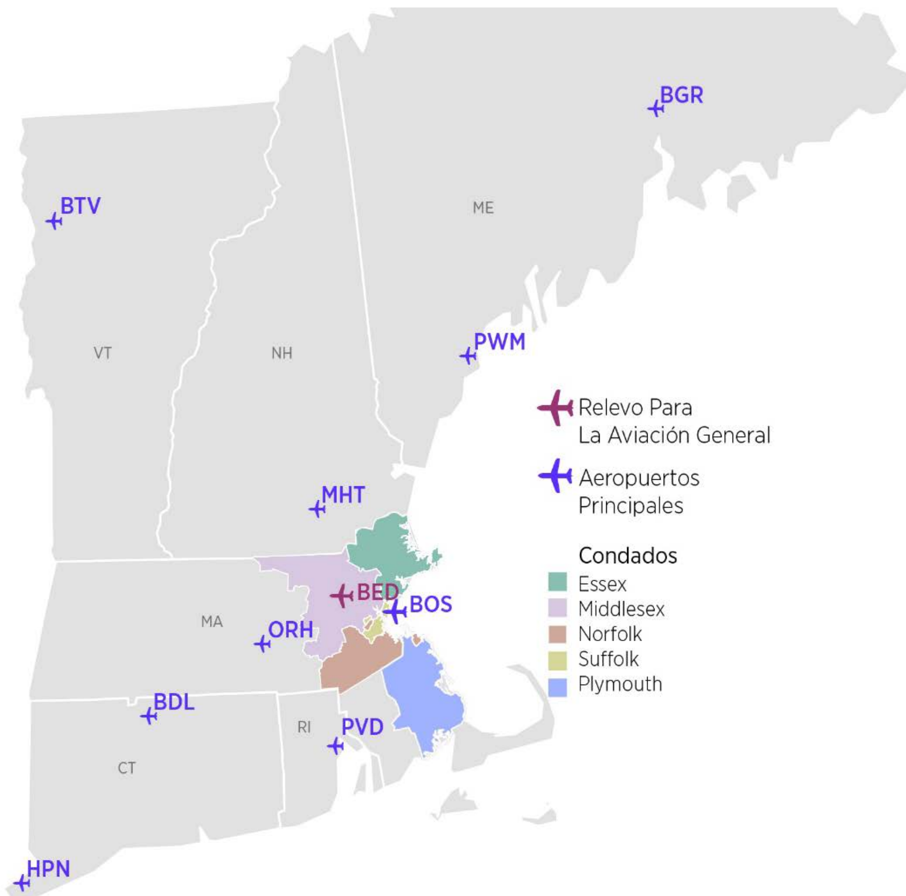
FIGURA 1-2 Aeropuerto Logan y Alrededores

2016 Environmental Data Report

El Aeropuerto Logan es un Impulsor de la Economía Regional

El Aeropuerto Logan cumple una función importante en la zona de Nueva Inglaterra y es el aeropuerto más grande en la región de los seis estados que la conforman (**Figura 1-3**). El aeropuerto está ubicado en Massachusetts, que alberga 14,8 millones de habitantes, y atrae pasajeros de toda la zona de Nueva Inglaterra. La principal zona de influencia está compuesta por los siguientes cinco condados de Massachusetts: Essex, Middlesex, Norfolk, Plymouth y Suffolk (que incluye la ciudad de Boston). Según las estadísticas disponibles más recientes, 4,4 millones de personas residen en estos cinco condados (**Tabla 1-1**).

Figura 1-3 Zona de influencia del aeropuerto internacional Logan de Boston



Notas: BDL: Aeropuerto Internacional Bradley; BED: Lawrence G. Hanscom Field, BGR: Aeropuerto Internacional de Bangor, BOS: Aeropuerto Internacional Logan de Boston, BTV: Aeropuerto Internacional de Burlington, HPN: Aeropuerto del Condado de Westchester, MHT: Aeropuerto Regional de Manchester-Boston, PVD: Aeropuerto T. F. Green, PWM: Aeropuerto Internacional Jetport de Portland

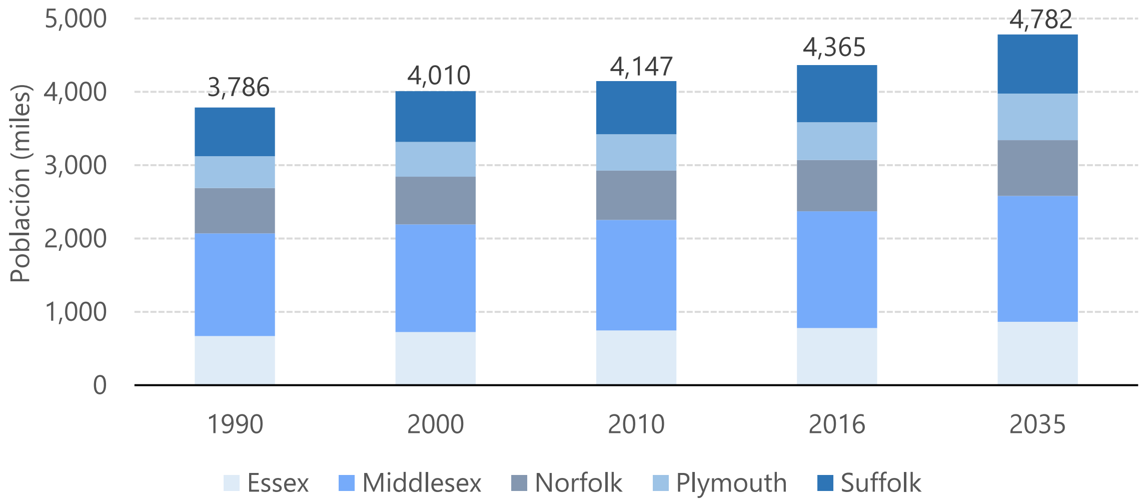
Tabla 1-1 Población de la principal zona de influencia del Aeropuerto Logan, 1990, 2000, 2010, 2016

	Población (miles)				Tasas de crecimiento anual compuestas		
Condado	**1990**	**2000**	**2010**	**2016**	**1990-2000**	**2000-2010**	**2010-2016**
Essex	671	725	746	780	0,8 %	0,3 %	0,8 %
Middlesex	1399	1467	1507	1591	0,5 %	0,3 %	0,9 **%**
Norfolk	617	651	672	699.	0,5 %	0,3 %	0,6 %
Plymouth	436	474	495	516	0,8 %	0,5 %	0,7 %
Suffolk	663	693	725	780	0,4 %	0,5 %	1,2 %
Zona de influencia de Boston	**3786**	**4010**	**4146**	**4366**	**0,6 %**	**0,3 %**	**0,9 %**
Massachusetts	6023	6361	6565	6825	0,5 %	0,3 %	0,6 %
Nueva Inglaterra	13 230	13 950	14 468	14 798	0,5 %	0,4 %	0,4 %
Estados Unidos	249 623	282 162	309 347	324 161	1,2 %	0,9 %	0,8 %

Fuente: Complete Economic and Demographic Data Source (CEDDS), Woods & Poole Economics, Inc., 2017.

Se espera que la función del Aeropuerto Logan continúe siendo predominante ya que la población de la zona de influencia ha crecido más rápido (0,9 por ciento) que la población de los Estados Unidos (0,8 por ciento), Massachusetts (0,6 por ciento) y de la zona de Nueva Inglaterra (0,4 por ciento) desde 2010 (**Tabla 1-1**). Se proyectó que la población del área de influencia aumentará en una tasa promedio del 0,5 por ciento todos los años durante los próximos 19 años (**Figura 1-4**).

Figura 1-4 Crecimiento de la Población de la Principal Zona de Influencia del Aeropuerto Logan, 1990, 2000, 2010, 2016, 2035



Mercado Regional del Aeropuerto Logan

Se observó un fuerte crecimiento económico en los últimos 10 años en el área que rodea el Aeropuerto Logan, lo que refleja la relación interdependiente entre la economía regional y el Aeropuerto Logan. La sólida economía regional impulsa la demanda para el aeropuerto de pasajeros y de carga, tanto entrantes como salientes. De manera similar, el servicio del aeropuerto permite que los negocios atiendan tanto a clientes que no pertenecen a la zona de Nueva Inglaterra como a turistas que usan los servicios que ofrecen los negocios locales.

El área metropolitana de Boston alberga una amplia variedad de industrias. Las industrias con la mayor cantidad de empleados son la atención de la salud y la asistencia social, los servicios educativos, profesionales, científicos y tecnológicos (que incluyen la creciente industria biotecnológica de Boston).[5] En 2016, Boston fue declarada la ciudad Nº 1 en los EE. UU. por fomentar el crecimiento y la innovación empresarial.[6] El aporte de la innovación y de las nuevas empresas también se evidencia en los cálculos del crecimiento económico desde finales de 2017 hasta la fecha y refleja tendencias al aumento de empleos y de industrias de alta tecnología. La perspectiva del estado es buena. En el tercer trimestre de 2017, la Mancomunidad de Massachusetts evitó el efecto de disminución provocado por los huracanes Harvey e Irma que afectaron a gran parte de los Estados Unidos en un 5,9 por ciento.[7] Los pronósticos de la

5 Oficina del Censo (Census Bureau) de EE. UU. a través de DataUSA, Boston-Cambridge, Newton, perfil del área metropolitana MA-NH, wwww.datausa.io

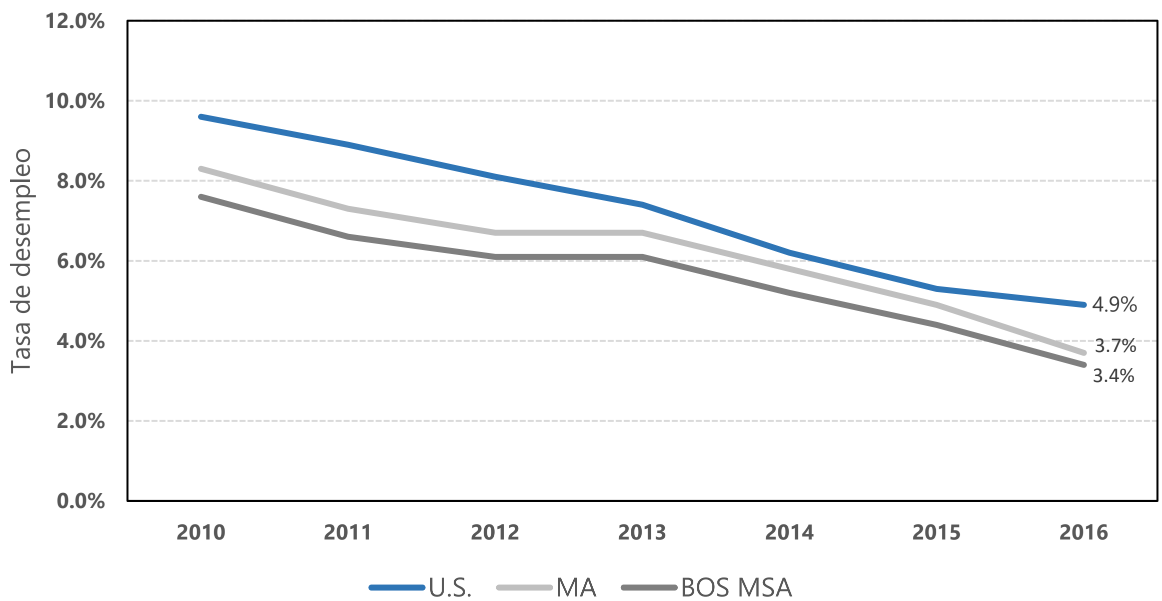
6 Oficina Chamber of Commerce Foundation and 1776. 2016. *Innovation That Matters*.

7 MassBenchmarks, The Benchmarks Bulletin, 27 de octubre de 2017. Tenga en cuenta que Massbenchmarks es un programa conjunto del Instituto Donahue de la Universidad de Massachusetts (University of Massachusetts Donahue Institute) y el Banco de la Reserva Federal de Boston (Federal Reserve Bank of Boston).

Mancomunidad sobre el producto bruto interno (PBI) para el cuarto trimestre de 2017 indican un crecimiento continuo de aproximadamente el 3,3 por ciento.

Otro reflejo de la fuerza del mercado regional del aeropuerto es su relativamente baja tasa de desempleo. El área metropolitana de Boston ha mantenido en forma constante una menor tasa de desempleo que la de la Mancomunidad y que la del país entero (consultar la **Figura 1-5**). En 2016, el MSA de Boston tenía una tasa de desempleo del 3,4 por ciento, que es menor que la tasa de la Mancomunidad (3,7 por ciento) y que la del país (4,9 por ciento). Incluso durante los años de la recesión económica de 2008-2010, Boston y la Mancomunidad sufrieron tasas de desempleo por debajo del promedio nacional.

Figura 1-5 Comparación de la Tasa de Desempleo: Estados Unidos, de Massachusetts y de Boston, 2010-2016, usando la Estadística de Área Metropolitana (MSA)



Fuente: U.S. Bureau of Economic Analysis, 2017.

El aeropuerto no solo atiende a una población en crecimiento, sino también a una población con mayores ingresos. El ingreso *per capita* en 2016 fue de US$ 64,617 (dólares estadounidenses en 2009) en el área de servicios principal del aeropuerto, 10,9 por ciento más alta que en la Mancomunidad y 44,8 por ciento más alta que el promedio nacional.

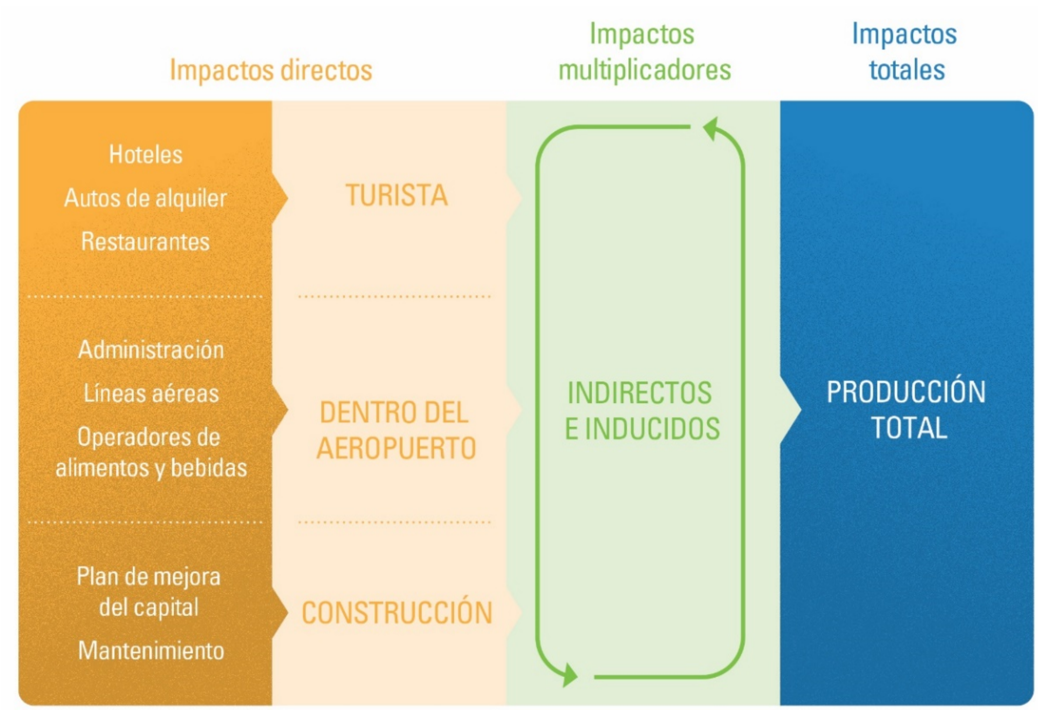
Impactos Económicos Regionales del Aeropuerto Logan

El Aeropuerto Logan y la industria del aeropuerto son un motor económico importante en el estado y en la región. La *Actualización del estudio del impacto económico del aeropuerto estatal de Massachusetts,* realizado por MassDOT en 2014,[8] calcula que la aviación contribuye con US$ 16,6 mil millones en producción a la economía de Massachusetts anualmente (**Tabla 1-2**). De esta producción, el 80,7 por

8 MassDOT. 2014. *Actualización del estudio del impacto económico del aeropuerto estatal de Massachusetts.*http://www.massdot.state.ma.us/portals/7/docs/airportEconomicImpactSummary.pdf.

ciento se debe solo al Aeropuerto Logan.[9] La producción incluye los negocios del aeropuerto, la construcción, los visitantes y los efectos multiplicadores (consultar la **Figura 1-6**).[10]

Figura 1-6 Impactos Económicos del Aeropuerto



Los negocios del aeropuerto incluyen la administración del aeropuerto, las aerolíneas, los concesionarios y otras empresas que operan en el Aeropuerto Logan. La implementación del Plan Capital de Mejoras (Capital Improvement Plan) (como se analizó en el Capítulo 3, *Planificación del Aeropuerto*). Los impactos de los visitantes representan los gastos de hotel, de alquiler de auto y de atracciones de los turistas que arriban al aeropuerto. Millones de personas viajan a Massachusetts, especialmente a la ciudad de Boston, todos los años para disfrutar del importante legado histórico y cultural, o de los eventos deportivos, para realizar negocios, visitas a las áreas recreativas, y para asistir a conferencias en algunos de los centros de convenciones de la ciudad. Más de 1,8 millones de visitantes extranjeros y 25 millones de visitantes nacionales[11] viajaron al estado en 2016.[12]

Además de los efectos directos, el Aeropuerto Logan genera efectos multiplicadores en la región circundante, los que se componen de dos categorías: 1) los gastos de los arrendatarios comerciales del aeropuerto y 2) el nuevo gasto proveniente de los salarios de los empleados del aeropuerto. Como consecuencia, el dinero que se gasta en el aeropuerto recircula en la economía local numerosas veces. Los

9 *Ibíd*.

10 Los efectos multiplicadores se refieren a la recirculación del dinero en la economía local después de haber sido gastados inicialmente por el aeropuerto, sus locatarios o los turistas. Esta recirculación aumenta el impacto general de las operaciones del aeropuerto en la economía local.

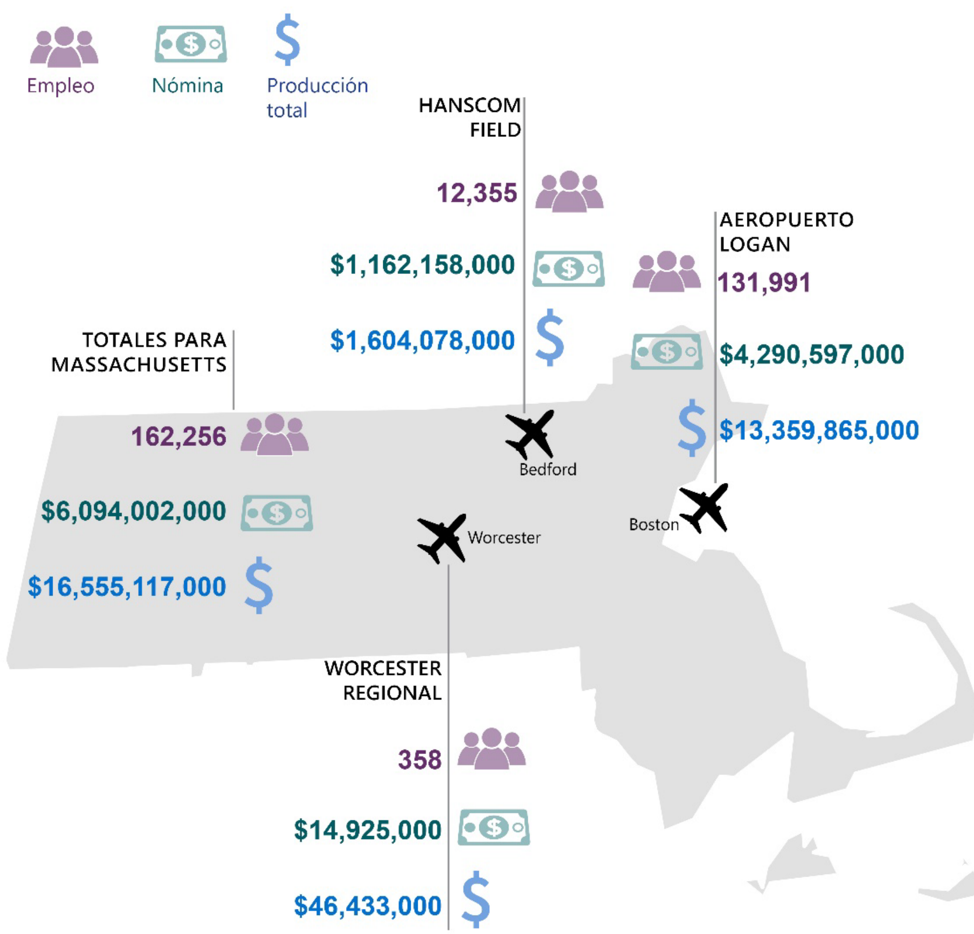
11 Incluye residentes y no residentes.

12 Oficina de viajes y turismo de Massachusetts (Massachusetts Office of Travel and Tourism), https://www.massvacation.com/travel-trade/getting-around/stats-reports/.

arrendatarios o las personas que tienen negocios en el aeropuerto compran bienes y servicios locales (como servicios de entrega e ingredientes para las comidas). Los salarios y beneficios anuales (aproximadamente US$ 4,3 mil millones) de los más de 132.000 empleados regionales (**Tabla 1-2**) respaldados por el aeropuerto vuelven a gastar en la comunidad local ya que los empleados compran artículos para las necesidades diarias.

El crecimiento del servicio internacional sin escalas en el aeropuerto, operado por nuevas aerolíneas extranjeras que usan aeronaves más limpias, silenciosas y espaciosas, ayudó a la llegada de visitantes extranjeros. En 2016, los visitantes internacionales gastaron US$ 2,8 mil millones en la Mancomunidad, un aumento del 3,1 por ciento desde 2015, en trasporte público, alquileres de autos, comida, alojamiento, entretenimiento y compras minoristas (**Tabla 1-3**). Los visitantes internacionales sustentaron 19 300 puestos de trabajo en 2016 con US$ 636,9 millones en nóminas y beneficios.

Figura 1-7 Impacto Económico Total de los Aeropuertos de Massachusetts



Fuente: MassDOT, Massachusetts Statewide Airport Economic Impact Study Update, 2014.

Notas: "Totales para Massachusetts" se refiere a la producción económica total de todos los aeropuertos de Massachusetts.

Tabla 1-2 Impacto Económico de los Aeropuertos de Massachusetts, 2013[13]

Ingreso *per capita* (2009 en US$)			
Aeropuerto	**Empleo**	**Nómina (cientos de dólares)**	**Producción (cientos de dólares)**
Logan de Boston	131 991	US$ 4.290.597	US$ 13.359.865
Worcester Regional	358	US$ 14.925	US$ 46.433
Hanscom Field	12.355	US$ 1.162.158	US$ 1.604.078
Subtotal para Massport	144.704	US$ 5.467.680	US$ 15.010.376
Aeropuertos de servicios comerciales de Massachusetts (MA)	**157.790**	**US$ 5.924.898**	**US$ 16.039.049**
Aeropuertos de aviación general (GA) de Massachusetts	**4.466**	**US$ 169.104**	**US$ 516.068**
Total para MA	**162.256**	**US$ 6.094.002**	**US$ 16.555.117**

Fuente: MassDOT, Massachusetts Statewide Airport Economic Impact Study Update, 2014

Nota: Datos disponibles más recientes. Al momento de este estudio, el aeropuerto Worcester Regional no contaba con el servicio de JetBlue Airways durante todo el año. Las cifras de Hanscom Field incluyen la actividad militar.

Tabla 1-3 Impacto de los Viajes Internacionales en Massachusetts

Tipo de impacto	2015	2016	Crecimiento anual
Gasto directo de viajes (US$ en millones)	US$ 2.748,5	US$ 2.833,7	3,1 %
Nómina generada por viajes (US$ en millones)	US$ 609,2	US$ 636,9	4,5 %
Empleos directos generados por los viajes (cientos de puestos de trabajo)	18,9	19,3	1,8
Ingresos fiscales generados por los viajes (US$ en millones)	US$ 435,2	US$ 463,1	6,4 %

Fuente: US Travel Association for Massachusetts Office of Travel and Tourism, Economic Impact of Travel on Massachusetts Counties 2016, octubre de 2017.

Asociaciones de Massport

Desde hace tiempo, Massport tiene un compromiso de ser un buen vecino. Al trabajar en colaboración con el gobierno, con la comunidad y con los líderes civiles en todo Massachusetts y de la zona de Nueva Inglaterra, Massport participa activamente realizando esfuerzos para mejorar la calidad de vida de las personas que residen cerca de las instalaciones de Massport.

Los empleados de Massport participan en numerosas actividades comunitarias. Durante la primavera, los empleados de Massport participan en la limpieza anual del vecindario Boston Shines de la ciudad de Boston. Durante la época de Acción de Gracias, los empleados de Massport donan alimentos a tres

13 Último disponible.

programas comunitarios, que atienden a más de 500 familias y personas todos los meses. Durante el otoño, a los niños de entre 4 y 17 años se les entrega una mochila nueva llena de artículos escolares y ropa nueva para empezar el año escolar. En 2016, Massport brindó apoyo financiero a más de 60 organizaciones comunitarias, entre ellas: Boys & Girls Clubs, Codman Square and South Boston Health Centers y numerosas organizaciones juveniles y recreativas. Massport ofrece numerosas oportunidades de becas para quienes se gradúan en el último año de la escuela superior. Para ver un listado completo de las iniciativas de colaboración de Massport, visite: http://www.massport.com/massport/community/community-partners/.

Fundación East Boston

La Fundación East Boston fue creada por Massport en 1997 a pedido de la comunidad y ha brindado cerca de US$ 10 millones en apoyo financiero para 85 programas comunitarios que benefician a niños, a adultos y a personas mayores, en áreas que van desde deporte y recreación hasta educación, entrenamiento y atención para niños. El consejo directivo de La Fundación East Boston está comprometido con la administración financiera, el reconocimiento de las necesidades que surgen de la comunidad y con la mejora de la calidad de vida de los residentes del sector Este de Boston.

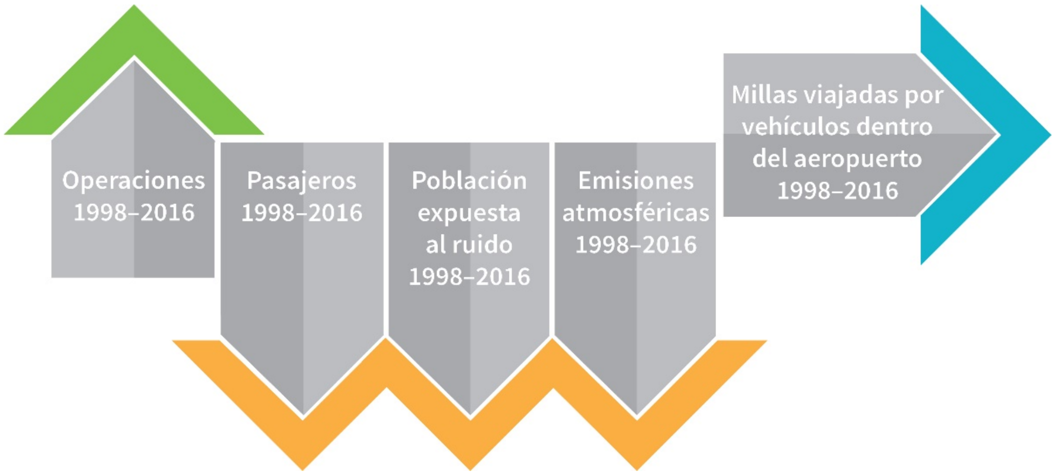
Massport Es Negocio

Massport está tomando medidas para crear más oportunidades de negocio en el Aeropuerto Logan para las empresas del sector Este de Boston. En 2016, Massport, la Cámara de Comercio del sector Este de Boston y East Boston Main Streets copatrocinaron la iniciativa *MASSPORT ES NEGOCIO* para conocer más sobre cómo es hacer negocios en Massport. La misión de Massport es garantizar que los negocios del sector Este de Boston tengan todas las oportunidades de prosperar al asociarse con nosotros para atender las necesidades de nuestros pasajeros y aerolíneas, y las necesidades de seguridad y mantenimiento.

Aspectos destacados y Resultados clave de 2016

Esta sección brinda un breve resumen de los resultados clave, por capítulo, en el Aeropuerto Logan en 2016 (consultar la Figura 1-8). Se ofrece información adicional sobre las actividades del aeropuerto en los capítulos subsiguientes. Esta sección también destacará las iniciativas de Massport para una mayor sustentabilidad a través de proyectos específicos e iniciativas con una LEAF sustentable y resume el programa de sustentabilidad de Massport.

Figura 1-8 Resumen de los resultados clave del EDR de 2016



Niveles de Actividad

El Aeropuerto Logan continúa siendo un importante aeropuerto de origen y de destino (O&D)[14] tanto a nivel nacional como internacional. El aeropuerto también es uno de los aeropuertos principales de los EE. UU. con crecimiento más rápido en cuanto a la cantidad de pasajeros en los últimos años.[15] Se ha producido un crecimiento tanto en la cantidad de pasajeros nacionales como internacionales. También se espera que las tendencias adicionales en la nueva tecnología de las aeronaves, que permite el uso de aeronaves más pequeñas y con mayor eficiencia de combustible en rutas internacionales, continúen beneficiando a los mercados de tamaño intermedio de O&D, como Boston. Los aspectos destacados y los resultados clave de 2016 en cuanto a las actividades de los pasajeros, a las operaciones de las aeronaves y a los volúmenes de carga incluyen los siguientes:

- En 2016, el tráfico de pasajeros en los EE. UU. creció 3,8 por ciento, mientras que el Aeropuerto Logan experimentó un crecimiento de pasajeros del 8,5 por ciento, más del doble durante el mismo período.[16]
- En total, el Aeropuerto Logan prestó servicios para 55 destinos internacionales sin escalas en 2016, en comparación con 47 en 2015.[17]
- Desde 2000 a 2016, la cantidad anual de pasajeros en el Aeropuerto Logan aumentó 30,9 por ciento, mientras que la cantidad anual de las operaciones de las aeronaves disminuyó 19,8 por ciento (**Figura 1-9**).

---

14 El "tráfico de origen y de destino" se refiere al tráfico de los pasajeros que se origina o que termina en un aeropuerto o en un mercado en particular. Un mercado de O&D fuerte, como Boston, genera una demanda local de pasajeros significativa, ya que muchos pasajeros inician y terminan su viaje en ese mercado. El tráfico de O&D es diferente al tráfico de conexión, que es tráfico de pasajeros que no inician ni terminan en el aeropuerto, sino que solo hacen conexiones en el aeropuerto en ruta hacia otros destinos.

15 Entre 2010 y 2016, el Aeropuerto Logan fue el octavo aeropuerto con crecimiento más rápido en los EE. UU. en términos de tráfico local de O&D (encuesta de O&D del Departamento de Transporte [Department of Transportation, DOT] de los EE. UU.).

16 Resumen del tráfico en los aeropuertos norteamericanos (North American Airport Traffic Summary) 2016 del Consejo Internacional de Aeropuertos (Airports Council International, ACI). http://www.aci-na.org/content/airport-traffic-reports.

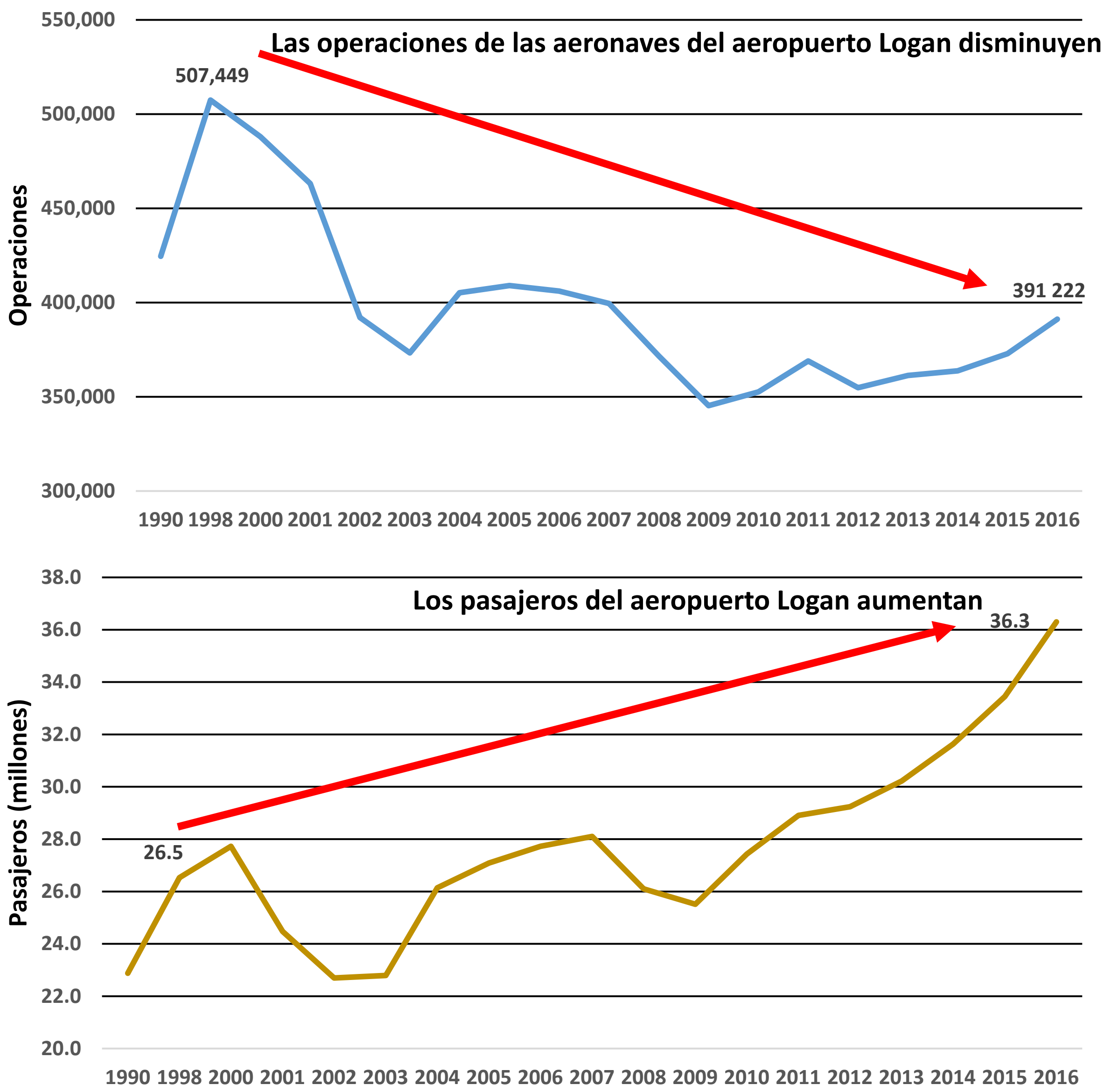
17Cronogramas de IATA Innovata. http://www.iata.org/publications/srs/Pages/innovata.aspx.

- La cantidad total de pasajeros aéreos aumentó 8,5 por ciento llegando a 36,3 millones en 2016, en comparación con 33,4 millones en 2015 (**Figura 1-10**). El nivel de pasajeros en 2016 representa una nueva cifra récord para el Aeropuerto Logan.

Figura 1-8 Pasajeros y Operaciones Anuales del Aeropuerto Logan, 1990, 1998, 2000, 2015, 2016

- Aunque la cantidad de pasajeros internacionales y nacionales aumenta, la demanda de pasajeros internacionales continúa aumentando en una tasa más rápida que la demanda de los pasajeros nacionales. El número de pasajeros internacionales totales en el Aeropuerto Logan aumentó de 5,5 millones en 2015 a 6,6 millones en 2016, un aumento del 19 por ciento. Los niveles de la actividad de los pasajeros con destinos nacionales aumentaron de 27,8 millones en 2015 a 29,6 millones en 2016, [18]un aumento del 6,4 por ciento. El atractivo económico de la región metropolitana de Boston y la fuerza de Boston como un mercado de O&D impulsaron el fuerte crecimiento de pasajeros internacionales

Figura 1-10 Niveles de Actividad y Operaciones de Pasajeros Anuales en el Aeropuerto Logan, 1990, 1998, 2000-2016



Fuente: Massport
Nota: 1998 representa el valor máximo histórico en términos de operaciones aéreas para el Aeropuerto Logan.

18 Sin incluir a los pasajeros de la aviación general.

- En respuesta a la demanda regional para el servicio internacional, numerosas aerolíneas extranjeras, incluidas Air Berlin, Norwegian Air Shuttle, Qatar Airways, Scandinavian Airlines y TAP Air Portugal, introdujeron nuevos servicios sin escala. Los nuevos destinos desde el Aeropuerto Logan en 2016 incluyeron Dusseldorf, Gatwick en Londres, Doha, Copenhague y Lisboa.
- La cantidad de operaciones aéreas en el Aeropuerto Logan aumentó de 372.930 en 2015 a 391.222 en 2016, un aumento del 4,9 por ciento. A pesar del aumento, las operaciones aéreas en el Aeropuerto Logan se mantuvieron debajo de las 487.996 operaciones en 2000 y el valor máximo histórico de 507.449 se alcanzó en 1998. En 1998, el Aeropuerto Logan atendió a 26,5 millones de pasajeros aéreos en comparación con 36,3 millones de pasajeros aéreos en 2016, en el que se realizaron 116.227 operaciones menos.
- 90,4 por ciento de las operaciones aéreas totales en 2016 fueron operaciones aéreas de pasajeros. Aunque las operaciones nacionales siguen siendo la mayor parte de las operaciones comerciales,[19] las operaciones internaciones han crecido en forma constante en el Aeropuerto Logan. En 2016, las operaciones nacionales programadas aumentaron 2,6 por ciento mientras que las operaciones internacionales programadas aumentaron 17,9 por ciento.
- Los pasajeros internacionales conformaron aproximadamente el 18 por ciento de los pasajeros totales del aeropuerto en 2016.
- JetBlue Airways y Delta Air Lines continuaron expandiendo sus servicios en el Aeropuerto Logan, aumentando sus operaciones totales 6,9 por ciento y 6,4 por ciento, respectivamente, en 2016. JetBlue Airways, la aerolínea más grande del Aeropuerto Logan, fue la responsable del 23,4 por ciento de las operaciones aéreas de pasajeros totales y del 26,8 por ciento de los pasajeros totales en 2016.
- Las operaciones de la aviación general (GA), que representaron el 7,9 por ciento de las operaciones totales en 2016, aumentaron 9,3 por ciento desde 2015.[20] Las 30.780 operaciones de GA en 2016 se mantuvieron debajo de las 35.233 operaciones de GA que el Aeropuerto Logan realizó en 2000. Hanscom Field, el aeropuerto de relevo del Aeropuerto Logan, manejó 120.891 operaciones en 2016.[21]
- La eficiencia de las aerolíneas continúa aumentando y la cantidad promedio de pasajeros por operación aérea en el Aeropuerto Logan aumentó de 89,7 en 2015 a 92,8 en 2016. La cantidad creciente de pasajeros por vuelo refleja una transición de las pequeñas aeronaves y el aumento de los factores de carga ya que las aerolíneas continúan enfocándose en el control de la capacidad y en las mejoras en la eficiencia.

19 Las operaciones comerciales incluyen las operaciones aéreas de pasajeros y una pequeña cantidad de operaciones aéreas solo de carga.

20 La aviación general (GA) se define como toda actividad de aviación que no sea de aerolíneas comerciales ni operaciones militares.

21 Hanscom Field, un aeropuerto con todos los servicios de GA, cumple una función muy importante como aeropuerto corporativo de relevo para el Aeropuerto Logan.

- El volumen total de la carga aérea[22] en el Aeropuerto Logan alcanzó un total de 290 millones de kilos en 2016, en comparación con 276 millones de kilos en 2015. Aproximadamente el 44 por ciento de la carga del Aeropuerto Logan fue transportada por aerolíneas de pasajeros como carga en la bodega, mientras que el 56 por ciento fue transportada por aerolíneas solo de carga, como FedEx y UPS. Las operaciones para el transporte de cargas aéreas aumentaron de 6.059 en 2015 a 6.680 en 2016, un aumento del 10,2 por ciento.

Antes de la aprobación de la secretaría de la EEA. Massport había preparado un EDR para 2016 a pesar de que este reporte anual originalmente se programó para fuese un *ESPR de 2016*. En los últimos años, las tendencias de demandas de pasajeros aéreos han aumentado rápidamente y el entorno de las compañías aéreas está cambiando. Además, el transporte terrestre en el Aeropuerto Logan también ha cambiado rápidamente con la introducción de las TNC, como Uber y Lyft.[23] Debido a estos rápidos cambios, 2016 no sirve como base razonable para la predicción de impactos de a largo plazo.

Como parte del proceso del ESPR, Massport habitualmente prepara predicciones de actividades de pasajeros, de operaciones aeronaúticas y de carga. Se estima que el Aeropuerto Logan alcanzará 40 millones de pasajeros anuales para 2019. Dado a que este crecimiento de pasajeros es más rápido que el esperado, Massport actualizará las proyecciones a largo plazo de pasajeros del Aeropuerto Logan en el *ESPR de 2017* para reflejar el crecimiento reciente en el Aeropuerto Logan, las expectativas revisadas para la economía local/nacional/internacional y las últimas tendencias de la industria. La revisión preliminar indica que lo niveles futuros de pasajeros en el Aeropuerto Logan pueden alcanzar aproximadamente 46 millones de pasajeros anuales. El *ESPR de 2017* brindará información más detallada y cifras de estimación actualizadas para 2030/2035.

Se brinda información adicional en el capítulo 2, *Niveles de actividad*.

Planificación Aeroportuaria

Las instalaciones del Aeropuerto Logan se han adaptado a los aumentos recientes en las actividades y en las operaciones en las zonas de operaciones, pero la terminal, las calles y los estacionamientos están saturados por el aumento de pasajeros. El año de informe 2016 estuvo marcado por la construcción de numerosos proyectos enfocados en la mejora de la experiencia del pasajero, en la adaptación a los aumentos en los niveles de actividad de los pasajeros y en la mejora del acceso terrestre. A continuación, se describen los recientes progresos en las iniciativas de planificación y los proyectos individuales en el Aeropuerto Logan. El Capítulo 3, *Planificación aeroportuaria*, describe el estado de todos los proyectos de planificación.

---

22 Las cargas aéreas incluyen paquetes de envío urgentes/pequeños, carga y correo.

23 La modalidad de viajes para recoger y dejar pasajeros puede incluir vehículos privados, taxis y servicios de vehículos con chofer. Por ejemplo, cuando a un pasajero lo llevan al aeropuerto para partir en un vuelo y luego lo retiran cuando regresa, ese solo pasajero genera un total de cuatro viajes con acceso terrestre: dos en el viaje para dejarlo (un ingreso al Aeropuerto Logan y una salida del Aeropuerto Logan) y dos en el viaje para recogerlo (un ingreso al Aeropuerto Logan y una salida del Aeropuerto Logan). El pasajero puede ser trasladado para su partida y llegada en un vehículo privado o en un taxi, por una empresa de red de transporte (TNC) o por automóviles con chofer que pueden no trasladar un pasajero en algún segmento desde o hacia el aeropuerto.

Proyectos en la Terminal y en la Zona de Operaciones

- **Proyecto de renovación y mejoras de la Terminal E.** Para tener capacidad para el servicio habitual de aeronaves más anchas y largas del grupo VI en la Terminal E, este proyecto incluyó mejoras en la parte interna y externa. El proyecto reconfiguró tres puertas de embarque existentes para que haya lugar para las aeronaves del grupo VI (incluidos el Aerobús A380 y el Boeing 747-8, usados principalmente por las aerolíneas internacionales). Una adición a la zona este de la Terminal E permitió que los salones de espera alberguen las cargas más grandes de los pasajeros relacionadas con las aeronaves más grandes. El proyecto también incluyó modificaciones para cumplir con los estándares de seguridad y diseño requeridos por la Administración Federal de Aviación (FAA) para albergar aeronaves más grandes. Se presentó una evaluación medioambiental (EA) y la FAA emitió un Hallazgo de Ningún Impacto Significativo (Finding of No Significant Impact, FONSI) el 29 de julio de 2016. La construcción se completó a principios de 2017.
- **Proyecto de Modernización de la Terminal E.** El proyecto de modernización de la Terminal E agregará las tres puertas de embarque aprobadas en 1996 como parte del proyecto Puerta de Acceso Internacional de la Sala de Pasajeros Oeste (EEA Nº 9791), que nunca se construyó, y cuatro puertas de embarque adicionales en la Terminal E. El edificio servirá como barrera de sonido entre la zona de operaciones y la comunidad. Se están planificando los salones para la atención de pasajeros y para la espera, así como posibles instalaciones adicionales para los Servicios de Inspección Federal FIS) y Aduana y Protección de Fronteras para complementar las áreas de FIS existentes en la Terminal E. Se construirá una conexión entre la Terminal E y la Estación de la Línea Azul de la Autoridad de Transporte de la Bahía de Massachusetts (MBTA) para mejorar la comodidad de los pasajeros. Esta conexión se está analizando actualmente y se están evaluando varios enfoques. Se está evaluando la construcción de un transporte público masivo automatizado (APM) que, a la larga, conectaría la Línea Azul de la MBTA con todas las terminales. El concepto de un APM está en las primeras etapas de la evaluación de viabilidad y será más definitivo a medida que progresa el diseño del proyecto de modernización de la Terminal E. El proyecto de modernización de la Terminal E ocupará un sector del área de carga norte (NCA) e incluirá las puertas de embarque de las terminales, el estacionamiento para aeronaves, hangares e instalaciones para las cargas. Massport presentó un Formulario de Notificación Medioambiental (ENF) en octubre de 2015 y una evaluación medioambiental provisoria federal/informe de impacto medioambiental estatal (EA/EIR) en conjunto en julio de 2016. Massport presentó la EA/el EIR el 30 de septiembre de 2016. El 10 de noviembre de 2016, la FAA emitió un FONSI y el 14 de noviembre de 2016, la FAA emitió un Registro de Decisión (ROD) en el proyecto en el que se declaró que Massport ahora puede actualizar el Plano de Disposición Espacial del Aeropuerto (ALP) con el proyecto de modernización de la Terminal E propuesto. (Por practicidad, Massport proporcionó la certificación del secretario en el ENF y en la EA/el EIR provisorio con respuestas a esos comentarios, en el apéndice A, *Certificados y respuestas a los comentarios de la MEPA* de este *EDR 2016).* El proyecto, incluyendo la conexión de la MBTA, está en fase de diseño y la construcción inicial probablemente comience en 2018. Los ESPR y EDR futuros proporcionarán actualizaciones a medida que avance el diseño final y la construcción.

- **Conector de la Terminal C con la zona de operaciones E.** El conector de la Terminal C con la zona de operaciones E proporciona una mayor conexión después de los controles de seguridad entre las terminales y ayuda a mejorar la flexibilidad para las aerolíneas. Además, el conector de la Terminal C con la E brinda una conexión después de los controles de seguridad entre las Terminales C y E en el nivel de salidas. El conector brinda circulación mejorada para los pasajeros dentro del (de los) salón(es) de pasajeros que se encuentra(n) después de los controles de seguridad, espacio adicional en el salón de espera en la Terminal E, reconfiguración del espacio de oficinas, concesiones y respaldo a la concesión, y una nueva ubicación unificada para las escaleras mecánicas y para las escaleras tradicionales. El proyecto se completó en mayo de 2016.
- **Proyecto de optimización de la Terminal B.** De manera similar a las renovaciones y mejoras en la Terminal B, Muelle A, Massport está actualizando sus instalaciones del lado del Muelle B para cumplir con las necesidades de las aerolíneas y para mejorar la experiencia de viaje de los pasajeros. Las mejoras incluyen un salón de emisión de boletos más grande, una zona de despacho y de reclamo de equipaje mejorada, ampliación de las zonas de concesión y de la capacidad de los salones de espera en las puertas de embarque. El proyecto unificará las operaciones de American Airlines en un Muelle de la terminal (que ahora opera en dos sectores diferentes de la terminal). Todas las puertas de embarque del Muelle B se conectarán después de los controles de seguridad. El proyecto también unificará los puntos de control de las operaciones para un mejor rendimiento de pasajeros y una experiencia para los pasajeros mejorada. Massport preparó una EA provisoria en mayo de 2017 y una EA final en junio de 2017. El 29 de junio de 2017, la FAA emitió un FONSI. Se completó el diseño final y la construcción está en curso. Se estima que la construcción se complete a principios del 2019.
- **Mejoras de los edificios, calles y aceras de la Terminal C.** En la actualidad, Massport está evaluando mejoras multifacéticas que mejorarían las instalaciones de la Terminal C y brindarían un conector después de los controles de seguridad entre la Terminal B y C, reemplazarían las calles más antiguas que conducen a la terminal y mejorarían la el funcionamiento de la acera de la Terminal C Las mejoras también incluirían el reemplazo de los toldos actuales en el nivel de salidas. El proyecto mejoraría la capacidad del Aeropuerto Logan de albergar de manera eficiente los volúmenes actuales y futuros de pasajeros al actualizar las instalaciones de la terminal y mejorar el acceso, el egreso y las operaciones para dejar y recoger pasajeros.
- **Proyectos en los Hangares.** El diseño arquitectónico comenzó en diciembre de 2010 para la mejora de dos hangares en el área de carga norte (NCA). El hangar renovado de JetBlue Airways abrió en 2012. El nuevo hangar de American Airlines, ocupado anteriormente por Northwest Airlines, se reequipó en 2013. La demolición del anterior hangar de American Airlines (hangar 16) comenzó en 2014 y se completó en agosto de 2016.

Acceso Terrestre Mejorado

Recientemente, se han diseñado una serie de proyectos de mejoras al acceso terrestre para obtener importantes beneficios medioambientales, en especial en las áreas de eficiencia del acceso terrestre y las reducciones de emisiones para mantener la calidad de aire relacionadas, en el aeropuerto y en el sector Este de Boston, según se documenta a continuación:

- **Programa de Redesarrollo del Área de Servicios Sureste (SWSA) del Centro de Alquileres de autos (RCC) (EEA 14137).** El RCC está completamente en funcionamiento y comenzaron a verse todos los beneficios del proyecto en 2014. La unificación de las operaciones de alquileres de autos y el servicio de autobuses asociado en una sola flota de autobuses de enlace dio como resultado mejoras en el servicio al cliente, reducción de las millas viajadas por los vehículos (VMT) dentro del aeropuerto y de las emisiones relacionadas con esto, así como también mejoras en el sistema de desagües pluviales. Las operaciones de alquiler de autos y autobuses en las instalaciones centralizadas comenzaron en septiembre de 2013. Las zonas de retorno rápido, los espacios para tomar transporte público, autobuses o limosinas y los espacios abiertos en el SWSA restantes se completaron en 2014. La unificación de las operaciones de los autobuses continuó reduciendo las VMT y las emisiones relacionadas con esto en el aeropuerto. Al RCC se le otorgó el primer Certificado Dorado de Leadership in Energy and Environmental Design, LEED® en 2016. En el capítulo 9, *Seguimiento del Proyecto de Mitigación*, se proporciona el estado de iniciativas para la mitigación del RCC.
- **La Nueva Flota de Autobuses del Aeropuerto Logan,** que comprende 22 autobuses a gas natural comprimido (GNC) y 32 autobuses a diésel limpio/eléctricos reemplazaron completamente la flota entera de autos de alquiler y autobuses de enlace a diésel ahora que el RCC está en pleno funcionamiento. En 2016, se puso en servicio un nuevo autobús a GNC adicional, lo que aumenta el total de 21 a 22 autobuses. La nueva flota de autobuses unificada mejoró la eficacia operativa y redujo la frecuencia de autobuses de enlace de 100 a 30 autobuses por hora.
- **LEED-Silver Green Bus Depot (Depósito de Autobuses)** es la instalación de mantenimiento dentro del Aeropuerto Logan para la nueva flota de autobuses de Massport que utilizan combustible limpio. Al cambiar la ubicación de las operaciones de mantenimiento de los autobuses fuera de la comunidad, Massport reduce el tráfico de autobuses en los sectores Este de Boston y Chelsea.
- **La circunvalación Martin A. Coughlin** reduce el tráfico comercial en el sector Este de Boston al proporcionar un enlace directo, junto a un antiguo corredor ferroviario, desde el área de servicios norte (NSA) del Aeropuerto Logan hasta Chelsea para los viajes de vehículos relacionados con el aeropuerto.
- **El Estacionamiento Economy Parking** simplificó y redujo la circulación dentro del aeropuerto al unificar el flujo de los diferentes estacionamientos en todo el aeropuerto en una sola ubicación atendida por una sola vía de autobuses de enlace. El tráfico total que circula por el aeropuerto disminuyó, lo que dio como resultado beneficios medioambientales y operativos significativos.
- **Proyecto de Unificación del Estacionamiento West Garage.** Massport unificó 2.050 espacios de estacionamiento temporarios como complemento al West Garage y a la superficie existente entre el

centro de oficinas de Logan y Harborside Hyatt. La ampliación del West Garage está ubicada en el lugar del estacionamiento existente del Hotel Hilton. La construcción de estos espacios abarcó todos los espacios sobrantes permitidos por el Congelamiento de Estacionamiento del Aeropuerto Logan (Logan Airport Parking Freeze).[24] El proyecto se inició en la primavera de 2016 y se completó a finales de 2016.

- **Proyecto de Estacionamiento del Aeropuerto Logan.** Como uno de sus elementos de estrategia de transporte terrestre, Massport propuso la construcción en etapas de 5.000 nuevos espacios de estacionamiento comerciales dentro del Aeropuerto Logan en dos ubicaciones. El objetivo del Proyecto de estacionamiento del Aeropuerto Logan es reducir la cantidad de pasajeros aéreos que eligen modalidades de viajes para recoger y dejar pasajeros que perjudican el medioambiente y que generan hasta cuatro viajes de vehículos en lugar de dos (a continuación, se ofrece una descripción detallada). La construcción de los espacios de estacionamiento comerciales adicionales en el Aeropuerto Logan se basó en un cambio reglamentario, que adoptó el Departamento de protección medioambiental de Massachusets (Massachusetts Department of Environmental Protection, MassDEP) para enmendar el congelamiento del estacionamiento existente del Aeropuerto Logan. En respuesta a la solicitud de Massport de 2016 para que se analice la enmienda al congelamiento del estacionamiento en el Aeropuerto Logan (para aumentar el límite del congelamiento de estacionamiento comercial a 5.000 espacios), MassDEP realizó un proceso público para enmendar la reglamentación del congelamiento del estacionamiento. MassDEP emitió una reglamentación enmendada el 30 de junio de 2017, en la que se aprobó la solicitud de aumento de estacionamiento. El 5 de diciembre de 2017, la Agencia de Protección del Medioambiente (Environmental Protection Agency, EPA) propuso una norma para aprobar la revisión del Plan de implementación Estatal (State Implementation Plan, SIP) de Massachusetts en la que se incorporó la enmienda al límite del congelamiento del estacionamiento del Aeropuerto Logan. La EPA aprobó la norma propuesta el 6 de marzo de 2018 y la nueva norma entró en vigor el 5 de abril de 2018. Para más información, consulte el capítulo 5, *Acceso terrestre desde y hacia el Aeropuerto Logan*. Massport inició un proceso paralelo con la EEA al presentar un ENF para nuevas instalaciones de estacionamiento el 31 de marzo de 2017. El 5 de mayo de 2017, la EEA emitió su certificado para el ENF en el que estableció el alcance para el EIR provisorio. Se inició el diseño conceptual para las nuevas instalaciones de estacionamiento y la preparación del EIR provisorio a finales de 2017. El EIR provisorio proporcionará detalles adicionales sobre la cantidad de espacios por ubicación y las fases de construcción previstas. Como se describe en el ENF, Massport identificó dos posibles lugares para el nuevo estacionamiento: Economy Garage (se muestra como 7a en la **Figura 3-1**) y el estacionamiento superficial de la Terminal E (se muestra como 7b en la **Figura 3-1**).
- **Reubicación del Estacionamiento Compartido para las TNC.** Debido a los cambios en el paisaje del acceso terrestre en el aeropuerto, y para abordar la congestión existente y mejorar el flujo del tráfico, Massport evaluó la reubicación del lote compartido para las TNC. Debido a la introducción en 2017 de la TNC para recoger pasajeros, Massport destinó una parte del estacionamiento rojo como área de espera similar a la de los taxis. Massport está analizando reubicar el estacionamiento compartido del SWSA en el estacionamiento para taxis existente que se encuentra al sur del estacionamiento del centro de oficinas Logan en Porter Street. Al reubicar

24 Código 310 de las normas de Massachusetts y 40 CFR 52.1120

el estacionamiento compartido de las TNC, Massport podrá atender mejor la cantidad creciente de TNC que prestan servicios al aeropuerto al proporcionar una base más grande, más flexibilidad operativa con opciones de rutas adicionales y reducción de los impactos de las TNC en Harborside Drive. El proyecto incluirá modificaciones en las señales de tránsito en Harborside Drive.

- **Adquisición de Braintree Logan Express.** En 2015, Massport adquirió la propiedad en donde se encuentra Braintree Logan Express, aumentando su compromiso de proporcionar el acceso de vehículos con muchos pasajeros (High-Occupancy Vehicle, HOV) desde núcleos regionales claves. El servicio de Braintree Logan Express realizó 655.158 traslados de pasajeros en 2016, lo que representó el 36 por ciento de todo el sistema de traslados de Logan Express. Aproximadamente la mitad de los conductores de Braintree Logan Express son empleados del Aeropuerto Logan. Las instalaciones de Braintree ocupan aproximadamente 8 hectáreas (5,5 hectáreas de tierra utilizable) y tienen aproximadamente 1.800 espacios en fila.
- **Reconstrucción a mitad de la vida útil de 8 autobuses de la línea Silver.** Ocho autobuses de la línea Silver, que conectan el aeropuerto con la estación sur, son propiedad de Massport y son operados por MBTA, pero Massport paga los costos operativos para SL1. En 2016, Massport financió aproximadamente US$ 6 millones para la reconstrucción a mitad de la vida útil de estos ocho autobuses. La reconstrucción a mitad de la vida útil aumentó en ocho años la vida útil de cada vehículo. Esto permitirá que MBTA mantenga su confiabilidad y calidad de las operaciones junto a la línea Silver hoy en día mientras comienza el proceso de aprovisionamiento para adquirir nuevos vehículos en el futuro.

Proyectos Parque Comunitario y Espacios abiertos

Massport destinó hasta US$ 15 millones para la planificación, la construcción y el mantenimiento de cuatro espacios abiertos y dos parques junto al perímetro del Aeropuerto Logan. Estos espacios abiertos ya se completaron e incluyen Bayswater Buffer, Navy Fuel Pier Buffer, la etapa 1 de SWSA Buffer y la etapa 2 de SWSA Buffer. Estas áreas están ubicadas en propiedades de Massport junto al límite del perímetro del Aeropuerto Logan y el objetivo es que proporcionen un paisaje atractivo entre las operaciones del aeropuerto y los barrios adyacentes del sector Este de Boston. El diseño de los espacios abiertos se realizó tras consultar a los vecinos del Aeropuerto Logan y a otras partes interesadas en un proceso de planificación abierto a la comunidad. Además de los espacios abiertos del aeropuerto, Massport ha trabajado con los líderes de la comunidad para proporcionar más oportunidades de recreación para los residentes locales, como los 53 kilómetros del conector East Boston Greenway y Piers Park con instalaciones para embarcaciones y vistas del centro de Boston. En los últimos 10 años, Massport ha invertido US$ 50 millones para el desarrollo, el mantenimiento y la seguridad de 13 hectáreas de espacio verde en el sector Este de Boston para caminar, jugar, andar en bicicleta y realizar otras formas de recreación pasiva.

- **Fase II de Piers Park.** Se emitió una solicitud de propuestas para el diseño de la etapa II de Piers Park en junio de 2017. La Fase II de Piers Park adicionará aproximadamente 1,7 hectáreas de espacio verde a la zona costera del sector Este de Boston. El sitio actual de la Fase II está ubicado junto al sitio de la Fase I, a lo largo de Marginal Street en el sector Este de Boston. El diseño conceptual del sitio de la Fase II visualiza un parque completamente accesible con un área de césped central, canchas de básquet y voleibol, y pistas de bicicletas y patines. Se espera que el parque proporcione características paisajísticas similares a aquellas en la Fase I de Park, incluidos caminos adoquinados, muebles del sitio, iluminación y cultivos. Se diseñó un nuevo centro de navegación/comunitario de 111,48 metros cuadrados ubicado en la zona costera para reemplazar el edificio del Centro de Navegación actual y, al mismo tiempo, proporcionar espacios de encuentro adicionales para la comunidad.

- **Fase III de Piers Park.** La fase III de Piers Park consta de una adición de 1,5 hectáreas de espacio verde de Piers Park en la zona costera del sector Este de Boston. El sitio está ubicado junto al sitio de la fase II, a lo largo de Marginal Street en el sector Este de Boston. La etapa III de Piers Park es un concepto de planificación de fase inicial que Massport propuso a desarrolladores externos. Massport emitió una solicitud de propuestas para el diseño de la etapa III de Piers Park en febrero de 2018. En función de las respuestas a la solicitud de las propuestas de Massport, es posible que el proyecto avance por parte de otra entidad.
- **Bremen Street Park y Dog Park.** En septiembre de 2016, Massport abrió oficialmente Bremen Street Dog Park (y Bremen Street Park en 2008) en la esquina de las calles Bremen y Porter en el sector Este de Boston. Esta área recreativa permite que perros de todo tipo y tamaño usen el espacio de 2.105 metros cuadrados ubicados en la esquina de las calles Bremen y Porter del sector Este de Boston.
- **El conector Narrow-Gauge.** La finalización del proyecto del conector Narrow-Gauge de 0,5 km en la primavera de 2016 representa la última parte de East Boston Greenway, que une el conector East Boston Greenway, que Massport completó en 2014 con Constitution Beach del DCR (Massachusetts Department of Conservation and Recreation's). Este proyecto hace posible que los peatones y los ciclistas se trasladen desde Jefferies Point, a través de Bremen Street Park y la nueva biblioteca del sector Este de Boston, hasta Wood Island Marsh y finalmente a Constitution Beach con solo dos cruces de calles. Existen contadores de peatones y ciclistas en el conector Greenway y en 2016 se registraron 43.787 paseos.

Iniciativas de Planificación

- **Planificación de Sustentabilidad y Resiliencia.** Consulte la sección a continuación, titulada *Sustentabilidad y resiliencia en el Aeropuerto Logan* para obtener información detallada.
- **Análisis de la Mitigación de la Incursión en Pista y Geometría Integral del Campo de Aviación.** A medida que la FAA comenzó a cancelar su programa integral nacional de mejoras del área de seguridad de las pistas en 2016, el foco de seguridad cambió al análisis de la geometría del campo de aviación. El programa de mitigación de la incursión en pista (Runway Incursion Mitigation, RIM) de varios años identifica, prioriza y desarrolla estrategias para ayudar a los aeropuertos de todos los Estados Unidos a que mejoren la seguridad del campo de aviación. En enero de 2016, Massport emitió una solicitud de propuestas para estudiar la geometría del campo de aviación en el Aeropuerto Logan. El estudio comenzó en diciembre de 2016 y se estima que finalizará en diciembre de 2018. Hasta esta presentación, el estudio ha llevado a cabo un análisis de la geometría del campo de aviación y de estándares de diseño, un pronóstico de la actividad de la aviación, una evaluación inicial del riesgo de la seguridad y ha desarrollado un modelo de simulación de operaciones del campo de aviación para las condiciones iniciales

existentes. Los EDR y ESPR futuros brindarán actualizaciones de estas iniciativas y es probable que esas iniciativas requieran permiso bajo las normas estatales o federales.

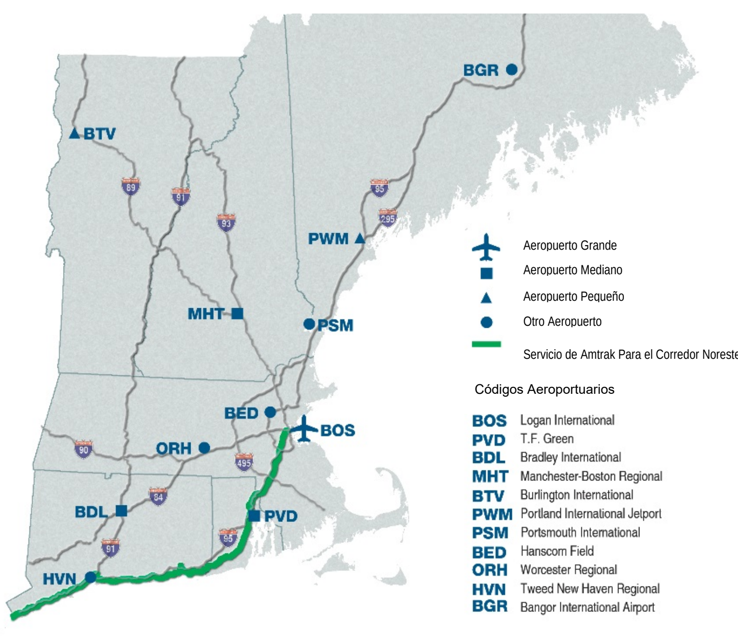
- **Concepto del Transporte Público Masivo Automatizado.** Massport está analizando numerosas opciones posibles para un transporte público masivo automatizado (Automated People Mover (APM). Este APM podría brindar una sólida conexión entre la Estación de la MBTA y todas las terminales, las instalaciones de servicios del área sudeste y otras áreas dentro del aeropuerto. Se está evaluando la posibilidad de construir tal sistema y los parámetros operativos que se requerirían.

Transporte Regional

El Aeropuerto Logan y un sistema de otros 10 aeropuertos de servicios comerciales, de relevo y de GA[25] (aeropuertos regionales) son el pilar de la región de la zona de Nueva Inglaterra. Juntos, estos 11 aeropuertos satisfacen prácticamente todas las [26]demandas de viajes aéreos comerciales de la zona de Nueva Inglaterra (consultar la **Figura 1-11**). El Aeropuerto Logan funciona como mercado principal de O&D nacional y es la principal entrada internacional para la región. El servicio de trenes Amtrak, que conecta Boston con las áreas metropolitanas de Nueva York/Washington D.C. al sur y Portland, Maine al norte, también asiste a la región.

- Por segundo año, la cantidad total de pasajeros aéreos anuales que usan los aeropuertos de servicios comerciales de la zona de Nueva Inglaterra (el Aeropuerto Logan más los aeropuertos regionales) representó una cifra récord, la cantidad total de pasajeros aéreos anuales aumentó en un 6,4 por ciento, de 48,8 millones de pasajeros aéreos en 2015 a 51,9 millones de pasajeros aéreos en 2016.
- En 2015, se sobrepasó el valor máximo histórico anterior de 2005 (48 millones de pasajeros aéreos regionales) con 48,8 millones de pasajeros aéreos. A nivel nacional, el tráfico

Figura 1-11 Sistema de transporte regional de Nueva Inglaterra



25 Los aeropuertos de servicios comerciales son aeropuertos de propiedad del estado que tienen al menos 2500 embarques de pasajeros todos los años y reciben un servicio de pasajeros programado. Los aeropuertos de relevo son aeropuertos designados por la FAA para aliviar la congestión de los aeropuertos de servicios comerciales y para brindar un mejor acceso de GA a la comunidad en general. Los aeropuertos de GA son aeropuertos de uso público que no tienen servicios programados o tienen menos de 2500 embarques de pasajeros anuales.

26 El servicio de aerolíneas comerciales se define como el transporte aéreo ofrecido por las aerolíneas por remuneración o alquiler. En contraposición, la GA se refiere a toda actividad de aviación que no sea de aerolíneas comerciales ni operaciones militares.

de pasajeros en los EE. UU. sobrepasó los niveles anteriores a la recesión en 2014. Continuó mostrando un fuerte crecimiento y alcanzó un nuevo valor máximo en 2016.

- El aumento en el tráfico de pasajeros de la región está impulsado por el continuo crecimiento del Aeropuerto Logan y de otros aeropuertos regionales. El aeropuerto internacional de Bradley, aeropuerto T.F. Green, el aeropuerto internacional de Burlington, Jetport internacional de Portland, el aeropuerto internacional de Bangor y el aeropuerto internacional de Portsmouth también experimentaron aumentos en el tráfico de pasajeros.
- De los 51,9 millones de pasajeros que usaron los aeropuertos de servicios comerciales de la zona de Nueva Inglaterra en 2016, el 69,9 por ciento de los pasajeros (36,3 millones) usaron el Aeropuerto Logan, en comparación con el 68,6 por ciento (33,5 millones) en 2015.[27]
- La cantidad de pasajeros en el aeropuerto T.F. Green aumentó 2,4 por ciento en 2016, en comparación con 2015. En 2017, con la adición del servicio de Frontier Airlines y de Norwegian Air Shuttle, el recuento de pasajeros aumentó aproximadamente 8 por ciento o aproximadamente 285.000 pasajeros.
- La cantidad de pasajeros en el aeropuerto internacional de Bradley aumentó 2,1 por ciento en 2016, en comparación con 2015. En 2017, la cantidad de pasajeros aumentó más del 6 por ciento. Este crecimiento marca el quinto año consecutivo de crecimiento de tráfico de pasajeros entre 2012 y 2017 (Tabla 4-2).
- En efecto, el Aeropuerto Logan, el aeropuerto T.F. Green y el aeropuerto regional Manchester-Boston actúan como un sistema, con cantidades significativas de pasajeros que escogen el aeropuerto más práctico en términos de acceso, de tarifas aéreas y de disponibilidad de servicios aéreos en función de sus necesidades de transporte aéreo individuales.[28]
- El Worcester Regional Airport es un importante recurso de aviación que tiene capacidad para la actividad de GA corporativa y servicios de aerolíneas comerciales. Massport continúa invirtiendo en Worcester Regional Airport al modernizar el aeropuerto para atender mejor las demandas de viajes en aerolíneas comerciales de la región central de Massachusetts.
    - Junto con la ciudad de Worcester, Massport invertirá US$ 100 millones en los próximos 10 años para revitalizar y hacer crecer las operaciones comerciales en Worcester Regional Airport. Como consecuencia de esta colaboración, Worcester Regional Airport ha experimentado un crecimiento consecutivo desde el 2013 ya que JetBlue Airways atendió a cerca de 500.000 pasajeros.
    - Massport completó las mejoras al sistema de aterrizaje instrumental de categoría III de Worcester para aumentar las condiciones operativas y de seguridad a un nivel igual al de todos los demás aeropuertos comerciales de la zona de Nueva Inglaterra. Este proyecto mejora significativamente la confiabilidad de Worcester Regional Airport en todas las condiciones climatológicas, un impedimento de larga data para una mayor utilización de este aeropuerto.

---

27 Basado en las estadísticas de los pasajeros en los aeropuertos desde 1985 hasta 2016.

28 Administración Federal de Aviación 2006. *Plan de sistemas de aeropuertos de la región de Nueva Inglaterra (New England Regional Airport System Plan, NERASP).*

- Hanscom Field está ubicado en Bedford, Massachusetts, a aproximadamente 32 kilómetros al noroeste del Aeropuerto Logan y es el establecimiento principal de la zona de Nueva Inglaterra para la aviación ejecutiva/corporativa y cumple una función crítica como aeropuerto de GA de relevo para el Aeropuerto Logan. Hanscom Field es un aeropuerto con servicio completo de GA en el que se realizan una amplia variedad de actividades de GA, incluidas la aviación corporativa, los vuelos privados, los servicios de aeronaves medianas o pequeñas, los servicios de alquiler y de carga liviana.
- Aunque los niveles de actividad de los pasajeros regionales aumentaron, los niveles de actividad de las operaciones aéreas disminuyeron de manera significativa desde 2000, como parte de las continuas tendencias de utilizar aeronaves de tamaño más grande, aeronaves con mayor capacidad de carga y la disminución del servicio en mercados menos rentables. Las operaciones aéreas totales en la región disminuyeron de 1,6 millones en 2000 a, aproximadamente, un millón en 2016.
- La región también cuenta con servicio ferroviario (provisto por Amtrak), que conecta Boston con las áreas metropolitanas de Nueva York y Washington D.C. al sur y Portland, Maine, al norte, así como con un extenso sistema de autopistas. En 2016, la cantidad total de pasajeros ferroviarios que viajaron por el corredor noreste fue de 2,6 millones[29] en comparación con los 36,3 millones de pasajeros aéreos en el Aeropuerto Logan.
- La cantidad de pasajeros en todo el sistema de Amtrak fue de 31,3 millones de pasajeros que realizaron solo viaje de ida en el año fiscal 2016, un aumento de 400.000 sobre el año anterior.[30] En el FY 2016, en el corredor noreste (North East Corridor, NEC) se transportaron 11,9 millones de pasajeros en los servicios de Acela Express y de Northeast Regional, un aumento del 2 por ciento desde el año anterior. Acela Express transportó casi 3,5 millones de pasajeros, mientras que Northeast Regional transportó 8,4 millones de pasajeros. En total, la cantidad de pasajeros en el NEC alcanzó un nuevo récord en 2016, sobrepasando los niveles récord de 2015. La parte correspondiente a Amtrak del total de pasajeros del mercado noreste aumentó significativamente desde la incorporación del servicio Acela Express en 2000.
- Massport se ha seguido involucrando en numerosas iniciativas de planificación interinstitucional tanto a nivel local como regional.

Se brinda información adicional en el capítulo 4, *Transporte regional*.

Acceso Terrestre desde y hacia el Aeropuerto Logan

Massport cuenta con una estrategia integral para diversificar y mejorar las opciones de transporte terrestre para los pasajeros y para los empleados. La estrategia de transporte terrestre está diseñada para brindar una amplia variedad de opciones de HOV, transporte público y transporte compartido para trasladarse desde y hacia el Aeropuerto Logan, así como para reducir al mínimo la cantidad de viajes en vehículo y brindar conexiones convenientes de transporte público, autobuses gratuitos, bicicletas y traslado peatonal al aeropuerto. El objetivo de la estrategia es también brindar estacionamiento dentro

29 Los pasajeros ferroviarios de Boston para el año fiscal 2016 comprenden aquellos de South Station, Back Bay, Route 128, Massachusetts. Amtrak. *Hoja informativa nacional, año fiscal 2016.*

30 Amtrak. Noviembre de 2016. Centro de medios de Amtrak. https://media.amtrak.com/2016/11/amtrak-delivers-strong-fy-2016-financial-results/.

del aeropuerto para los pasajeros que eligen conducir o que tienen opciones limitadas de HOV. El objetivo de la estrategia de Massport es limitar el impacto en el medioambiente y en la comunidad, al mismo tiempo que se brindan numerosas alternativas de traslados prácticos desde y hacia el aeropuerto para los pasajeros aéreos y para los empleados.

Massport está implementando una estrategia de reducción de viajes de varios flancos para limitar el impacto en el medioambiente y para reducir la cantidad de vehículos privados que acceden al Aeropuerto Logan y, en especial, la modalidad de dejar y recoger pasajeros asociada indeseable a nivel medioambiental, que genera hasta cuatro viajes en vehículos en lugar de dos.[31] Massport continúa invirtiendo en el Aeropuerto Logan y lo opera con el objetivo de mantener y aumentar la modalidad compartida de HOV (la cantidad de pasajeros y de empleados del aeropuerto que llegan por transporte público o por otras modalidades de HOV/viajes compartidos. El Aeropuerto Logan sigue liderando los rankings de aeropuertos estadounidenses en cuanto a modalidad de viajes en transporte público/HOV. La parte de la modalidad de HOV está levemente por encima del 30 por ciento.[32] Las medidas implementadas por Massport para aumentar la modalidad HOV incluyen una fusión de estrategias relativas a los precios (incentivos y penalidades), disponibilidad y calidad del servicio, mercadeo e información para viajeros. Debido a las diferentes características demográficas de los pasajeros aéreos del Aeropuerto Logan, ninguna medida por sí sola cumpliría el objetivo de aumentar la modalidad compartida de HOV.

Los resultados clave sobre las condiciones del acceso terrestre y sobre los niveles de actividad incluyen los siguientes:

- Desde 2000, el promedio más alto en los días laborales de millas viajadas por vehículos (VMT) calculado en el Aeropuerto Logan fue en 2007. Aunque los niveles de pasajeros aéreos de 2007 aumentaron el 29,1 por ciento, los cálculos de VMT diarias de 2016 permanecen aproximadamente 4,4 por ciento debajo de los niveles de 2007.
- Los valores del tráfico diario promedio anual actual (Annual Average Daily Traffic, AADT) y del tráfico diario promedio anual en los días laborales (Annual Average Weekday Daily Traffic, AWDT) son, aproximadamente, 5,4 por ciento más altos que en 2015, que fueron menor que el crecimiento del, aproximadamente, 8,5 por ciento de los niveles de pasajeros aéreos. Las VMT aumentaron, aproximadamente, 4,8 por ciento de 2015 a 2016. Aunque los volúmenes de tráfico diario en el sistema de rutas del aeropuerto han ido aumentando, es importante contrastar este aumento con el crecimiento histórico de pasajeros aéreos. El volumen del tráfico de entrada[33]

31 La modalidad de viajes para recoger y dejar pasajeros puede incluir vehículos privados, taxis y servicios de vehículos con chofer. Por ejemplo, cuando a un pasajero lo llevan al aeropuerto para partir en un vuelo y luego lo retiran cuando regresa, ese solo pasajero genera un total de cuatro viajes con acceso terrestre: dos en el viaje para dejarlo (un ingreso al Aeropuerto Logan y una salida del Aeropuerto Logan) y dos en el viaje para recogerlo (un ingreso al Aeropuerto Logan y una salida del Aeropuerto Logan). El pasajero puede ser trasladado para su partida y llegada en un vehículo privado o en un taxi, por una empresa de red de transporte (TNC) o por automóviles con chofer que pueden no trasladar un pasajero en algún segmento desde o hacia el aeropuerto.

32 De acuerdo con la *Encuesta sobre el acceso terrestre de pasajeros aéreos al Aeropuerto Logan de 2016,* el 30,5 por ciento de los pasajeros aéreos que accedieron al Aeropuerto Logan utilizaron la modalidad de transporte HOV.

33 Las entradas al aeropuerto se definen como los puntos de acceso desde y hacia el Aeropuerto Logan, que incluyen principalmente las rampas de la ruta Route 1A, las rampas con túneles de la ruta interestatal 90 Ted Williams y Frankfort Street/Neptune Road.

está creciendo en una tasa significativamente menor a la del crecimiento de pasajeros aéreos, lo que refleja el compromiso de hace una década de Massport para mejorar y apoyar el acceso con HOV al aeropuerto.

- En virtud de la ley estatal de Massachusetts, una ley que regula las empresas de la red de transporte (Ley H. 4570) y las normas de Massport para la seguridad y la eficacia de las operaciones de las TNC en el Aeropuerto Logan, en vigor desde febrero de 2017, en colaboración con las autoridades reguladoras estatales, Massport comenzó a permitir que las TNC recojan pasajeros en un estacionamiento compartido para TNC.[34] Este servicio se está monitoreando para el informe en 2017.
- A partir del *ESPR de 2017,* Massport introducirá una nueva definición para los HOV que toma en cuenta la ocupación de taxis, vehículos en alquiler y la modalidad TNC.[35] Con el sistema actual, Massport no cuenta a los taxis como HOV y cuenta a todos los vehículos de alquiler como HOV, independientemente de la cantidad de pasajeros que se transporta. En la actualidad, Massport tampoco clasifica a las TNC como HOV, independientemente de la cantidad de pasajeros que se transporta. A partir del *ESPR de 2017,* Massport usará una nueva definición de HOV, en donde la ocupación del transporte público, de los servicios de los autos de alquiler y de las TNC que sobrepasan a un pasajero aéreo por vehículo se definirá como HOV. Con esta nueva definición, Massport se comprometió a llegar a un objetivo del 35,5 por ciento de HOV para 2022 y 40 por ciento para 2027.
- Massport continúa ofreciendo un programa piloto, Back Bay Logan Express, que brinda servicio habitual de autobuses, directo y rápido desde la ciudad de Boston. Este servicio ha sido muy importante al proporcionar una alternativa para los pasajeros aéreos y para los empleados afectados por el cierre temporario de dos años de Government Center Station (una conexión clave entre Blue Line y el Aeropuerto Logan), y brinda una nueva alternativa de transporte público desde el área de Back Bay/Hynes Convention Center hasta el aeropuerto. La cantidad de pasajeros en 2016 de Back Bay Logan Express alcanzó un total de 216.329 pasajeros (en comparación con los 290.796 pasajeros en 2015), un promedio de, aproximadamente, 600 pasajeros por día. La cantidad de pasajeros disminuyó, aproximadamente, 33 por ciento en la segunda mitad del año (de julio a diciembre), lo que se puede atribuir a la reapertura de Government Center Station de MBTA.
- Ocho autobuses de la línea Silver, que conectan el aeropuerto con South Station, son de propiedad de Massport y son operados por MBTA, pero Massport paga los costos operativos de la línea Silver para la ruta SL1. En 2016, Massport financió aproximadamente US$ 6 millones para la reconstrucción a mitad de la vida útil de estos ocho autobuses. La reconstrucción a mitad de la vida útil aumentó en ocho años la vida útil de cada vehículo. Esto permitirá que MBTA mantenga su confiabilidad y calidad de las operaciones junto a la línea Silver hoy en día mientras comienza el proceso de aprovisionamiento para adquirir nuevos vehículos en el futuro.

---

34 Ley de regulación de las empresas de la red de transporte. https://malegislature.gov/Bills/189/House/H4570.

35 Una empresa de la red de transporte (TNC) es una empresa que usa una plataforma habilitada en línea para conectar a los pasajeros de pago con los conductores que proporcionan transporte con sus propios vehículos no comerciales. Las TNC surgieron como una nueva opción de modalidad de transporte para dejar y recoger pasajeros en automóviles en las terminales de Logan. La encuesta sobre pasajeros de 2016 y los próximos documentos analizarán las tendencias relacionadas con las TNC.

- Las salidas totales de los estacionamientos comerciales dentro del aeropuerto disminuyeron 0,2 por ciento en 2016. El crecimiento más lento en el estacionamiento en general puede ser el resultado de que los clientes elijen modalidades alternativas debido al conocido problema del limitado estacionamiento en el aeropuerto y, especialmente para los residentes que llegan por la ruta 128, el surgimiento de las TNC como una alternativa confiable y rentable.
- El abastecimiento inadecuado de estacionamiento hace que los pasajeros aéreos circulen en las rutas del aeropuerto en busca de estacionamiento. En situaciones de exceso, se redirige a los autos o se los lleva a áreas que no están destinadas al estacionamiento, incluidos espacios repletos, algunos de los cuales están ubicados fuera del aeropuerto. El estacionamiento no solo demanda actividad por encima de la capacidad y niveles de servicio al cliente inferiores, también aumenta las emisiones de vehículos en las calles del aeropuerto relacionadas con el tráfico circulante, los desvíos[36]y los servicios de valet[37] se han transformado en una práctica habitual en el Aeropuerto Logan. Massport continuaba cumpliendo con las reglamentaciones del congelamiento del estacionamiento del aeropuerto en 2016.
- Massport continúa administrando la oferta de estacionamiento, la fijación de precios y las operaciones para promocionar el uso de transporte público/opciones de viajes compartidos y para reducir la cantidad de desvíos/servicios de valet. Massport se esfuerza por cumplir estos objetivos sin aumentar la cantidad de viajes para dejar/recoger pasajeros que se realizan debido a la limitada oferta de estacionamiento. Estas políticas apoyaron el crecimiento desde que se aplicaron las alternativas de transporte público y de viajes compartidos en 2015, especialmente del aparcamiento disuasorio Logan Express y de los servicios de autobuses privados.

Se brinda información adicional en el capítulo 5, *Acceso terrestre desde y hacia el Aeropuerto Logan*.

Disminución del Ruido

Massport se esfuerza por minimizar los efectos del ruido de las operaciones del Aeropuerto Logan en sus vecinos mediante diferentes programas, procedimiento y demás herramientas para la disminución del ruido. En el Aeropuerto Logan, Massport implementa uno de los programas para la disminución del ruido más antiguos y amplios de cualquier aeropuerto del país. El programa de disminución del ruido incluye una Oficina de disminución del ruido (Noise Abatement Office) especializada, un sistema de monitoreo del ruido y de operaciones de avanzada, programas de aislación del sonido para casas y escuelas, restricciones de horarios y de pistas para los aviones más ruidosos, procedimientos de prueba de motores en tierra y rastreo de vuelos diseñados para optimizar las operaciones sobre el agua (especialmente durante las horas de la noche[38]).

Desde 1998, el año con el valor máximo de operaciones en el Aeropuerto Logan, la cantidad de operaciones aéreas diarias disminuyó el 23 por ciento (de 1.390 operaciones por día en 1998 a 1.069 operaciones por día en 2016[39]) debido a las tendencias en toda la industria a la disminución de las cargas

36 Los desvíos son las prácticas operativas de enviar vehículos que desean estacionar en una determinada instalación a otra instalación (dentro o fuera del aeropuerto) debido a que la instalación inicial estaba completa.

37 El servicio de valet es la práctica operativa en la que empleados estacionan los vehículos para los pasajeros, habitualmente para maximizar la cantidad de vehículos que se estacionan en una instalación o dentro del aeropuerto.

38 Las horas de la noche se definen como las horas entre las 10:00 p. m. y las 7:00 a. m.

39 Tenga en cuenta que 2016 fue año bisiesto y tuvo 366 días.

de los pasajeros. En 2016, las operaciones de jets representaron el 86 por ciento de las operaciones en comparación con el 55 por ciento en 1998, lo que refleja un cambio en la mezcla de las flotas aéreas. Los volúmenes de pasajeros continúan aumentando en una tasa mayor a las operaciones aéreas. En 2016, la cantidad total de pasajeros aéreos aumentó 36,7 por ciento en comparación con 1998 y 8,5 por ciento desde 2015. Esta tendencia refleja un aumento en el uso de aviones grandes en la flota, la fusión de aerolíneas y el aumento de factores de cargas aéreas[40] por parte de las aerolíneas.

Las condiciones de ruido para 2016 se evaluaron principalmente mediante modelado por computadora, complementado con el análisis de los niveles de ruido medidos mediante el sistema de monitoreo de ruidos del Aeropuerto Logan. Este *EDR de 2016* marca la transición del software de análisis heredado de la FAA, el Modelo de ruido integrado (Integrated Noise Model, INM), al software de próxima generación, Aviation Environmental Design Tool (AEDT). Massport desarrolló una serie de ajustes personalizados para el uso con el INM, necesarios para el modelado preciso del entorno único del Aeropuerto Logan y ha trabajado con la FAA desde 2015 para implementar métodos equivalentes en AEDT. La FAA respondió a la solicitud de Massport. La FAA no aprobó dos ajustes: la propagación del ruido sobre el agua y los efectos de las colinas. La FAA sí aprobó el uso de los ajustes de los datos del tiempo de 2016 y del tiempo de vuelo de las aeronaves específico para el Aeropuerto Logan. Massport presenta los resultados del modelo de AEDT como el modelo principal en este *EDR de 2016,* congruente con las prácticas anteriores. Se brindan los resultados del INM para la comparación solo para 2016 y las presentaciones futuras presentarán solo los resultados del AEDT.

Las iniciativas de investigación que abordan posibles mejoras en el modelo del AEDT están en desarrollo para mejoras del terreno y se finalizaron recientemente para superficies acústicamente reflectantes. Los resultados de estos estudios, si se implementan y cuando se implementen en el AEDT, agregarán aptitudes anteriormente abordadas por los ajustes de los efectos sobre el agua y de las colinas del Aeropuerto Logan.

Operaciones, Mezcla de Flotas y Uso de las Pistas

- Las operaciones aéreas anuales en 2016 aumentaron de 372.930 operaciones en 2015 a 391.222 en 2016 (un aumento del 4,9 por ciento). En comparación con el valor máximo de 507.449 operaciones de 1998, en 2016 se realizaron 22,9 por ciento menos operaciones. Al mismo tiempo, los volúmenes de pasajeros están en su punto más alto, aumentaron de 33.449.580 pasajeros en 2015 a 36 288.042 en 2016 (un aumento del 8,5 por ciento).
- El tráfico comercial total aumentó de 344.764 a 360.400 (un aumento del 4,2 por ciento) en comparación con 2015. En 2016, hubo un cambio continuo de operaciones de aeronaves jet regional (regional jet, RJ) más pequeñas a aeronaves de aerolíneas más grandes en muchas rutas, lo que aumentó la cantidad de pasajeros transportados por operación.
- Entre las operaciones en jet comerciales en el Aeropuerto Logan, el 18 por ciento fueron en aeronaves que ya satisfacen los nuevos límites establecidos para las aeronaves en la etapa 5.[41]

40 Factor de carga: cantidad de pasajeros como porcentaje de asientos totales operados en el aeropuerto.

41 En octubre de 2017, la FAA estableció las fechas límite para la certificación de la etapa 5 para las aeronaves nuevas. Las aeronaves más grandes (más de 54 885 kg de peso máximo en el despegue) deben satisfacer los límites de etapa 5 si

Cuando se consideran todos los tipos de aeronaves, el 97 por ciento cumplió con los límites de ruidos de la etapa 4. Del 3 por ciento restante, solo tres operaciones en 2016 se realizaron en aeronaves retroalimentadas para satisfacer los estándares de la etapa 3. Todas las demás operaciones en jet comerciales se realizaron en aeronaves con certificación de etapa 3 o mejor.[42] A partir del 01 de enero de 2016, la FAA prohibió que todas las aeronaves de etapa 2 operen dentro de los Estados Unidos y no se realizaron operaciones de etapa 2 en el Aeropuerto Logan en 2016.

- Los informes de monitoreo de seguimiento de vuelos de 2016, en el apéndice H, Disminución del ruido, muestran que el 99 por ciento de los cruces sobre la línea costera (ubicaciones en donde las aeronaves que partieron desde el agua vuelven a pasar por tierra) fueron realizados por aeronaves que volaban por encima de los 6.000 pies, el mismo porcentaje que en 2015. Esto trae como resultado niveles de exposición de niveles sonoros promedio durante el día y la noche (day-night level, DNL) menores para las comunidades que se encuentran debajo de esas rutas de vuelo.

Niveles Sonoros y la Población

- Las diferencias medidas entre los valores medidos y los valores modelo se han estrechado en los últimos años ya que se refinaron tanto el monitoreo del ruido como los procesos de modelado. Para 2016, estas diferencias aumentaron moderadamente con el cambio a AEDT para el modelado.
- Las curvas de nivel de 2016 son más pequeñas en la cobertura del área que las curvas de nivel de 2000 en la mayoría de las áreas, como resultado de motores más silenciosos y menos vuelos, aunque la curva de nivel se expandió en partes de Eagle Hill en el sector Este de Boston.

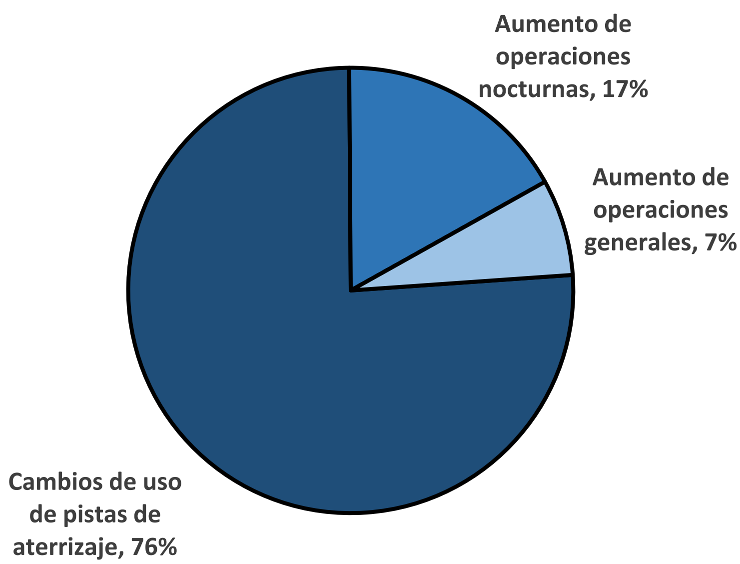
A continuación, se analizan los cambios en las operaciones en el Aeropuerto Logan que influencian la exposición sonora para 2016 frente a 2015 y se muestran en la **Figura 1-12**.

---

entran en servicio después del 31 de diciembre de 2017, y las aeronaves más pequeñas que entran en servicio después del 31 de diciembre de 2020 deben satisfacer estos límites.

42 Las aeronaves jet que actualmente operan en el Aeropuerto Logan están categorizadas por la FAA en dos grupos: etapa 3 y etapa 4. La designación corresponde a la clasificación sonora especificada por la parte 36 de la reglamentación de la aviación federal (Federal Aviation Regulation, FAR) que establece estándares de emisión sonora en función del peso máximo certificado de una aeronave. En general, cuanto más pesada es la aeronave, se le permite que haga más ruido dentro de los límites establecidos por la parte 36 de la FAR.

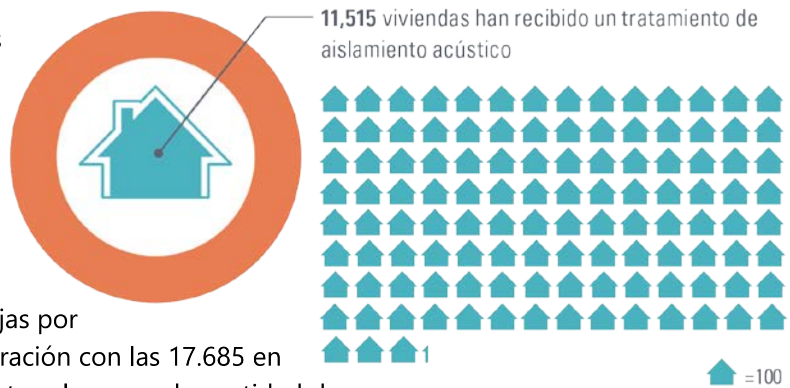
Figura 1-12 Motivo para el aumento en la cantidad de Personas Expuestas a los Valores de DNL. Mayor o igual a 65 dB (INM de 2015 a INM 2016)



Nota: Cuando se compara la curva de nivel del INM de 2015 con la curva de nivel del INM de 2016, hay un aumento en la población expuesta al ruido. Sin embargo, cuando se compara el INM de 2015 (el modelo de 2015 oficial) y el AEDT de 2016 (el modelo oficial de 2016) hay una disminución en la población expuesta al ruido.

- Los cambios en el uso de las pistas de 2015 a 2016 fueron los factores más grandes en la influencia de la exposición sonora en 2016. El cierre de un mes de la pista 4L-22R para el repavimentado provocó que el tráfico aéreo se traslade a la pista 15r-33L y a la pista 9-27, y estos cambios en el uso de las pistas se reflejan en los cambios de las curvas de nivel.
  - El sector Este de Boston se ve afectado por el ruido del inicio del recorrido de despegue (start-of-takeoff roll, SOTR) de la pista 15R y los sobrevuelos de partida de la pista 33L, ambos tienen aumentos en las partidas.
  - Los aumentos en las partidas de la pista 9 y de la pista 27 tienen el efecto de expandir la curva de nivel sobre Winthrop cerca de Deer Island.
  - Otros cambios en la curva de nivel fueron en áreas no residenciales o de la costa, pero estos fueron afectados de manera similar por los cambios en el uso de la pista.
- Un factor adicional que influenció las curvas de nivel en 2016 fue un aumento en las operaciones nocturnas, de 50.786 en 2015 a 55.499 en 2016. Debido a la penalidad 10-dB aplicada a las operaciones nocturnas modeladas, estas operaciones tienen un efecto desproporcionado en la curva de nivel.
- La población expuesta al ruido en 2016 estaba debajo de los niveles del valor máximo alcanzado en 1990 y fue menor que el año 2000 cuando 17.745 personas estuvieron expuestas a los niveles de DNL mayores o iguales a los 65 db de DNL. Se calculó que la población expuesta a estos niveles de ruido para 2016 fue de 16.985 usando el modelo heredado de INM y 7.450 usando el modelo AEDT de próxima generación.

- Massport es un líder nacional en mitigación de la aislación sonora. Al día de la fecha, en las proximidades del Aeropuerto Logan, Massport proporcionó aislación sonora para un total de 11.515 unidades residenciales y continuará buscando financiamiento para la aislación sonora de propiedades que son elegibles y cuyos propietarios eligieron participar.
- Prácticamente todas las residencias expuestas a niveles mayores o iguales a 65 db de DNL en 2016 fueron elegibles en el pasado para participar en el programa de aislación sonora residencial (Residential Sound Insulation Program, RSIP) de Massport.



- En 2016, Massport recibió 38.045 quejas por ruidos de 83 comunidades, en comparación con las 17.685 en 2015 de 84 comunidades. Es importante aclarar que la cantidad de quejas individuales aumentó de 1.903 en 2015 a 2.260 en 2016. El aumento en las quejas sigue principalmente relacionado con los procedimientos de despegue de RNAV de la FAA, que concentra el seguimiento de vuelos en corredores más estrechos. Las quejas fueron reenviadas a la FAA, como es la práctica de Massport.

Informe y Actualización de la FAA

- En 2015, la FAA solicitó el uso de su AEDT como reemplazo para su herramienta heredada, el INM, para los análisis de niveles sonoros que requieren la aprobación de la FAA. Antes de esto, la FAA había aprobado ajustes específicos para el Aeropuerto Logan para usar con el INM y Massport ha estado trabajando con la FAA para desarrollar ajustes análogos para implementar en el AEDT. Massport eligió seguir usando el INM para el *EDR de 2015* mientras avanzaban estos análisis, ya que no se requiere la aprobación de la FAA para el EDR. En agosto de 2017, la FAA brindó un acuerdo formal para algunos ajustes propuestos, pero se negó a acordar otros. Los memorandos relacionados con esta decisión se incluyen al final de este capítulo y en el apéndice H, *Disminución del ruido*. Se brindan más detalles a continuación en la sección sobre el modelado de AEDT.
- El 07 de octubre de 2016, Massport y la FAA firmaron un memorando de entendimiento (Memorandum of Understanding, MOU) [43] para darle un marco al proceso para el análisis de oportunidades para reducir el ruido mediante cambios o enmiendas a la navegación basada en el rendimiento (Performance Based Navigation, PBN), incluida RNAV. Massport ha estado trabajando con la FAA y con otros para desarrollar proyectos de prueba que están diseñados para ayudar a abordar la concentración del ruido de la PBN. Esta colaboración es el primer programa en el país entre la FAA y un operador aeroportuario para entender mejor lo que implica la PBN y evaluar las estrategias para abordar las preocupaciones de la comunidad.

---

43 Massport. 07 de octubre de 2016. *Massport y la FAA trabajan para reducir el ruido de los sobrevuelos (Massport and FAA Work to Reduce Overflight Noise)* https://www.massport.com/news-room/news/massport-and-faa-work-to-reduce-overflight-noise/.

- El registro de la decisión de la FAA (agosto de 2002) en el que se aprueba la construcción de la pista 14-32 de un solo sentido requirió que la FAA, Massport y el Comité Asesor de la Comunidad (Community Advisory Committee, CAC) del Aeropuerto Logan emprendan conjuntamente un estudio para mejorar medidas existentes y/o para desarrollar nuevas medidas para reducir el ruido para reducir aún más los impactos sonoros. El foco principal del estudio de niveles sonoros del Aeropuerto Logan de Boston (Boston-Logan Airport Noise Study, BLANS) fue determinar formas viables de reducir el ruido de las operaciones aéreas desde y hacia el Aeropuerto Logan sin disminuir la seguridad ni la eficacia del aeropuerto.[44] Las partes del despegue con RNAV de la fase 1 del proyecto, implementado por primera vez en 2010, se continuó usando en 2016.
  - Durante la fase 2 del BLANS, el CAC del Aeropuerto Logan votó abandonar el sistema asesor de pista preferencial (Preferential Runway Advisory System, PRAS) porque no alcanzó la disminución del ruido prevista. Aunque el PRAS no es un programa activo, Massport continúa informando sobre el uso de pistas en relación con los objetivos del PRAS.
  - La fase 3 del BLANS es una serie de pruebas de un posible Programa para Uso en las Pistas, que comenzó en noviembre de 2014 y finalizó en noviembre de 2015.
  - El proyecto BLANS finalizó en 2016 sin el desarrollo de un nuevo programa para uso en pistas. Se emitió un informe final para el programa en marzo de 2017.[45]
- En mayo de 2015, la FAA anunció que había comenzado un estudio en todo el país para volver a evaluar el método para medir los efectos del ruido de las aeronaves (DNL).[46] Este es un estudio de varios años para actualizar la evidencia científica sobre la relación entre la exposición al ruido de las aeronaves y sus efectos en las comunidades alrededor de los aeropuertos. La FAA ha estado evaluando encuestas y datos de ruidos de 20 aeropuertos en todo el país y luego analizará los resultados para decidir si actualizará los métodos para determinar la exposición a los ruidos. Los resultados de este estudio están previstos para el verano de 2018. El EDR y ESPR futuros brindarán actualizaciones, si están disponibles.

Como se muestra en la **Figura 1-13**, la curva de nivel de 65dB del DNL de 2016 es más pequeña que la de los años anteriores, incluida la curva de nivel del DNL de 1998 y de 1990.

Se brinda información adicional en el capítulo 6, *Disminución del ruido*.

---

44 Para más información, visite el sitio web BLANS en www.bostonoverflightnoisestudy.com/index.aspx.

45 Para más información, consulte el informe final del BLANS en http://bostonoverflight.com/docs/blans-phase-3-final-report.pdf

46 FAA. Comunicado de prensa: FAA to Re-Evaluate Method for Measuring Effects of Aircraft Noise https://www.faa.gov/news/press_releases/news_story.cfm?newsId=18774.

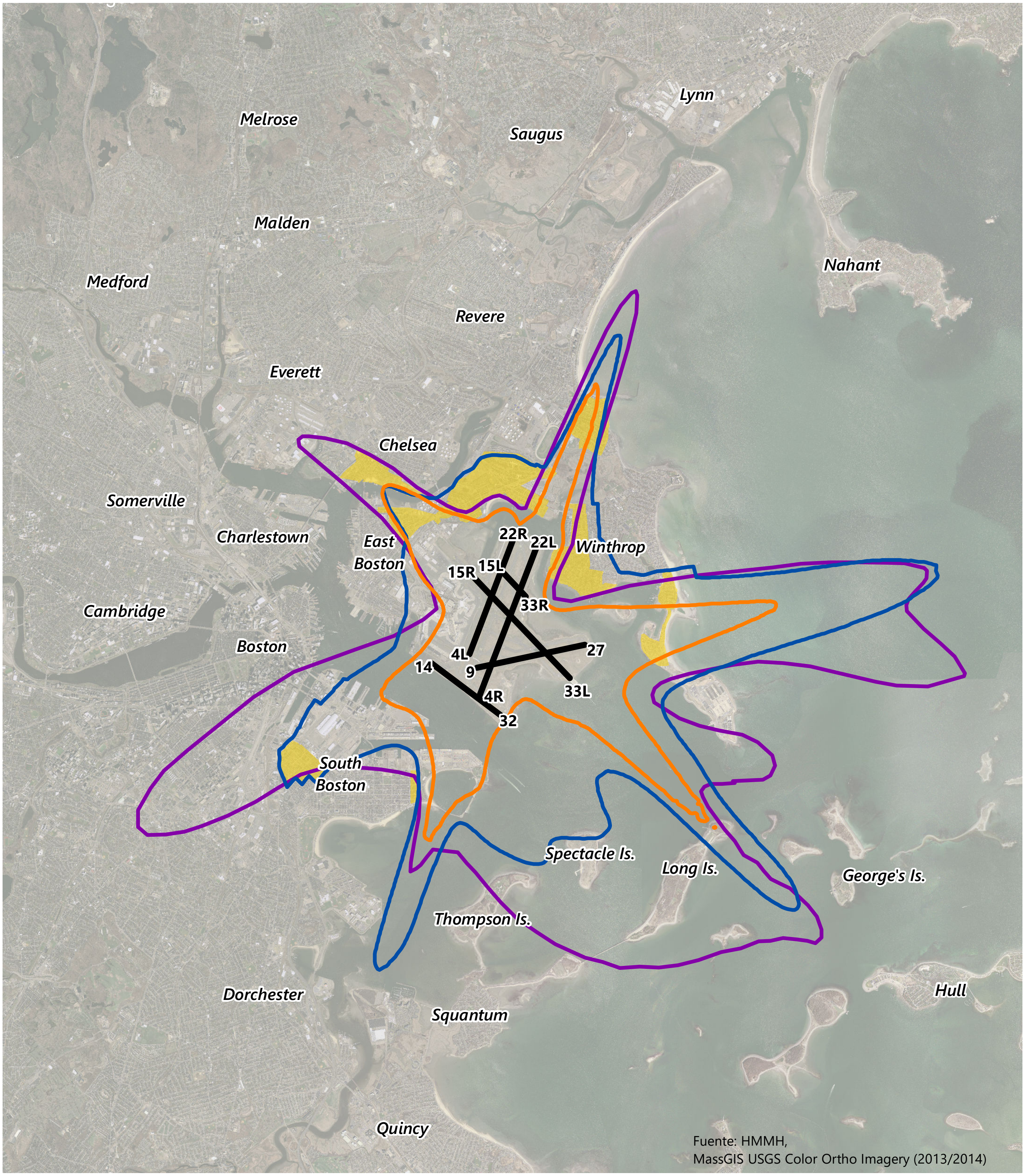


FIGURA 1-13 DNL Comparación del Límite de 65 dB con el Límite Histórico

2016 Environmental Data Report

Limite DNL de 2016 (AEDT 2c)
Limite DNL de 1998
Limite DNL de 1990
Áreas de aislamiento acústico

0 2500 5000 10000 Feet

Calidad del Aire/Reducción de Emisiones

Como se informó en EDR anteriores, las emisiones atmosféricas totales de todas las fuentes relacionadas con el Aeropuerto Logan son considerablemente menores a las de hace una década. Esta tendencia hacia la disminución es congruente con el objetivo de larga data de Massport de adaptarse a las demandas del aumento de pasajeros y de los niveles de actividad de las cargas con emisiones reducidas. En comparación con 2015, los cambios en las emisiones atmosféricas en 2016 aumentaron levemente. Los cambios están relacionados con el crecimiento de las operaciones aéreas. Massport también está comprometido con la reducción de las VMT y de las emisiones relacionadas con esto en las instalaciones de transporte terrestre controladas por Massport (como calles y aceras, estacionamientos y zonas designadas para vehículos), así como con la reducción de las VMT por parte de los usuarios que viajan desde y hacia el aeropuerto. El capítulo 5, *Acceso terrestre desde y hacia el Aeropuerto Logan,* brinda información detallada sobre el acceso terrestre y las estrategias de manejo del estacionamiento de Massport.

Todos los años, Massport modela los cambios en las emisiones atmosféricas para las actividades relacionadas con el aeropuerto. A los fines de esta evaluación, los resultados modelados de la calidad del aire son también una función de otros parámetros modelo de entrada importantes, entre los que se incluyen los siguientes:

- Características de mezcla de flotas de aeronaves
- Rodaje/Tiempos de demora en el aeropuerto
- Uso de equipamiento de servicio terrestre (Ground Service Equipment, GSE), incluidas las unidades auxiliares de potencia (auxiliary power units, APU)
- Volúmenes del tráfico de vehículos motorizados
- Operaciones de fuentes estacionarias, como la calefacción central y la planta de refrigeración, equipos para derretir la nieve y generadores de emergencia.

La siguiente es una sinopsis de estas entradas y actualizaciones de este modelo para este *EDR de 2016*.

- A partir de 2015, la FAA requiere que se lleven a cabo las evaluaciones relacionadas con las aeronaves usando esta nueva herramienta de simulación para el ruido y para las emisiones atmosféricas, AEDT, para los proyectos de la ley nacional de políticas medioambientales (NEPA) y para la elegibilidad de la insonorización. Para 2016, se realizó el modelado de la calidad de aire con la última versión del AEDT de la FAA para computar las emisiones de las aeronaves, de la APU y del GSE específicas del Aeropuerto Logan. El modelado también se completó usando el modelo heredado, Sistema de modelado de emisiones y dispersión (Emissions and Dispersion Modeling System , EDMS), a los fines de la comparación. Massport usará el AEDT para los próximos EDR y ESPR.
- Las entradas clave en el inventario de las emisiones atmosféricas incluyen las operaciones aéreas y el recorrido/tiempos de demora promedio de las aeronaves. Las operaciones aéreas aumentaron 4,9 por ciento en 2016, de 195 611 aterrizajes y despegues (landing and take offs,

LTO)[47] en 2016, en comparación con 186.465 LTO en 2015. El promedio de recorrido de aeronaves/tiempos de demora disminuyeron aproximadamente 30 segundos (25,3 minutos en 2016 frente a 25,9 minutos en 2015). Aunque se produjo un aumento en los LTO en 2016, las operaciones aéreas y los tiempos de recorrido permanecieron muy por debajo de los niveles de los valores máximos históricos de 2000.[48] Se realizaron 243.998 LTO en 2000 y los tiempos de recorrido de aeronaves fueron aproximadamente 27 minutos.

- Los factores de emisiones en la base de datos del AEDT (obtenidas del modelo de la agencia de protección medioambiental [Environmental Protection Agency, EPA] OFFROAD) disminuyeron en 2016 en comparación con 2015 ya que este modelo también tiene en cuenta la modernización de la flota de un año al otro. Los datos de entrada del modelo se basan en una encuesta actualizada sobre el tiempo de operación del GSE realizada en junio de 2017 en el aeropuerto. Estos datos se combinan con la información más reciente respecto del uso de combustible del GSE (por ej., gasolina, diésel, GNC; gas licuado del petróleo [GLP] y electricidad) de la documentación de solicitud del permiso para vehículos del aeródromo del Aeropuerto Logan.[49] En comparación con 2015, los tiempos de operación de las APU de 2016 aumentó aproximadamente 7,7 y 5,8 minutos para las aerolíneas con aeronaves con fuselaje angosto y aeronaves grandes de transporte regional respectivamente. Este cambio se atribuye principalmente a la actualización 2017 de la encuesta de tiempo en modo, que brinda una representación de los tiempos reales de operación de las APU. La encuesta de tiempo en modo del GSE de 2017 se puede encontrar en el apéndice I, *Calidad del aire/Reducción de emisiones*.
- Se obtuvieron los factores de emisión de los vehículos con motor de la versión más reciente del modelo de simulación de emisiones de los vehículos con motor de la EPA (MOVES2014A) y se combinaron con los datos de mezcla de flota de vehículos a motor recomendados por MassDEP y otros parámetros de entradas específicos para Massachusetts.
- Otro importante parámetro de entrada del modelo son las VMT dentro del aeropuerto, que aumentaron aproximadamente 4,8 por ciento en 2016 en comparación con 2015. El aumento en las VMT está ampliamente asociado con el aumento del 8,5 por ciento de los pasajeros, de 33,4 millones en 2015 a 36,3 millones en 2016 (consulte el capítulo 5, *Acceso terrestre desde y hacia el Aeropuerto Logan,* para información adicional).
- El uso de gas natural de las fuentes estacionarias (como las calderas y los equipos para derretir la nieve) disminuyó 7,3 por ciento en 2016, en comparación con 2015 (de 13 millones de metros cúbicos en 2015 a 12 millones de metros cúbicos en 2016). El uso del combustible diésel de otros equipos para derretir nieve también disminuyó en 2016 (de 1.444.441 de litros en 2015 a 343.904 en 2016). Estos cambios se debieron ampliamente a un invierno más suave en 2016 en comparación con 2015.

47 LTO se define como un ciclo de aterrizaje/despegue. Incluye tanto el arribo como la salida. En el capítulo 2, *Niveles de actividad*, el recuento de operaciones se define de manera diferente y un arribo (aterrizaje) *o* una partida (despegue) se cuenta como una operación. Por lo tanto, hubo 391 222 operaciones en 2016 (195 611 LTO) y 372 930 operaciones en 2015 (186 465 LTO).

48 Consulte el capítulo 2, *Niveles de actividades,* para obtener información adicional sobre las operaciones aéreas en 2016 y tendencias a largo plazo.

49 Todos los vehículos y el equipo (incluido el GSE) que operan en el aeródromo deben obtener un permiso para vehículos del aeródromo del Aeropuerto Logan. El formulario de solicitud para este permiso se modificó en 2007 para solicitar la información de tipo de combustible (por ej., gasolina, diésel, GNC; GLP y electricidad).

- El rendimiento del combustible del Jet A y la gasolina aumentaron 21,6 por ciento y 4,9 por ciento, respectivamente, en 2016 en comparación con 2015. Estos cambios se debieron mayormente al aumento en la cantidad de operaciones aéreas y de viajes de vehículos a motor/VMT en 2016.

En función de estos parámetros de entrada del modelo, los resultados del modelo del inventario de emisiones atmosféricas de 2016 para el aeropuerto de Logan se resumen a continuación. Como se muestra en la **Tabla 1-4,** el AEDT computa las emisiones de compuestos orgánicos volátiles (volatile organic compounds, VOC), óxidos de nitrógeno (NO_x) y monóxido de carbono (CO) relacionados con las aeronaves, que son levemente superiores en comparación con los resultados del modelo del EDMS. Sin embargo, para el cálculo del material particulado (particulate matter, $PM)_{10/2,5}$, los resultados son inversos, el EDMS produce emisiones más modelizadas que el AEDT.

Tabla 1-4 Comparación de las emisiones totales mediante AEDT/EDMS

Modelo	Contaminante (kg/día)			
	VOC	NOx	CO	$PM_{10}/PM_{2.5}$
EDMS 2015	1188	4262	7243	98
EDMS 2016	1242	4696	7328	106
AEDT 2016	1280	5300	7350	96
Diferencia en % entre el EDMS 2016 y el AEDT 2016	**3.0 %**	**12,9 %**	**0,3 %**	**(9,4 %)**
Diferencia en % entre el EDMS 2015 y el AEDT 2016	**7,7 %**	**24,4 %**	**1,5 %**	**(2,0 %)**

Fuente: Massport, KBE.
Nota: Los números negativos se muestran entre ()

- Las emisiones modelizadas de VOC aumentaron 7,7 por ciento en 2016 a 1.280 kilogramos (kg)/día, en comparación con 1.188 kg/día en 2015, que sigue siendo muy por debajo de los niveles de 1990 y 2000. El aumento en las emisiones de VOC está influenciado principalmente por el aumento de las emisiones de otras fuentes, que incluyen las fuentes estacionarias y de combustible, y un aumento en las emisiones de VOC relacionadas con las aeronaves debido a las diferencias de modelado entre el EDMS y el AEDT.
- Las emisiones de NO_x totales modelizadas aumentaron 24,4 por ciento en 2016 a 5300 kg/día, en comparación con 4.262 kg/día en 2015. El aumento en 2016 sigue estando muy por debajo de los niveles de 1990 y 2000. El aumento en las emisiones de NO_x está influenciado por el aumento en las operaciones de aeronaves en 2016 y se debe ampliamente a las diferencias de modelado entre el EDMS y el AEDT.
- Las emisiones modelizadas de CO aumentaron 1,5 por ciento en 2016 a 7.350 kilogramos (kg)/día, en comparación con 7.243 kg/día en 2015, las emisiones en 2016 seguían estando muy por debajo de los niveles de 1990 y 2000. El cambio en las emisiones de CO está influenciado por el

aumento en las operaciones de aeronaves; sin embargo, esto fue compensado por una disminución en los factores de emisiones de vehículos a motor en 2016.

- Las emisiones de $PM_{10}/PM_{2,5}$ totales modelizadas aumentaron 2,0 por ciento en 2016 a 96 kg/día, en comparación con 98 kg/día en 2015. La disminución de las emisiones de $PM_{10}/PM_{2,5}$ está influenciada principalmente por las diferencias de modelo para las emisiones de aeronaves en el AEDT.
- Durante nueve años consecutivos, Massport confeccionó en forma voluntaria un inventario de emisiones de gases de efecto invernadero (Greenhouse Gas, GHG) para el EDR del Aeropuerto Logan. En 2016, las emisiones de GHG crecieron aproximadamente 2,8 por ciento. Como se informó en el EDR de años anteriores, las emisiones de GHG relacionadas con el Aeropuerto Logan en 2016 comprendieron menos del 1 por ciento de las emisiones totales en todo el estado.
- En respuesta al Certificado del Secretario sobre el EDR de 2016 Aviso sobre cambios en el proyecto (Notice of Project Change), del 09 de marzo de 2018, Massport amplió sus informes sobre GHG para mostrar los datos normalizados de las emisiones de GHG y del uso de la energía en la construcción (consulte el capítulo 7, Calidad del aire/Reducción de las emisiones). La normalización de los datos demuestra que el Aeropuerto Logan opera de manera más eficiente con el paso del tiempo, atendiendo a más pasajeros en huellas de edificios más grandes con menor consumo de energía.
- Las emisiones de GHG por pasajero (Alcances 1 y 2) han disminuido más del 34 % desde el 2007 al 2016.
- La intensidad del uso de la energía del Aeropuerto Logan, que es una medida del consumo de energía del edificio únicamente, por metro cuadrado, ha disminuido más del 23 % desde el 2007 al 2016.
- Las emisiones de GHG del edificio por metro cuadrado han disminuido más del 43 % desde el 2007 al 2016.

Se brinda información adicional en el capítulo 7, *Calidad del aire/Reducción de las emisiones*.

Calidad del Agua/Cumplimiento y Manejo Medioambiental

El enfoque de Massport en cuanto al manejo y al cumplimiento medioambiental es un componente clave de su compromiso con la sustentabilidad y con las prácticas responsables en el Aeropuerto Logan (consulte la siguiente sección de este capítulo para obtener detalles). El desempeño medioambiental se evalúa mediante el monitoreo y la documentación, lo que permite que se desarrollen, implementen, evalúen y mejoren constantemente las políticas y los programas.

Massport es el encargado del cumplimiento de las leyes y reglamentaciones medioambientales estatales y federales aplicables. Massport promueve las prácticas medioambientales apropiadas a través de la prevención de la contaminación y de las medidas de reparación. Massport también trabaja estrechamente con los arrendatarios comerciales aeroportuarios y con el equipo de operaciones del aeropuerto para mejorar el cumplimiento. A continuación, se resumen los resultados claves sobre la calidad del agua y el cumplimiento para 2016.

- El 14 de junio de 2014 se llevó a cabo la certificación del sistema de manejo medioambiental de la Organización Internacional de Normalización (International Organization for Standardization, ISO) 14001 más reciente y se emitió un certificado en julio de 2014. El certificado es válido hasta julio de 2017. Massport realiza reuniones regulares para cumplir con los requisitos regulatorios y para mejorar el desempeño medioambiental más allá del cumplimiento.
- El Plan para la prevención de la contaminación pluvial (Stormwater Pollution Prevention Plan, SWPP) de Massport aborda contaminantes pluviales generales y también aborda las sustancias químicas descongelantes y anticongelantes, posibles bacterias, combustible y aceite, y otras posibles fuentes de contaminación pluvial.[50]
- En 2016, aproximadamente 98,6 por ciento de las muestras pluviales cumplían con las normas (consulte la **Tabla J-15** en el apéndice J, *Calidad del Agua/Cumplimiento y Manejo Medioambiental*, para más detalles). Debido al gran tamaño de las áreas de drenaje y la relativamente baja concentración de contaminantes, no siempre es posible rastrear los excesos de eventos específicos. Cuando se informa un evento conocido, como un derrame, Massport controla de manera rutinaria el sistema de drenaje para detectar los impactos del evento y toma acciones correctivas si es necesario.
- De las 204 muestras (incluido el aceite y la grasa, el total de sólidos en suspensión [total suspended solids, TSS] y el PH en las desembocaduras norte, oeste, Porter Street y Maverick Street), 201 eran iguales o estaban por debajo de los límites permitidos por el sistema nacional de eliminación de residuos contaminantes (National Pollutant Discharge Elimination System, NPDES).
    - Una muestra de una desembocadura, de un total de 23 muestras, en la desembocadura de Maverick Street superó el límite regulatorio del permiso de la NPDES para el TSS. Se informó el exceso de TSS en la desembocadura de Maverick Street en noviembre de 2016.
    - Las mediciones de una muestra de una desembocadura, de un total de 11 muestras, en la desembocadura de Maverick Street y una muestra, de un total de 11 muestras, en la desembocadura norte estuvieron fuera de los límites regulatorios del permiso de la NPDES para el pH. El exceso en los valores de pH en la desembocadura de Maverick Street se informó en marzo de 2016 y el exceso en los valores de pH en la desembocadura norte se informó en abril de 2016, como se solicitó.
- En 2016, se produjeron 14 derrames de aceite y de materiales peligrosos que requirieron informe a MassDEP, cinco de los cuales afectaron el sistema de drenaje pluvial.[51] Se abordaron todos los derrames de manera adecuada y no se produjeron efectos adversos en la calidad del agua.

---

50 Se presentaron los certificados de cumplimiento anuales de 2016 ante la EPA y ante MassDEP el 21 de diciembre de 2016 para Massport y para los copermisionarios.

51 Las reglamentaciones medioambientales estatales requieren que los derrames de un volumen de aceite de 38 litros o más se informen a MassDEP.

- En virtud del Plan para contingencias de Massachusetts (Massachusetts Contingency Plan, MCP), Massport continúa evaluando, remediando y consiguiendo la clausura reglamentaria de las áreas con contaminación subsuperficial. Massport trabaja para alcanzar la clausura reglamentaria según las reglamentaciones de los sitios del MCP restantes del Aeropuerto Logan asociados con derrames conocidos, así como para abordar los sitios que se descubren durante la construcción. (Consulte la **Tabla 8-4** en el capítulo 8, *Calidad de Agua/Cumplimiento y Manejo Medioambiental,* para más información sobre las actualizaciones y el progreso realizado para todos los sitios del MCP).

El capítulo 8, *Calidad del Agua/ Cumplimiento y Manejo Medioambiental,* brinda información adicional.

Sustentabilidad y Resiliencia en el Aeropuerto Logan

Figura 1-14 Enfoque de EONS para la sustentabilidad

Massport está comprometido con un sólido programa de sustentabilidad. La sustentabilidad ha redefinido los valores y los criterios para medir el éxito organizacional al usar un enfoque de resultado triple que toma en cuenta el bienestar económico, ecológico y social. Aplicar este enfoque a la toma de decisiones es una manera práctica de optimizar el capital económico, medioambiental y social. Massport tiene una amplia visión de la sustentabilidad que se basa en el concepto de resultado triple y toma en cuenta el contexto específico del aeropuerto. En congruencia con la definición de la sustentabilidad de los aeropuertos[52] del Consejo Internacional de Aeropuertos - Norteamérica (Airports Council International - North America, ACI-NA) (**Figura 1-14**), Massport se centra en un enfoque holístico para el manejo del Aeropuerto Logan para garantizar la viabilidad económica, la eficacia operativa, la conservación de los recursos naturales y la responsabilidad social (Economic viability, Operational efficiency, Natural resource conservation, and Social responsibility, EONS). Massport está comprometido con la implementación de prácticas sustentables para el medioambiente tanto por parte del aeropuerto como por parte de las autoridades y continúa progresando en diferentes iniciativas. Las siguientes secciones resumen muchas de las iniciativas de sustentabilidad a largo plazo y multifacéticas llevadas adelante por Massport, que se describen de manera más detallada en los capítulos individuales de este *EDR de 2016,* si corresponde. **Figura 1-15,** puntos destacados de algunas de las iniciativas de sustentabilidad más recientes de Massport.

---

52 Consejo Internacional de Aeropuertos (ACI) Airport Sustainability: A Holistic Approach to Effective Airport Management. Sin fecha. http://www.aci-na.org/static/entransit/Sustainability%20White%20Paper.pdf.

Figura 1-15 Aspectos destacados de la sustentabilidad recientes

- Cinco instalaciones certificadas por Leadership in Energy and Environmental Design (LEED) en el Aereopuerto Logan.
- Plan de Manejo para la Sustentabilidad e Informe anual.
- Estándares de Diseño Sustentable y Pautas.
- Cambio Climático y Planificación para la Resiliencia: 60 % de los activos críticos mejorados.
- Paneles solares en Economy Garage, Centro de Alquileres de autos y en las Terminales A, B y E.
- Flota de autobuses compartidos de combustible alternativo.
- Estación de servicio de gas natural comprimido.
- Compromiso a los Proyectos Parque Comunitario y Espacios abiertos: más de 13 hectáreas de espacio verde en el sector Este de Boston.

Plan de Manejo para la Sustentabilidad (Sustainability Management Plan, SMP) del Aeropuerto Logan

Massport está comprometido con la reducción de los impactos medioambientales locales sin sacrificar el nivel de servicios. El sólido programa de sustentabilidad de Massport muestra este compromiso. En 2013, la FAA le otorgó a Massport un subsidio para preparar un SMP para el Aeropuerto Logan. Las iniciativas de planificación del SMP del Aeropuerto Logan comenzaron en mayo de 2013 y se completaron en abril de 2015. El SMP del Aeropuerto Logan tiene una amplia perspectiva de sustentabilidad que incluye el estudio de la vitalidad económica, de la eficacia operativa, de la conservación de los recursos naturales y de la responsabilidad social. El SMP del Aeropuerto Logan tiene como objetivo promover e integrar la sustentabilidad en todo el aeropuerto y coordinar las iniciativas de sustentabilidad en curso en todo Massport. El SMP del Aeropuerto Logan desarrolló un marco y un plan de implementación, con mediciones y objetivos diseñados para hacer un seguimiento del progreso en el tiempo. En la actualidad, Massport está avanzando en una serie de iniciativas a corto plazo para ayudar a alcanzar sus objetivos (**Tabla 1-5**) en las áreas de energía y emisiones de gases de efecto invernadero, de bienestar de la comunidad, de los empleados y de los pasajeros, de resiliencia, de materiales, del manejo de los desperdicios y reciclado, y de la preservación del agua. El SMP del Aeropuerto Logan se encuentra disponible en línea en https://www.massport.com/massport/business/capital-improvements/sustainability/sustainability-management/.

El informe anual de sustentabilidad del Aeropuerto Logan, publicado por primera vez en abril de 2016, brinda un resumen del progreso de las iniciativas de sustentabilidad en el Aeropuerto Logan en función de los objetivos y de las metas de Massport establecidas en el SMP. Se puede obtener una copia del informe anual de sustentabilidad en el siguiente enlace: http://www.massport.com/media/2363/logan-annual-sustainability-report-2016.pdf.

Objetivos de Sustentabilidad del Aeropuerto Logan

Como parte del SMP del Aeropuerto Logan, Massport estableció objetivos para mejorar el desempeño del Aeropuerto Logan en 10 categorías de sustentabilidad: (1) energía y emisiones de gases de efecto invernadero, (2) conservación del agua, (3) bienestar de la comunidad, de los empleados y de los pasajeros, (4) materiales, manejo de los desperdicios y reciclado, (5) resiliencia, (6) disminución del ruido, (7) mejora de la calidad del aire, (8) acceso terrestre y conectividad, (9) calidad del agua/desagües pluviales y (10) recursos naturales. La **Tabla 1-5** describe cada objetivo, como lo define el SMP del Aeropuerto Logan. Massport informa su progreso para alcanzar cada objetivo, incluidos los cambios en el desempeño relacionado, en los informes de sustentabilidad. Massport publicó su primer informe de sustentabilidad en 2016. Desde la publicación del *SMP del Aeropuerto Logan de 2015*, Massport sigue ampliando sus iniciativas de sustentabilidad, que aumentan el enfoque de implementar medidas de resiliencia para proteger las operaciones marítimas y del Aeropuerto Logan, la infraestructura crítica y al personal. El último Informe de Resiliencia y Sustentabilidad Anual resalta el progreso de Massport para mejorar la sustentabilidad y potenciar la resiliencia en las intalaciones, y está disponible en el sitio web: http://www.massport.com/massport/business/capital-improvements/sustainability/sustainability-management/.

Tabla 1-5 Objetivos y descripciones de sustentabilidad del Aeropuerto Logan

Categoría de sustentabilidad	**Objetivo**	**Categoría de sustentabilidad**	**Objetivo**
Energía y emisiones de gases de efecto invernadero (GHG)	Reducir la intensidad de la energía y las emisiones de GHG mientras se aumenta la parte de energía del Aeropuerto Logan generada a través de fuentes renovables.	Preservación del agua	Preservar los recursos de agua regionales mediante la reducción del consumo de agua potable.
Bienestar de la comunidad, de los empleados y de los pasajeros	Promover comunidades económicamente prósperas y sanas, y el bienestar de los pasajeros y de los empleados.	Materiales, manejo de los desperdicios y reciclado	Reducir la producción de desperdicios, aumentar la tasa de reciclado y utilizar materiales ecológicos.
Resiliencia	Transformarse en un modelo innovador para la planificación de resiliencia e implementación entre las autoridades portuarias.	Disminución del ruido	Minimizar los impactos del ruido de las operaciones en el aeropuerto de Logan.
Mejora de la calidad del aire	Disminuir las emisiones de los contaminantes del aire de las fuentes del Aeropuerto Logan.	Acceso terrestre y conectividad	Proporcionar un acceso terrestre superior al Aeropuerto Logan mediante modos alternativos y de transporte en HOV.
Calidad del agua/Desagües pluviales	Proteger la calidad del agua y minimizar los desechos de contaminantes.	Recursos naturales	Proteger y restaurar los recursos naturales en las cercanías del Aeropuerto Logan.

Sustentabilidad en la Planificación, Diseño y Construcción

Las siguientes secciones detallan los logros de sustentabilidad de Massport en la planificación, en el diseño y en la construcción de sus proyectos.

Instalaciones Certificadas por Leadership in Energy and Environmental Design (LEED®) en el Aeropuerto Logan

El sistema de calificación LEED de United States Green Building Counsil (USGBC) es el sistema de certificación de construcciones ecológicas de terceros más reconocido en los Estados Unidos. Massport se esfuerza por alcanzar la certificación de LEED para todos los proyectos de construcción nuevos y de renovación sustancial sobre más de 1.858 metros cuadrados. Más recientemente, en 2017, la nueva ala de aeronaves grandes de la Terminal E (Proyecto de renovación y mejoras de la Terminal E) recibió la certificación dorada de LEED para los interiores comerciales. Otros ejemplos recientes de construcciones certificadas por LEED en el Aeropuerto Logan son los nuevos RCC y Green Bus Depot (Depósito de Autobuses) (consultar la **Figura 1-16** y **Tabla 1-6**). Se comenzó la construcción del nuevo RCC en la SWSA en 2010 y se completó en 2013. Massport está muy orgulloso de que el RCC obtuvo la primera certificación dorada de LEED para el Aeropuerto Logan en 2015. El Silver Green Bus Depot (Depósito de Autobuses) con certificación de LEED cambió las operaciones de mantenimiento de autobuses dentro del aeropuerto a una ubicación fuera del aeropuerto, lo que redujo los viajes de los autobuses y las emisiones innecesarias en las rutas congestionadas del vecindario. Hay más detalles disponibles en el capítulo 3, *Planificación del Aeropuerto*.

Figura 1-16 Instalaciones certificadas por LEED en el Aeropuerto Logan

Instalaciones de aviación general que respaldan los vuelos característicos, certificación de LEED (2008)

Terminal A, certificación de LEED (2006)

Centro de alquileres de autos, certificación dorada de LEED (2015)

Green Bus Depot, certificación plateada de LEED (2014)

Nueva ala para aeronaves grandes en la terminal E, certificación dorada de LEED (2017)

Estándares de Diseño Sustentable y Pautas, y Certificación LEED

Para los proyectos de construcción más pequeños y para los proyectos que no son de construcción, Massport usa sus *Estándares de Diseño Sustentable y Pautas (Sustainable Design Standards and Guidelines,* SDSG) para incorporar sustentabilidad. Los SDSG, revisados y vueltos a emitir en marzo de 2011, brindan un marco para el diseño y la construcción sustentables tanto para la construcción nueva como para los proyectos de rehabilitación. Los SDSG se aplican a una amplia variedad de criterios específicos del proyecto, como el diseño del sitio, los materiales del proyecto, el manejo de la energía, las emisiones atmosféricas, el manejo de la calidad del agua y la eficacia, la calidad del aire en el interior y la comodidad de los ocupantes. Massport usó los nuevos estándares para guiar los US$ 200 millones en proyectos de capital entre las autoridades entre los años fiscales de 2010 a 2013, incluidos US$ 30 millones para proyectos marítimos. Además de los SDSG, Massport se esfuerza por obtener la certificación LEED para los proyectos elegibles. En 2014, el Green Bus Depot (Depósito de Autobuses) recibió el certificado plateado de LEED y en 2015, el RCC recibió el certificado dorado de LEED.

Tabla 1-6 Instalaciones Certificadas por Leadership in Energy and Environmental Design (LEED®) en el Aeropuerto Logan

Terminal A (certificación LEED), completada en 2005/2006

- Primera terminal aeroportuaria en el mundo en recibir la certificación LEED
- Aceras con prioridad para vehículos de alta ocupación (HOV) y para bicicletas
- Retroalimentación con paneles solares en el techo de la terminal A
- Filtración de los desagües pluviales
- Techo reflectante
- Características de reducción del consumo de agua
- Iluminación diurna natural junto con tecnologías de iluminación avanzadas para la eficacia de la energía
- Uso de materiales reciclados y de fuentes regionales
- Medidas para mejorar la calidad del aire en el interior

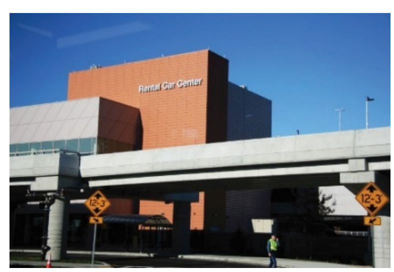
Instalaciones de Aviación General que respaldan los vuelos característicos (certificación de LEED), completadas en 2007/2008

- Mecanismos para reducir el uso del agua
- Iluminación diurna natural con tecnologías de iluminación avanzadas para la eficacia de la energía
- Acristalamiento de las ventanas y sombrillas para maximizar la luz diurna y para minimizar el calentamiento
- Materiales reciclados y de fuentes regionales
- Medidas para mejorar la calidad del aire en el interior

Green Bus Depot (certificación LEED), completado en 2014

- Paneles solares en el techo
- Características de ahorro de agua y energía
- Reducción de las millas viajadas por vehículos (VMT)
- Nueva flota de transportes compartidos que incluyen 50 autobuses con diésel limpio/autobuses híbridos eléctricos y autobuses a GNC.
  Materiales de construcción de crecimiento, cosecha, producción y transporte sustentables

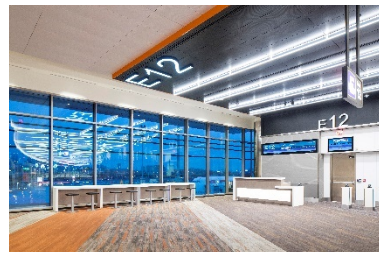
Centro de alquileres de autos (RCC) (certificación dorada de LEED), completado en 2013



- Materiales de construcción ecológicos
- Paneles solares en el techo
- Accesos y conexiones para bicicletas y peatones
- Iluminación diurna natural y tecnologías de iluminación avanzadas para la eficacia de la energía
- Uso de materiales reciclados y de fuentes regionales
- Calidad del aire en el interior mejorada
- Estaciones para enchufar vehículos eléctricos y otras alternativas de fuentes de combustible como el E-85 (etanol)
- Flotas de autos de alquiler que incluyen vehículos híbridos/de combustible alternativo/de emisiones bajas
- Conexiones para peatones
- Instalaciones para bicicletas y duchas, vestuarios para empleados
- Recuperación del agua para el lavado de autos y uso de desagües pluviales para los usos no potables, como el lavado de vehículos y el riego.
- Reducción de VMT

Tabla 1-6 Instalaciones Certificadas por Leadership in Energy and Environmental Design (LEED®) en el Aeropuerto Logan (Continuado)

Nueva Ala para Aeronaves Grandes en la Terminal E (certificación dorada de LEED para interiores comerciales) completada en 2017



- Reducción del efecto isla de calor al proporcionar un techo blanco reflectante y asfalto de concreto de color claro
- Instalaciones para el agua y retretes de flujo bajo
- Instalaciones para la luz eficientes, y calefacción, ventilación y sistema de aire acondicionado (heating, ventilation, and air conditioning, HVAC) eficientes
- Uso de fuentes de energía renovables
- Materiales reciclados y de fuentes regionales
- Calidad del aire en el interior mejorada
- Sistema de agua caliente solar térmico para agua de uso doméstico para calentar el 100 por ciento del agua de uso doméstico del ala

Cambio Climático y Planificación para la Resiliencia

Ya que el área de Boston continuará experimentando temperaturas elevadas, condiciones climáticas extremas más frecuentes y nivel del mar más elevado debido al cambio climático,[53] Massport entiende la importancia de prepararse para los impactos para proteger y mejorar su infraestructura, sus activos operativos y su mano de obra críticos. Mediante la sólida planificación y la colaboración regional, Massport se esfuerza por continuar su función de liderazgo en la planificación de la resiliencia entre las autoridades aeroportuarias, la industria aeroportuaria y la región de Boston.

A finales de 2013, Massport comenzó un estudio para la planificación para desastres y resiliencia de la infraestructura (Disaster and Infrastructure Resiliency Planning, DIRP) para el Aeropuerto Logan, para el puerto de Boston y para los recursos marítimos de Massport en el sur y sector Este de Boston. El estudio de DIRP incluye el análisis de los peligros, modelado de aumento del nivel del mar y marejada ciclónica, y proyecciones de temperatura, precipitaciones y aumentos anticipados de fenómenos meteorológicos extremos. El estudio de DIRP brinda recomendaciones sobre las estrategias a corto plazo para hacer que las instalaciones de Massport sean más resilientes a los posibles efectos del cambio climático. En 2014, el estudio se completó y se comenzó la implementación de las iniciativas de adaptación a finales de 2014.

Además del estudio de DIRP y de sus iniciativas relacionadas, Massport completó una evaluación de los riesgos con todas las autoridades de sus iniciativas de planificación estratégica, emitió una guía de diseño a prueba de inundaciones (Floodproofing Design Guide) y desarrolló un marco de resiliencia para brindar mediciones congruentes para la planificación a corto y largo plazo, y para la protección de sus instalaciones e infraestructura críticas. Más allá de la resiliencia física, Massport también se centra en la incorporación de resiliencia social y económica en su planificación operativa y de capital a largo plazo. La Guía de diseño a prueba de inundaciones de Massport se publicó en noviembre de 2014 y se actualizó en abril de 2016.

Los aspectos operativos de la estrategia de resiliencia incluyen el desarrollo de planes para el manejo de inundaciones para el aeropuerto de Logan y para las instalaciones marítimas de Massport. Estos planes se

53 City of Boston, *Climate Ready Boston (2016*)

introdujeron en 2015 e incluyeron los despliegues previstos para las barreras temporarias contra inundaciones para proteger hasta 12 ubicaciones de infraestructura crítica en caso de condiciones climáticas extremas. Se mejoraron de manera permanente ubicaciones adicionales para prevenir inundaciones. Los planes operativos para inundaciones se evalúan anualmente para mejorar su eficacia y para que se adapten a los requisitos cambiantes y por experiencias pasadas.

Se realizaron ejercicios de simulación de un huracán y talleres multifuncionales para refinar más los planes y para entrenar al personal. Por último, el nivel de inundación del diseño originado por el estudio de DIRP en 2015 se actualizó como resultado del modelado de tormentas mejorado que MassDOT puso a disposición de Massport. Se realizaron ajustes a las recomendaciones de resiliencia prioritarias para adaptarlos al nivel de inundación revisado.

Massport informa el progreso hacia los objetivos de resiliencia en los informes de sustentabilidad anuales del Aeropuerto Logan. Se encuentra disponible información adicional sobre las iniciativas de resiliencia de Massport en el siguiente enlace:http://www.massport.com/massport/business/capital-improvements/sustainability/climate-change-adaptation-and-resiliency/resiliency-and-climate-change/.

Proceso de Revisión Medioambiental del Aeropuerto Logan

Este *EDR de 2016* es parte de un proceso de revisión estatal, bien consolidado, que evalúa los impactos medioambientales acumulados del Aeropuerto Logan. El proceso brinda un contexto frente al cual los proyectos individuales que alcanzan umbrales de revisión medioambiental estatales y federales se evalúan sobre las bases de proyectos específicos. A continuación, se describen los procesos de revisión medioambiental específicos del proyecto para todo el aeropuerto.

Contexto Histórico para el EDR/ESPR del Aeropuerto Logan

En 1979, la secretaría de la EEA emitió un certificado solicitando a Massport que defina, evalúe y divulgue cada tres años el impacto del crecimiento a largo plazo del aeropuerto a través de un Informe de impactos medioambientales genérico (Generic Environmental Impact Report, GEIR). En el certificado también se solicitó actualizaciones anuales provisorias para brindar datos sobre las condiciones para los años entre los GEIR. El GEIR evolucionó hasta transformarse en una herramienta de planificación eficaz para Massport y brindó proyecciones de condiciones medioambientales para que los efectos acumulados de los proyectos individuales se puedan evaluar dentro de un contexto más amplio.

La EEA eliminó los GEIR después de las revisiones de 1998 para sus reglamentaciones de la MEPA. Sin embargo, la certificación del secretario sobre la actualización anual de 1997[54] propuso un proceso de análisis medioambiental revisado para el Aeropuerto Logan lo que dio como resultado la confección de los EDR/ESPR de Massport subsiguientes. El EPRS más amplio brinda un análisis de largo alcance de las operaciones, de los pasajeros y de los impactos acumulados proyectados, mientras que los EDR se confeccionan anualmente para brindar una revisión de las condiciones medioambientales para el año que se informa en comparación con el año anterior. Se desarrolló el proceso del EDR/ESPR para permitir que

54 Certificación del secretario de la Oficina ejecutiva de Asuntos Medioambientales sobre la actualización anual del Aeropuerto Logan 1997, emitida el 16 de octubre de 1998.

se analicen los proyectos individuales en el Aeropuerto Logan en un contexto más amplio en todo el aeropuerto. Como se estableció en la introducción del *ESPR de 1999,* mientras que el ESPR y el EDR de Logan brindan el contexto amplio de la planificación para los proyectos propuestos para el Aeropuerto Logan y los conceptos de planificación futuros que Massport analiza, no se puede crear ningún proyecto sólido en las bases de inclusión y análisis en el *ESPR de 1999*. Luego establece que los proyectos que cumplen con los umbrales de revisión de la MEPA o NEPA deben someterse a estos procesos, si es necesario. En resumen, los EDR/ESPR brindan un contexto de planificación que complementa las presentaciones individuales específicas del proyecto.

En los últimos años, los niveles de las operaciones de las aeronaves y de las actividades de los pasajeros y los efectos medioambientales asociados se mantuvieron bien por debajo de los niveles analizados previamente para el Aeropuerto Logan. Por lo tanto, el crecimiento de la aviación pronosticado presentado en el *ESPR 2004,* la afirmación sobre la que se estableció inicialmente el cronograma del ESPR, no se produjo. En consecuencia, con la aprobación del secretario, Massport confeccionó los *EDR 2009 y 2010* en lugar del ESPR originalmente planeado para 2009. El *ESPR 2011,* presentado a principios de 2013, informó sobre el año calendario 2011 y los pronósticos de los niveles actualizados de las actividades de los pasajeros y de las operaciones de las aeronaves. El *EDR 2012/2013* presentó condiciones para ambos años calendarios 2012 y 2013. El *EDR 2014* y el *EDR 2015* presentaron condiciones para los años calendarios 2014 y 2015.

Este *EDR de 2016* brinda un análisis acumulado exhaustivo de los efectos de todas las actividades del Aeropuerto Logan en función de los niveles actuales de actividades de los pasajeros y de las operaciones de las aeronaves en 2016, y presenta planes para el manejo medioambiental para abordar las áreas de preocupación medioambiental. Massport propone confeccionar un *ESPR de 2017* para informar los niveles de actividad y las condiciones medioambientales para ese año y las proyecciones hasta el 2035, y anticipa la publicación de este informe para principios de 2019. Si corresponde, Massport continuará identificando y abordando cualquier tendencia de aviación y medioambiental a largo plazo tanto en el EDR como en el ESPR. Como se indica en la certificación del secretario sobre el ENF del proyecto de modernización de la Terminal E, el EDR/ESPR continuará siendo el foro para abordar los impactos acumulados de todo el aeropuerto.

Revisión Específica del Proyecto

Aunque esta revisión de todo el aeropuerto brinda el contexto de planificación más amplio para los proyectos propuestos y para los conceptos de planificación futuros, determinados proyectos del aeropuerto también están sujetos al proceso público de revisión medioambiental específico del proyecto cuando cumplen los umbrales de revisión medioambiental estatal. Cuando se solicita, los locatarios de Massport y del aeropuerto presentan el ENF y el EIR en virtud de la MEPA. De manera similar, cuando se desencadena la revisión medioambiental de la NEPA, se revisan los proyectos de acuerdo con el proceso de revisión medioambiental de la NEPA.[55]

55 42 USC Sección 4321 et seq. La Administración Federal de Aviación (FAA) implementa la NEPA mediante la ordenanza 1050.1E, Impactos medioambientales, de la FAA. Políticas y procedimientos, Administración Federal de Aviación, Departamento de Transporte de los Estados Unidos, fecha de entrada en vigor: 20 de marzo de 2006.

Organización del *EDR 2016*

El resto de este *EDR 2016* incluye lo siguiente:

- **Resumen Ejecutivo en Español,** proporciona una versión traducida del Resumen ejecutivo, que se incluye después de la versión en inglés del capítulo 1, *Introducción/Resumen* ejecutivo.
- **Capítulo 2, *Niveles de Actividades*,** presenta las estadísticas de las actividades de aviación para el Aeropuerto Logan en 2016 y compara los niveles de actividad con los del año anterior. Las mediciones de las actividades específicas analizadas incluyen pasajeros aéreos, operaciones de aeronaves, mezcla de flota y volúmenes de carga/correo.
- **Capítulo 3, *Planificación Aeroportuaria*,** brinda una descripción general de la planificación, de la construcción y de las actividades permitidas que se realizaron en el Aeropuerto Logan en 2016. También describe la planificación, construcción, y actividades permitidas e iniciativas conocidas futuras.
- **Capítulo 4, *Transporte Regional*,** describe los niveles de actividades en los aeropuertos de la zona de Nueva Inglaterra en 2016 y actualiza las actividades de planificación regional recientes.
- **Capítulo 5, *Acceso Terrestre desde y hacia el Aeropuerto Logan*,** informa la cantidad de pasajeros en el transporte público, las calles, los volúmenes de tráfico y el estacionamiento para el 2016.
- **Capítulo 6, *Disminución del Ruido*,** actualiza el estado del entorno sonoro en el Aeropuerto Logan en 2016 y describe las iniciativas de Massport para reducir los niveles de ruido.
- **Capítulo 7, Calidad del Aire/Reducción de las Emisiones,** brinda una descripción general de la calidad del aire en relación con el aeropuerto en 2016 y las iniciativas para reducir las emisiones.
- **Capítulo 8, *Calidad del Agua/Cumplimiento y Manejo Medioambientales*,** describe las actividades del manejo medioambiental en curso incluido el cumplimiento con el sistema nacional de eliminación de residuos contaminantes (National Pollutant Discharge Elimination System, NPDES), los desagües pluviales, los derrames de combustible, las actividades del Plan para contingencias de Massachusetts (MCP) y el manejo de tanques.
- **Capítulo 9, *Seguimiento del Proyecto de Mitigación*,** informa sobre los progresos de Massport para cumplir con los compromisos de mitigación para los proyectos específicos para el aeropuerto de la sección 61 de la MEPA[56].

---

56 El capítulo 30, sección 61 (M.G.L. 30, § 61) de las leyes generales de Massachusetts establece que todas las agencias deben revisar, evaluar y determinar los impactos medioambientales de todos los proyectos o actividades, y deben usar todos los medios prácticos y mediciones para minimizar el daño al medioambiente. Para los proyectos que requieren un informe de impacto medioambiental, los resultados de la sección 61 especificarán todas las posibles medidas que se pueden tomar para evitar o mitigar los impactos medioambientales y el cronograma de implementación anticipado para las medidas de mitigación.

Los apéndices de referencia incluyen los siguientes:

Apéndices de la MEPA estos incluyen la certificación del secretario de la EEA para el *EDR 2015,* cartas con comentarios recibidas para el *EDR 2015* y las respuestas a esos comentarios, certificaciones del secretario para los informes anuales emitidos para los años de informe de 2011 a 2015, una lista de revisores a quienes se les distribuyó el *EDR 2016* y un alcance propuesto para el *ESPR 2017*. También se incluyen en esta sección las certificaciones del secretario para el ENF del proyecto de modernización de la Terminal E, EA/EIR provisorios y EA/EIR finales, y la certificación del secretario para el ENF del proyecto de estacionamiento del Aeropuerto Logan.

Apéndice A: certificaciones de la MEPA y respuestas a los comentarios[57]
Apéndice B: cartas de comentarios y respuestas
Apéndice C: alcance propuesto para el ESPR 2017
Apéndice D: lista de distribución

Apéndices técnicos:[58] estos incluyen datos analíticos detallados y documentación metodológica para los diferentes análisis medioambientales presentados y realizados para este *EDR 2016*.

Apéndice E: Niveles de Actividad
Apéndice F: Transporte Regional
Apéndice G: Acceso Terrestre
Apéndice H: Disminución del Ruido
Apéndice I: Calidad del Aire/Reducción de Emisiones
Apéndice J: Calidad del Agua/Cumplimiento y Manejo Medioambiental
Apéndice K: Informe del Control de Precios para el período de valores máximos de 2016 y 2017
Apéndice L: Memorando de la Reducción del Recorrido con un solo motor en el Aeropuerto Logan

57 Las certificaciones del secretario para el Formulario de notificación medioambiental para el proyecto de modernización de la Terminal E, Evaluación medioambiental/Informe del impacto medioambiental provisorios y Evaluación medioambiental/Informe del impacto medioambiental finales se incluyen el apéndice A. Por practicidad, Massport respondió a los comentarios que se relacionan con el EDR y el ESPR.

58 Los apéndices técnicos se incluyen en www.massport.com.

2

Activity Levels

Introduction

Boston-Logan International Airport (Logan Airport or Airport) plays a number of roles in the local, New England, and national air transportation systems. It is the primary airport serving the Boston metropolitan area, the principal New England airport for long-haul services, and a major U.S. international gateway airport for transatlantic services.

This chapter reports on annual air traffic activity at Logan Airport in 2016, including air passengers, aircraft operations, aircraft fleet mix, and cargo volumes. Air traffic and passenger activity levels at Logan Airport are the basis for the evaluation of noise, air quality effects, and ground access conditions associated with the Airport. In this chapter, current activity levels at the Airport are compared to prior-year levels, and historical passenger and operations trends at Logan Airport dating back to 2000 are reviewed.[1]

Source: ACI, 2017; USDOT, 2016

Logan Airport is an important origin and destination (O&D)[2] airport both nationally and internationally, and is one of the fastest growing major U.S. airports, in terms of number of passengers, over the past five years.[3] In 2016, U.S. passenger traffic grew by 3.8 percent, whereas Logan Airport experienced a passenger growth of 8.5 percent, more than double during the same period.[4] In 2016, passenger activity levels reached an all-time high of 36.3 million passengers and aircraft operations totaled 391,222. From 2000 to 2016, the annual number of passengers at Logan Airport increased by 30.9 percent, while the annual number of aircraft operations[5] decreased by 19.8 percent. Despite the increase in passengers, aircraft operations at Logan Airport remained well below the 487,996 operations in 2000 and the historical peak of 507,449 operations reached in 1998.
Logan Airport's market demand and passenger levels are a result of the Boston metropolitan area's status as an

1 Refer to Appendix E, *Activity Levels* for available information dating back to 1980.
2 "Origin and destination" traffic refers to the passenger traffic that either originates or ends at a particular airport or market. A strong O&D market like Boston generates significant local passenger demand, with many passengers starting their journey and ending their journey in that market. O&D traffic is distinct from connecting traffic, which refers to the passenger traffic that does not originate or end at the airport but merely connects through the airport en route to another destination.
3 Between 2011 and 2016, Logan Airport was the 8th fastest growing airport in the U.S. in terms of domestic O&D traffic (U.S. DOT O&D Survey).
4 2016 ACI North American Airport Traffic Summary. http://www.aci-na.org/content/airport-traffic-reports.
5 An aircraft operation is defined as one arrival or one departure.

important national and international destination, a robust regional economy, and regional demographics favorable to air travel.

This chapter specifically describes 2016 activity levels, historical trends for:

- Air passengers and aircraft operations;
- Cargo and mail volumes; and
- Airline service.

Figure 2-1 Logan Airport Annual Passenger and Operations, 1990, 1998, 2000, 2015, 2016

Air Passenger Levels in 2016

The following section provides an overview of air passenger levels in 2016 for Logan Airport.

Logan Airport Passengers

Logan Airport is the principal airport for the greater Boston metropolitan area, and the international and long-haul gateway for much of New England. Logan Airport was ranked the 17th busiest airport in the U.S. in terms of passengers in 2016.[6] Logan Airport served 36.3 million passengers in 2016, an increase of 8.5 percent over 2015. This represented a historic high for Logan Airport, exceeding the previous record of 33.4 million in 2015. Logan Airport is one of the fastest growing airports in the U.S., with passenger growth continuing to outpace overall U.S. passenger growth. Factors that contributed to the strong passenger growth at Logan Airport in 2016 included:

- Continued economic growth and an increase in air travel demand across the nation, especially in Massachusetts and the Boston metropolitan area;
- JetBlue Airways' continued growth at Logan Airport in response to passenger demand; and
- Increasing international passenger demand accommodated with new international services at Logan Airport.

International passenger traffic at Logan Airport, in particular, has exhibited strong growth over the past several years. After three periods of decline and gradual recovery in 2001, 2006, and 2008, Logan Airport's international traffic finally surpassed 2000 levels for the first time in 2013. In 2016, international passengers made up approximately 18 percent of total Airport passengers, an increase of 19 percent over 2015 and 32 percent over 2014 levels. Since 2010, the international passenger segment has averaged a 10.2 percent annual growth. This growth has been driven by strong market demand, resulting in the growth of JetBlue Airways and Delta Air Lines' international service at Logan Airport, as well as a rapid increase in foreign carrier services in recent years. Boston is currently the 11th largest U.S. gateway for international air travel, and the largest U.S. gateway airport that is not a connecting U.S. airline hub.[7] The O&D strength of the Boston market makes Logan Airport an attractive gateway for international airlines. Additional trends in new aircraft technology allowing for smaller and more fuel-efficient aircraft on international routes are also expected to continue to benefit mid-size O&D markets like Boston.

Logan Airport is a primary economic engine for the New England region, the state, and the Boston metropolitan area. It supports nearly 132,000 direct and indirect jobs,[8] while generating approximately $13.3 billion per year in total economic activity. International passengers contribute a substantially higher share to the local and regional economy than domestic passengers do. Approximately 1.6 million overseas visitors visited the Boston area in

6 Airports Council International. September 2017 *Worldwide Airport Traffic Report*.

7 U.S. DOT, T100 Database, YE 2016.

8 Massachusetts Aeronautics Commission. 2014. *Massachusetts Statewide Airport Economic Impact Study*. https://www.massdot.state.ma.us/portals/7/docs/airportEconomicImpactSummary.pdf.

2015,[9] spending more than $1 billion;[10] this visitor level represented a 14 percent increase from 2014 and is widely attributed to the increased international service at Logan Airport, particularly non-stop flights to China and Hong Kong.[11] However, in 2016, the number of international overseas visitors to Boston declined by 5 percent to 1.5 million.[12] New international service in the last five years alone has contributed more than $1.3 billion per year to the local economy and $49 million in new incremental tax revenue through income and sales.[13]

As shown in **Table 2-1**, domestic air passengers represent Logan Airport's largest market segment, accounting for 81.5 percent of total passengers in 2016. The domestic passenger market increased by 6.4 percent in 2016. Growth in JetBlue Airways', Southwest Airlines', and Spirit Airlines' domestic networks from Logan Airport were the main contributors to growth in domestic passengers. JetBlue Airways carried 8.9 million domestic passengers at Logan Airport in 2016, compared to 8.1 million in 2015. Southwest Airlines carried 3.0 million domestic passengers in 2016, up 16.6 percent from 2.6 million passengers in 2015. Spirit Airlines carried 1.0 million domestic passengers in 2016, up 53.4 percent from 0.6 million passengers in 2015.[14]

Figure 2-2 shows the total annual passengers for the five major airlines at Logan Airport and highlights the rapid growth of JetBlue Airways at Logan Airport since 2004. The figure also shows a sixth airline, US Airways, which merged with American Airlines in 2013. Overall, the substantial low-cost carrier growth at the Airport over the past decade – particularly the entry of JetBlue Airways in 2004 and its subsequent decision to expand and make Logan Airport one of its focus cities – has exceeded recent consolidation and contraction among other carriers serving Logan Airport.[15] Domestic passenger activity levels have recovered from the economic downturn in 2008/2009, when the total number of domestic air passengers fell to 21.8 million. In 2016, domestic passenger activity levels reached a new peak of 29.6 million.

9 U.S. Department of Commerce, National Travel and Tourism Office. 2015. *Overseas Visitation Estimates for U.S. States, Cities and Census Regions*. http://travel.trade.gov/outreachpages/download_data_table/2015_States_and_Cities.pdf. Accessed September 8, 2017.

10 Greater Boston Convention and Visitors Bureau. Overseas Visitation. https://www.bostonusa.com/media/statistics-reports/overseas-visitation/. Accessed August 29, 2017.

11 Boston Business Journal. September 15, 2015. "Boston's 2015 Tourism Season Was Best in Years". https://www.bizjournals.com/boston/news/2015/09/16/bostons-2015-tourism-season-was-best-in-years.html. Accessed September 8, 2017.

12 U.S. Department of Commerce, National Travel and Tourism Office. 2015. *Overseas Visitation Estimates for U.S. States, Cities and Census Regions*. http://travel.trade.gov/outreachpages/download_data_table/2015_States_and_Cities.pdf. Accessed September 8, 2017.

13 InterVISTAS. 2016. *Economic Impact of Recent International Routes.*

14 U.S. DOT, T100 Database

15 Recent airline industry consolidation includes the merger of Delta Air Lines and Northwest Airlines in October 2008, United Airlines and Continental Airlines in August 2010, Southwest Airlines and AirTran Airways in April 2011, and American Airlines and US Airways in December 2013.

Table 2-1 Air Passengers by Market Segment, 1990, 1998, 2000, and 2010-2016

	1990	1998[1]	2000	2010	2011	2012	2013	2014	2015	2016	Percent Change (2015-2016)	Avg. Annual Growth (2010-2016)
Domestic	**19,519,247**	**22,429,639**	**23,100,645**	**23,688,471**	**24,579,780**	**24,743,008**	**25,578,080**	**26,545,978**	**27,810,256**	**29,591,053**	**6.4%**	**3.8%**
International	**3,358,944**	**3,985,954**	**4,513,192**	**3,681,739**	**4,215,071**	**4,383,945**	**4,546,018**	**4,992,225**	**5,534,176**	**6,587,473**	**19.0%**	**10.2%**
Europe/ Middle East	N/A	2,467,585	2,948,542	2,672,635	2,939,226	2,896,002	2,901,529	3,194,109	3,473,579	4,096,114	17.9%	7.4%
Bermuda/ Caribbean[2]	N/A	702,383	693,620	518,088	700,267	793,953	863,842	887,301	946,428	1,032,330	9.1%	12.2%
Canada	N/A	790,731	833,669	486,911	573,660	614,879	643,987	669,546	688,459	878,191	27.6%	10.3%
Asia/Pacific	N/A	25,255	37,451[3]	0	0	78,484	104,235	170,867	316,621	415,869	31.3%	N/A%
Central/ South America	N/A	0	0	4,105	1,918	627	32,425	70,402	109,089	164,969	51.2%	85.1%
General Aviation	**N/A**	**111,115**	**112,996**	**58,752**	**114,416**	**109,134**	**94,872**	**96,242**	**105,148**	**109,516**	**4.2%**	**10.9%**
Total Passengers	**22,878,191**	**26,526,708**	**27,726,833**	**27,428,962**	**28,909,267**	**29,236,087**	**30,218,970**	**31,634,445**	**33,449,580**	**36,288,042**	**8.5 %**	**4.8%**

Source: Massport

Notes: Reported International passengers include only international passengers using Logan Airport as an international gateway; a significant number of international O&D passengers also board domestic flights from Logan Airport to connect to other U.S. gateways to international destinations.

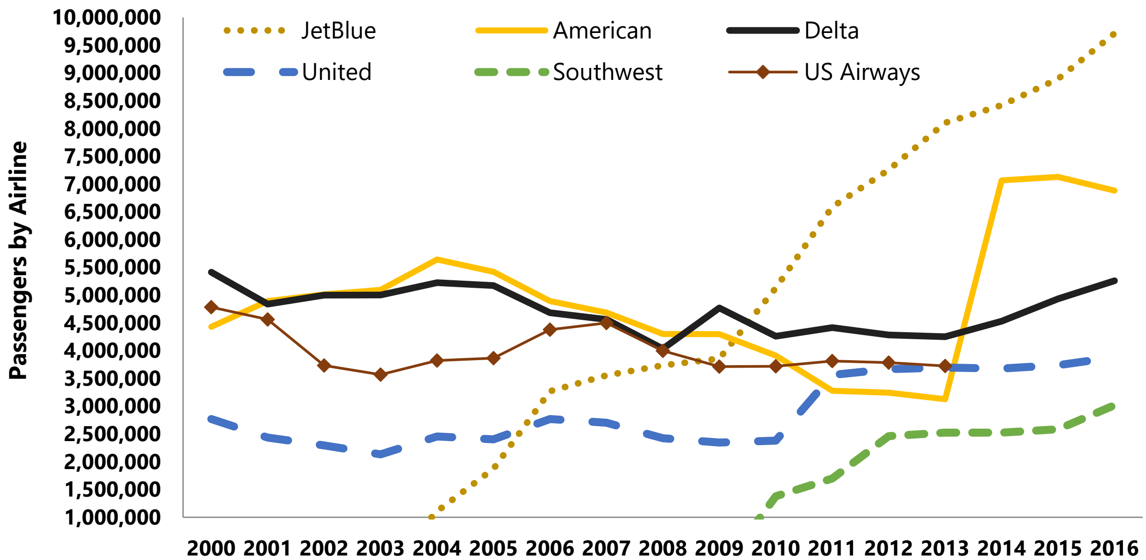
N/A Not available.

1 1998 represents the historic peak in terms of aircraft operations for Logan Airport.

2 Includes Puerto Rico and U.S. Virgin Islands.

3 Between 1996 and 2001, Korean Air served Logan Airport with one-stop service via New York JFK and Washington Dulles; this service was discontinued in February 2001.

Figure 2-2 Annual Passengers at Logan Airport Served by Top Airlines, 2000-2016



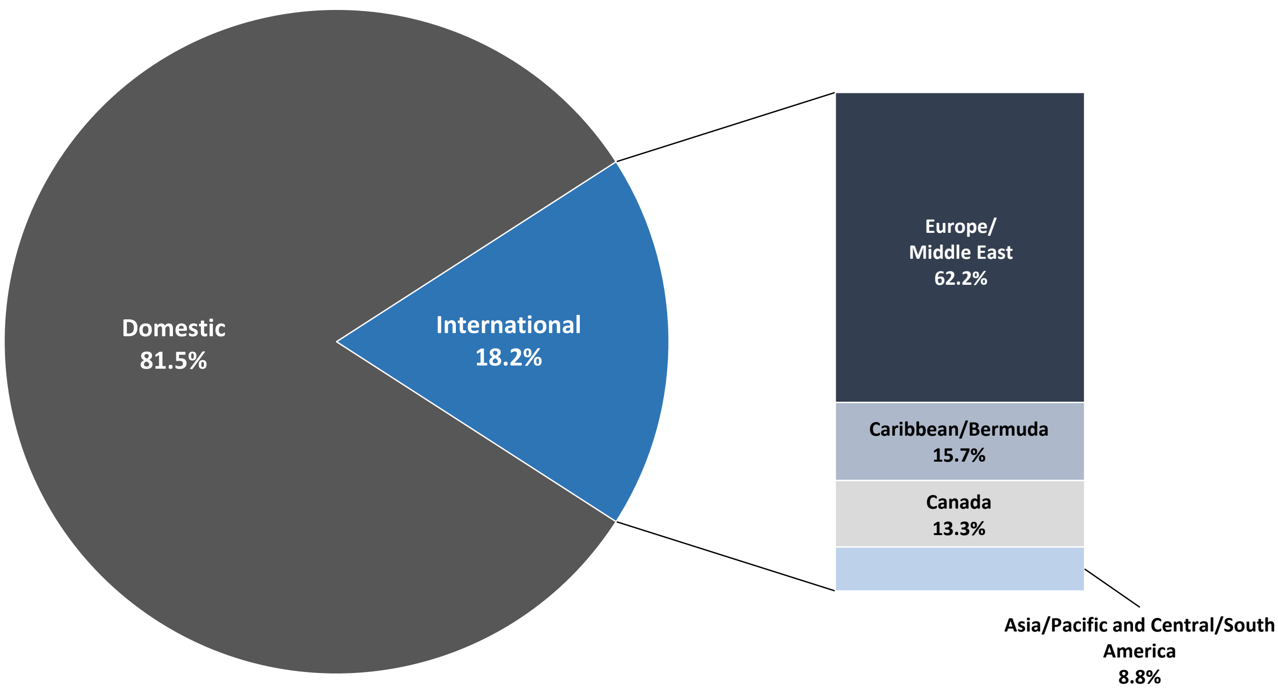
Source: Massport

Notes: US Airways totals in this chart include America West Airlines beginning in 2006 (following 2005 merger), Delta Air Lines totals include Northwest Airlines beginning in 2009 (following 2008 merger), United Airlines totals include Continental Airlines beginning in 2011 (following 2010 merger), Southwest Airlines include AirTran Airways beginning 2012 (following 2011 merger), and American Airlines includes US Airways beginning in 2014 (following 2013 merger). Totals for American Airlines, Delta Air Lines, United Airlines, and US Airways include Delta Shuttle, US Airways Shuttle, and contract carriers doing business as Delta Connection, United Express, US Airways Express, American Eagle, or American Connection.

Due to the region's continually strong economy, Logan Airport experienced substantial growth in international passenger activity levels in 2016 for the third consecutive year. In 2014, international passenger traffic at Logan Airport increased by 9.8 percent over 2013 to reach 5.0 million, exceeding the historical international passenger peak achieved in 2000. International passenger growth accelerated in 2015, growing by 10.9 percent to reach a record 5.5 million. In 2016, this growth accelerated further, growing by 19 percent to 6.6 million. JetBlue Airways has expanded international services at Logan Airport in recent years, continuing to grow its Caribbean network. Logan Airport has also attracted a significant amount of foreign carrier service, including new service by Emirates, Hainan Airlines and Turkish Airlines in 2014, Aeromexico, Cathay Pacific, El Al, and WOW Air in 2015, and most recently Air Berlin, Norwegian Air Shuttle, Qatar Airways, Scandinavian Airlines, TAP Air Portugal, and WestJet Airlines in 2016.

Figure 2-3 shows the distribution of Logan Airport passengers by market segment. Europe/Middle East was the dominant international destination market, accounting for 62.2 percent of international traffic and 11.3 percent of total traffic at Logan Airport. Passenger traffic to Europe/Middle East was up 17.9 percent in 2016, driven by new services to Europe by several European carriers and to the Middle East by Qatar Airways. The Bermuda/Caribbean regions and Canada accounted for 15.7 percent and 13.3 percent of international passengers respectively in 2016, with traffic to Bermuda/Caribbean seeing strong growth of 9.1 percent and traffic to Canada increasing by 27.6 percent. Asia/Pacific and Central/South America passenger traffic accounted for 6.3 percent and 2.5 percent of international passengers respectively, with 2016 being the first full year of service for several new routes to these regions launched in 2015.

Figure 2-3 Distribution of Logan Airport Passengers by Market Segment, 2016



Source: Massport
Note: General Aviation accounted for 0.3 percent of Logan Airport Passengers in 2016.

Aircraft Operation Levels in 2016

This section reports on aircraft operations levels for Logan Airport, including passenger aircraft operations, General Aviation (GA) operations, all-cargo aircraft operations, and aircraft load factors.

Logan Airport Aircraft Operations

The total number of aircraft operations at Logan Airport increased 4.9 percent from 372,930 operations in 2015 to 391,222 operations in 2016 (**Table 2-2**). Increases were seen in passenger, GA, and all-cargo operations in 2016, driven by faster airline capacity growth and declining fuel prices. As shown in **Figure 2-4**, passenger operations account for 90.4 percent of total aircraft operations at Logan Airport, while GA and all-cargo operations account for 7.9 percent and 1.7 percent, respectively. **Figure 2-5** depicts passenger levels and aircraft operations since 1990 and shows a historical trend of increasing passenger levels and decreasing operations. While passenger activity levels have reached historic highs the last several years, aircraft operations at Logan Airport are well below the historical peak of 507,449 operations in 1998. From 2000 to 2016, the annual number of passengers at Logan Airport increased by 30.9 percent, while the annual number of aircraft operations decreased by 19.8 percent, indicating a trend of increasing aircraft utilization by air carriers.

Table 2-2 Logan Airport Aircraft Operations (1990, 1998, 2000, and 2010 – 2016)

Category	1990	1998[1]	2000	2010	2011	2012	2013	2014	2015	2016	Percent Change (2015-2016)	Avg. Annual Growth (2010-2016)
Total Aircraft Operations	**424,568**	**507,449**	**487,996**	**352,643**	**368,987**	**354,869**	**361,339**	**363,797**	**372,930**	**391,222**	**4.9%**	**1.7%**
Operations by Type and Aircraft Class												
Passenger Jet	N/A	244,642	254,968	214,307	223,083	225,166	233,072	240,252	254,250	270,330	6.3%	3.9%
Passenger Regional Jet	N/A	12,172	37,600	66,498	61,704	46,753	47,875	44,079	38,229	36,564	(4.4%)	(9.5%)
Passenger Non-Jet	N/A	207,880	147,913	50,882	49,700	49,599	48,307	47,339	46,225	46,868	1.4%	(1.4%)
Total Passenger Operations	**N/A**	**464,694**	**440,481**	**331,687**	**334,487**	**321,518**	**329,254**	**331,670**	**338,705**	**353,762**	**4.4%**	**1.1%**
GA Jet Operations	N/A	13,636	20,595	11,430	21,129	21,042	21,237	21,025	20,589	24,499	9.3%	13.5%
GA Non-Jet Operations	N/A	18,076	14,638	3,252	7,101	7,072	5,445	5,391	7,577	6,281	9.3%	11.6%
Total GA Operations	**24,976**	**31,712**	**35,233**	**14,682**	**28,230**	**28,114**	**26,682**	**26,416**	**28,166**	**30,780**	**9.3%**	**13.1%**
Cargo Jet	N/A	10,428	11,788	5,332	5,053	4,220	4,647	4,911	5,605	5,745	10.2%	1.3%
Cargo Non-Jet	N/A	630	494	942	1,217	1,017	756	800	454	935	10.2%	(0.1%)
Total All-Cargo Operations	**N/A**	**11,058**	**12,282**	**6,274**	**6,270**	**5,237**	**5,403**	**5,711**	**6,059**	**6,680**	**10.2%**	**1.1%**

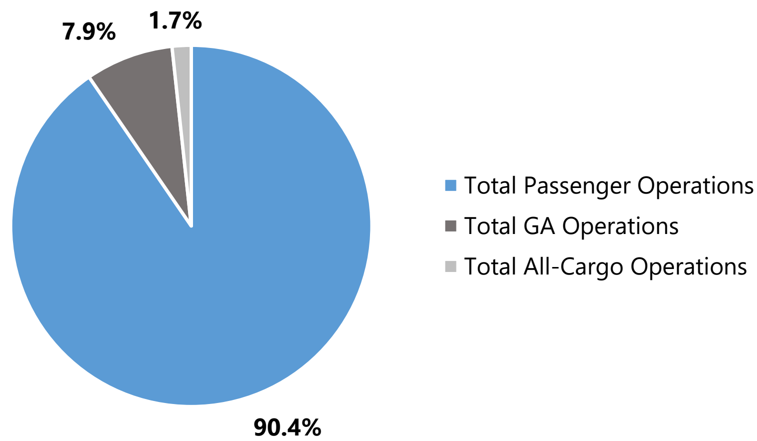
Source: Massport

Notes: Jet includes the Embraer E-190, which is a regional jet configured with 88 to 100 seats, but is similar in size to some traditional narrow-body jets. Numbers in parentheses ( ) indicate negative numbers.

N/A Not Available.

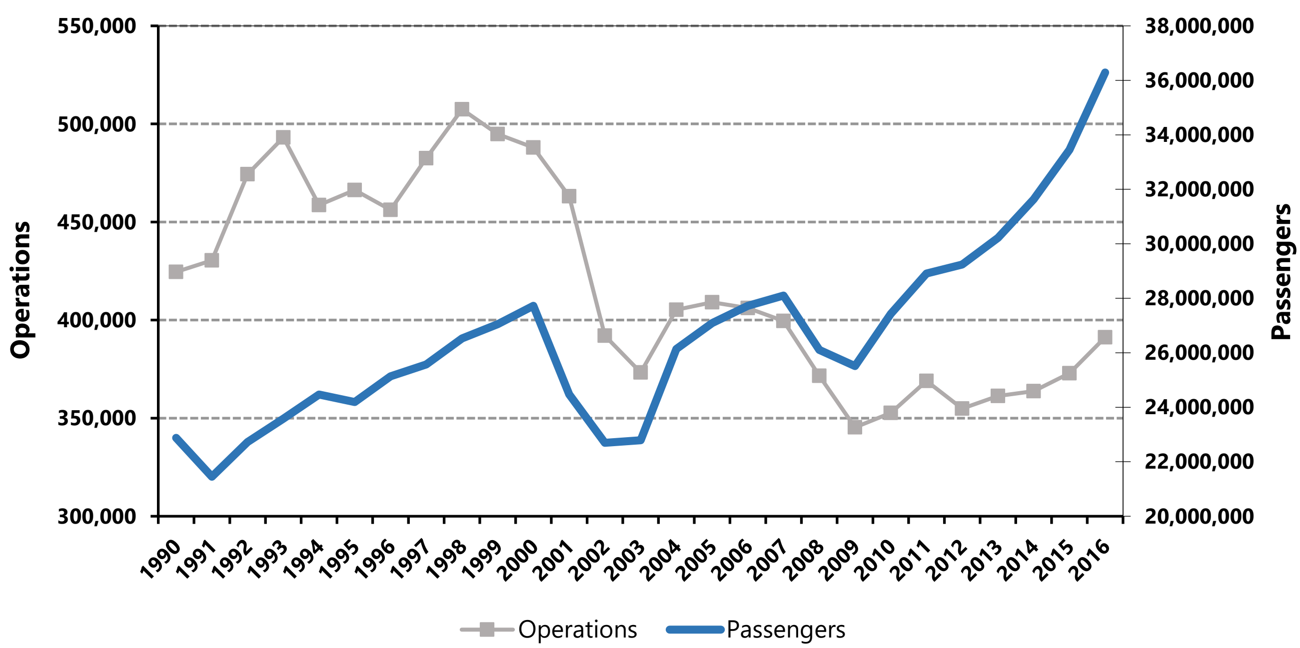
1 1998 represents the historic peak in terms of aircraft operations for Logan Airport.

Figure 2-4 Logan Airport 2016 Aircraft Operations by Type



Source: Massport

Figure 2-5 Logan Airport Historical Air Passenger Activity Levels and Aircraft Operations, 1990-2016



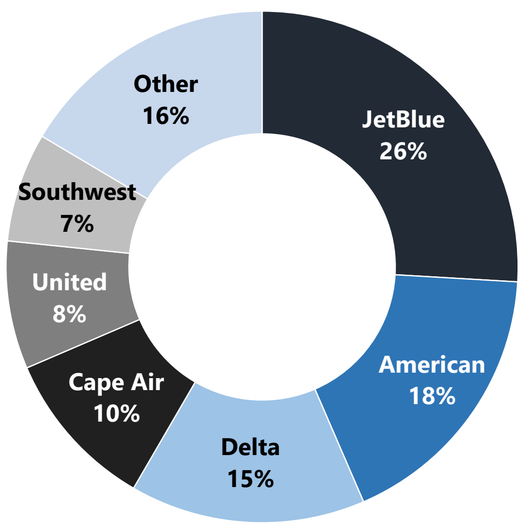
Source: Massport

Passenger Operations

Logan Airport accommodated 353,762 passenger aircraft operations in 2016, a 4.4-percent increase from 2015. Passenger aircraft operations represented 90.4 percent of total aircraft operations at Logan Airport in 2016, while GA operations and all-cargo operations represented 7.9 percent and 1.7 percent respectively (**Figure 2-4**).

The leading carriers at Logan Airport, based on the number of aircraft operations in 2016, are shown in **Figure 2-6**. JetBlue Airways, American Airlines, Delta Air Lines, Cape Air, and United Airlines were the top carriers in 2016 based on the number of aircraft operations.[16] In 2016, JetBlue Airways accounted for approximately 91,736 operations, American Airlines accounted for 62,200 operations, and Delta Air Lines ranked third with 52,553 operations. Cape Air, United Airlines, and Southwest Airlines ranked fourth, fifth, and sixth, respectively, in 2016 with 35,993 operations, 28,597 operations, and 24,436 operations.[17]

Figure 2-6 Air Passenger Carriers at Logan Airport by Aircraft Operations, 2016



Source: Massport
Notes: Totals for American Airlines, Delta Air Lines, and United Airlines include all regional affiliates and contract carriers.
American Airlines includes US Airways (2013 merger) and Southwest Airlines includes AirTran Airways (2011 merger).
"Other" category includes all other carriers that have a smaller portion of aircraft operations at Logan Airport and that provide either year-round or seasonal service at Logan Airport.

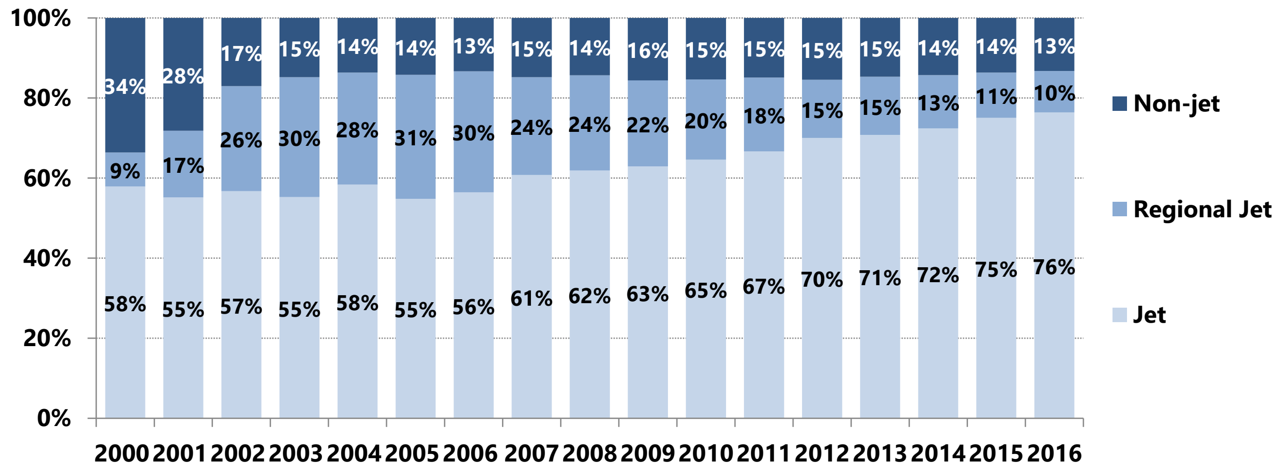
Passenger Regional Jet (RJ) operations (jet aircraft with fewer than 90 seats) decreased by 4.4 percent in 2016. Non-jet passenger operations increased by 1.4 percent in 2016 after several years of gradual decline. Passenger jet operations increased by 6.3 percent.[18] RJ operations have been declining steadily since 2006, as airlines eliminated unprofitable services to small and medium size markets and consolidated services after a period of

16 Aircraft operation numbers for airlines include regional partners and subsidiaries.
17 Totals aircraft operations for American Airlines, Delta Air Lines, and United Airlines include regional affiliates and contract carriers.
18 In this report, the term regional jet refers to small jet aircraft with fewer than 90 seats. The Embraer-190, operated by jetBlue Airways at Logan Airport, carries up to 100 passengers and is considered a jet.

airline mergers. The decreases in RJ operations also reflect the retirement of smaller, less fuel-efficient RJs with 30 to 50 seats.

The change in mix of passenger aircraft operations since 2000 is shown in **Figure 2-7**. RJs accounted for 10 percent of total passenger operations in 2016, compared to 31 percent at the peak level in 2005. Similarly, non-jets have declined from 34 percent in 2000 to 13 percent in 2016.

Figure 2-7 Passenger Aircraft Operations at Logan Airport by Aircraft Type, 2000-2016



Source: Massport

Notes: Jet includes the Embraer E-190, which is a regional jet configured with 88 to 100 seats, but is similar in size to some traditional narrow-body jets.

Passengers per Aircraft and Load Factors

The average number of passengers per aircraft operation increased in 2016, continuing the long-term trend. An increase in the average number of passengers per aircraft operation indicates an increase in the average aircraft seating capacity and/or an increase in the percentage of aircraft seats occupied by passengers (i.e., load factor[19]). Load factors at Logan Airport have matched or exceeded the national average each year since 2012. Changes in the number of passengers per operation and load factors at Logan Airport are shown in **Figure 2-8**. In 2016, Logan Airport operations accommodated an average of 92.8 passengers per flight compared to 89.7 in 2015 (**Table 2-3**). The average number of passengers per flight has risen by 19.3 percent since 2010 when the average number of passengers per flight was 77.8. The trend of more passengers on fewer flights is more efficient, reflecting a shift away from smaller, less fuel-efficient aircraft and rising load factors as airlines carefully monitored and restricted capacity growth. In 2016, Logan Airport's average domestic load factor was 82.8 percent, unchanged from 2015. The national average domestic load factor decreased during the same period, falling from 82.6 percent in 2015 to 81.7 percent in 2016.[20]

19 The number of passengers as a percentage of total seats operated at the airport.

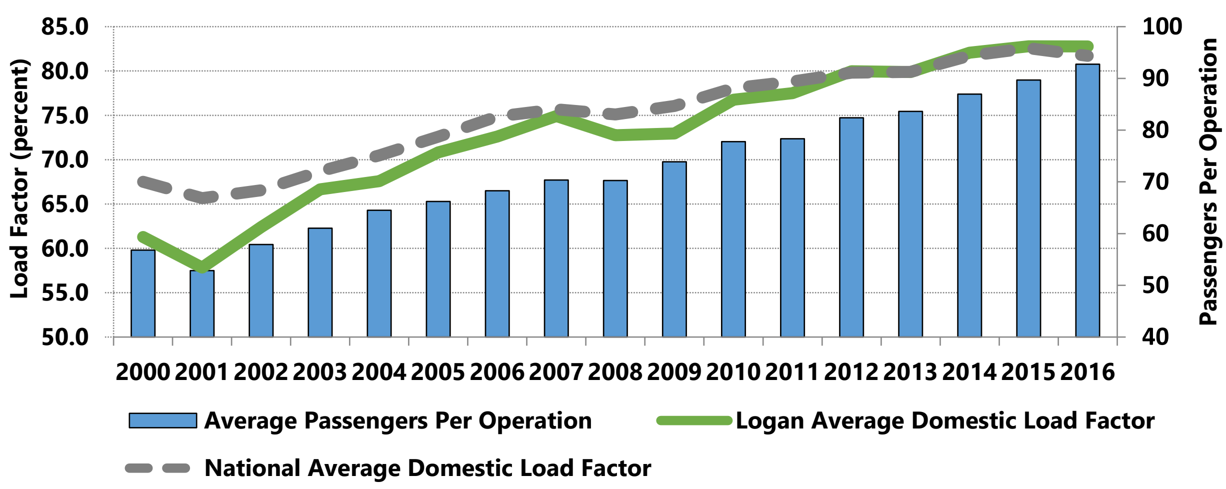
20 U.S. DOT, T100 Database; includes scheduled passenger service only.

Table 2-3 Air Passengers and Aircraft Operations, 2000, 2010-2016

Year	Air Passengers	Percent Change from Previous Year	Aircraft Operations	Percent Change from Previous Year	Average Number of Passengers per Operation	Net Change from Previous Year (No. Pass/Op.)	Logan Airport Average Domestic Load Factor	Net Change from Previous Year (Pct. Points)
2000	27,726,833	2.5%	487,996	(1.4%)	56.8	2.1	61.3%	0.4
2010	27,428,962	7.5%	352,643	2.1%	77.8	3.9	76.8%	3.8
2011	28,907,938	5.4%	368,987	4.6%	78.3	0.6	77.5%	0.7
2012	29,235,643	1.1%	354,869	(3.8%)	82.4	4.0	80.0%	2.5
2013	30,218,631	3.4%	361,339	1.8%	83.6	1.2	79.9%	(0.1)
2014	31,634,445	4.7%	363,797	0.7%	87.0	3.3	82.1%	2.1
2015	33,449,580	5.7%	372,930	2.5%	89.7	2.7	82.8%	0.7
2016	36,288,042	8.5%	391,222	4.9%	92.8	3.1	82.8%	0.0

Sources: Massport; U.S. Department of Transportation (DOT), T100 Database
Notes: Numbers in parentheses ( ) indicate negative numbers.
Includes scheduled passenger service only.
Refer to Appendix E, *Activity Levels* for additional passenger and operations data dating back to 1980.

Figure 2-8 Passengers per Aircraft Operation and Aircraft Load Factor, 2000-2016



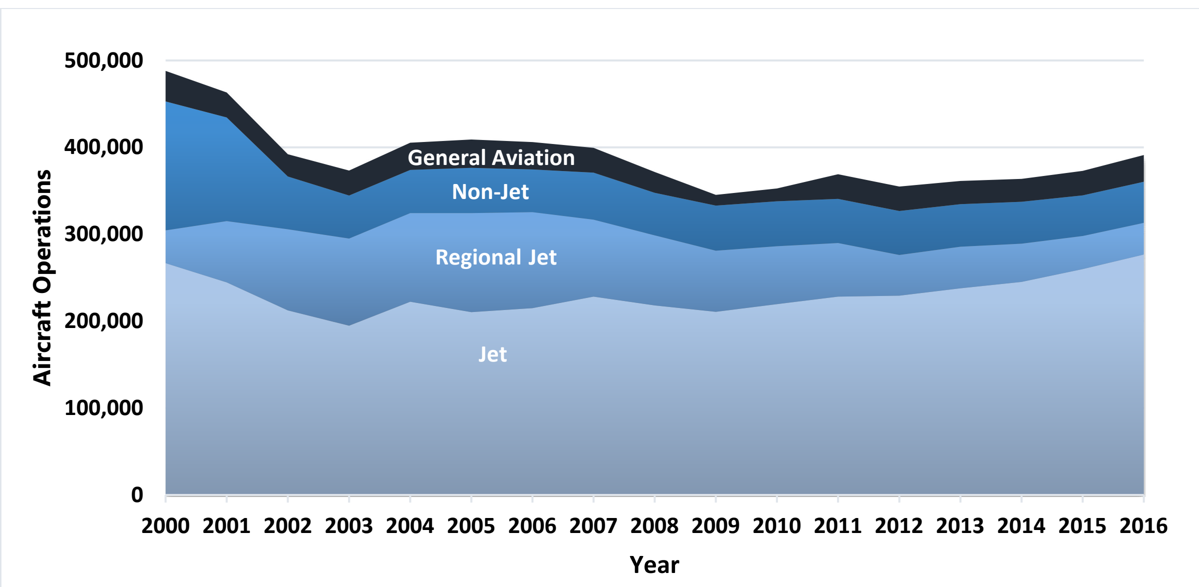
Source: Massport; U.S. Department of Transportation (DOT), T100 Database
Note: Includes scheduled passenger service only.

General Aviation Operations

GA is defined as all aviation activity other than commercial airline and military operations. It encompasses a variety of aviation activities at Logan Airport, including: corporate/business aviation, private business jet charters, law-enforcement, and emergency medical/air ambulance services. GA operations are conducted by a diverse group of private and business aviation aircraft ranging from single-engine piston driven aircraft to high-performance, long-range jets. GA activity at Logan Airport declined following the 2008/2009 economic recession, but recovered in 2011. Lower oil prices and decreased fuel expenses over the past two years have contributed to an increase in GA activity at Logan Airport. GA operation levels in 2016 remain well below the 35,233 GA operations that Logan Airport handled in 2000. In 2016, GA operations at Logan Airport totaled 30,780 operations which increased 9.3 percent from the 28,166 operations in 2015.

In 2016, GA operations accounted for 7.9 percent (30,780 operations) of aircraft activity at Logan Airport (**Figure 2-4**). Hanscom Field remains the primary GA airport for the Greater Boston region, accommodating four times the number of GA operations than at Logan Airport. Hanscom Field accommodated 120,891 GA operations in 2016, representing 99.3 percent of Hanscom Field's aircraft activity. **Figure 2-9** depicts changes in number of Logan Airport aircraft operations by category since 2000.

Figure 2-9 Aircraft Operations at Logan Airport by Aircraft Class, 2000-2016



Source: Massport
Notes: Jet, regional jet, and non-jet operations are associated with commercial passenger and all-cargo airlines.
GA operations also include jet and non-jet aircraft, but are associated with private charter and corporate use.

All-Cargo Operations

Operations by cargo-dedicated aircraft represent less than 2 percent of aircraft activity at Logan Airport. All-cargo carriers at Logan Airport include FedEx, UPS, DHL, and a few other smaller carriers. In 2016, all-cargo operations at Logan Airport totaled 6,680 operations, an increase of 10.2 percent compared to 2015.

Airline Passenger Service in 2016

Airlines can adjust service at an airport or on a specific route in two ways: changing the number of flights operated or changing the size of the aircraft. Changes in flight frequency and changes in aircraft size both affect the number of seats available to passengers (seat capacity). Airline services are therefore typically discussed in terms of seat capacity as well as the number of flight departures.[21] This section examines changes in airline departures and seat capacity at Logan Airport in 2016 and provides an overview of new and discontinued routes.

Service Developments at Logan Airport

In 2016, 41 airlines provided scheduled passenger service from Logan Airport to 129 non-stop destinations.[22] The average non-stop stage length (the average length of non-stop flights) of scheduled domestic flights from Logan Airport increased from 811 miles in 2015 to 837 miles in 2016. The average non-stop stage length of scheduled international flights increased from 2,109 miles in 2015 to 2,249 miles in 2016. The major changes in Logan Airport's scheduled passenger services in 2016 are described below.

Changes in Domestic Passenger Service

As shown in **Table 2-4**, the total number of scheduled domestic flights at Logan Airport in 2016 increased by 2.6 percent compared to 2015. Overall, scheduled jet operations by legacy carriers and low-cost carriers increased by 4.3 percent in 2016, while regional/commuter flights decreased by 3 percent.

Legacy carrier jet operations decreased slightly from 114,987 operations in 2015 to 114,012 operations in 2016. This slight decrease is due to American Airlines' schedule adjustments following its recent merger with US Airways. In 2016, American Airlines reduced jet operations by 2.4 percent from the combined 56,222 operations performed by American Airlines and US Airways in 2015. Legacy carrier RJ operations declined more significantly, by 37.9 percent to 6,418 operations in 2016.

Total domestic low-cost carrier operations grew by 9.7 percent in 2016, increasing from 110,642 operations in 2015 to 121,369 operations in 2016. Low-cost carriers accounted for 40 percent of Logan Airport's total scheduled domestic operations in 2016. JetBlue Airways, the dominant low-cost carrier at Logan Airport, continued to expand, increasing its domestic operations by 6.6 percent from 79,364 operations in 2015 to 84,590 operations in 2016. Southwest Airlines increased domestic operations by 13.4 percent from 21,542 operations in 2015 to 24,436 operations in 2016. In 2016, ultra-low-cost carrier Spirit Airlines expanded operations at Logan Airport, increasing domestic operations by 48 percent from 4,896 operations in 2015 to 7,245 operations in 2016. Since 2014, Spirit Airlines has increased domestic jet operations by 146 percent.

Regional commuter flights were down by 2.9 percent in 2016 due to reductions by American Airlines and United Airlines regional affiliates. Delta Air Lines increased regional operations by 20.2 percent in 2016 after significantly decreasing regional operations in 2015.

21 A departure is an aircraft take-off at an airport. While aircraft operations include both departures and arrivals, airline services are typically described in terms of departures, as the number of scheduled departures generally equals the number of scheduled arrivals. Changes in departures translate to changes in overall operations.

22 Based on OAG Schedules.

Table 2-4 Scheduled Domestic Air Passenger Operations by Airline Category, 2000, 2010-2016

Category	2000	2010	2011	2012	2013	2014	2015	2016	Percent change 2015-2016	Avg. Annual Growth (2010-2016)
Scheduled Jet Carriers	233,993	203,081	207,369	203,376	211,176	214,854	225,629	235,381	4.3%	2.5%
Legacy Carriers[1]	222,564	117,877	111,761	108,374	107,162	109,470	114,987	114,012	(0.8%)	(0.6%)
Low-Cost Carriers[2]	11,429	85,204	95,608	95,002	104,014	105,384	110,642	121,369	9.7%	6.1%
Regional/ Commuter	160,041	94,535	89,586	79,790	79,922	76,682	70,274	68,204	(2.9%)	(5.3%)
Total Scheduled Domestic	**394,034**	**297,616**	**296,955**	**283,166**	**291,098**	**291,536**	**295,903**	**303,585**	**2.6%**	**0.3%**

Source: Massport
Notes: Numbers in parentheses ( ) indicate negative numbers.
1 Includes legacy carrier large jet operations only; regional jet and non-jet operations operated by regional affiliates or subsidiaries of legacy carriers are included in the "Regional/Commuter" category.
2 Low-cost carriers that provided domestic service at Logan Airport in 2016 included JetBlue Airways, Southwest Airlines, Spirit Airlines, Virgin America, and Sun Country Airlines.

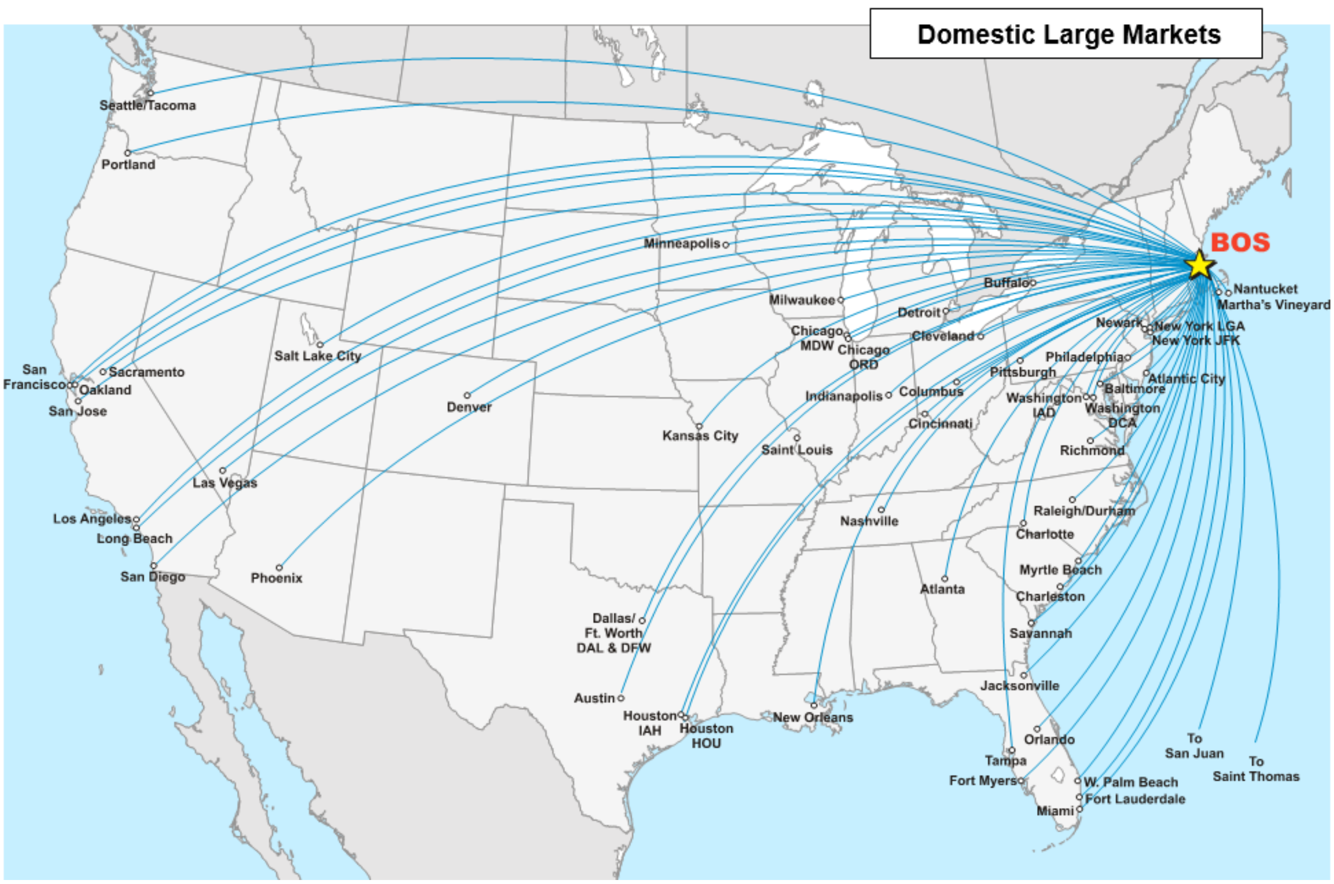
Highlights of key domestic airline service changes at Logan Airport in 2016 include:

- JetBlue Airways continued to grow operations from Logan Airport. In 2016, the airline averaged over 120 daily departures from Logan Airport. New domestic destinations introduced in 2016 included Nashville, New York LaGuardia (LGA), and Salt Lake City. JetBlue Airways also added frequencies in markets including Fort Lauderdale, Fort Myers, and Tampa. As Logan Airport's largest carrier, JetBlue Airways accounted for 27.8 percent of total domestic passenger aircraft operations and 26.8 percent of total passengers in 2016.
- Delta Air Lines continued to add airline departures and seat capacity at Logan Airport in 2016, adding frequencies and capacity to several traditionally strong markets and increasing service on newly competitive routes. After significantly increasing capacity on the Boston-New York LGA Delta Shuttle route in 2015, Delta shifted some of the frequencies to regional partners in 2016, reducing total capacity on the Boston-New York LGA Delta Shuttle route by 8 percent from 2015. However, Delta Air Lines added frequencies in the New York (JFK), Los Angeles, and Salt Lake City markets. Delta Air Lines also introduced new non-stop service from Logan Airport to Seattle and Nashville in 2016.
- American Airlines reduced domestic operations and capacity at Logan Airport in 2016, as part of the integration process with US Airways following the American Airlines/US Airways merger in December 2013. The carrier did not discontinue any existing routes or add any new routes in 2016, but it did make several capacity adjustments at Logan Airport. Overall, American Airlines reduced domestic seat capacity at Logan Airport by 3.7 percent in 2016. Frequencies were reduced in markets including Buffalo, New York JFK, New York LGA, Philadelphia, Pittsburgh, and Syracuse. Minor capacity reductions were made in several other key markets such as Dallas/Fort Worth, Miami, Chicago Midway, and Phoenix. American Airlines increased capacity to Washington DCA, Los Angeles, and Harrisburg.

- Spirit Airlines significantly expanded its network at Logan Airport in 2016 building on its strong growth in 2015. Spirit Airlines increased total seat capacity by approximately 53 percent in 2016. The airline launched new service to Baltimore, Orlando, and Minneapolis in 2016. Spirit Airlines also increased operations frequency to Fort Lauderdale.
- Southwest Airlines increased seat and operations capacity from Logan Airport in 2016 despite introducing no new routes. All new services launched in 2015 were continued in 2016 including services to Columbus, Indianapolis, Dallas Love Field, and Austin. Additional capacity was also added to markets such as Nashville, Baltimore, Denver, Houston Hobby, and Chicago Midway.

A complete listing of all changes in scheduled departures by domestic destination is in Appendix E, *Activity Levels*. Logan Airport's scheduled domestic large jet and domestic regional services are illustrated in **Figure 2-10** and **Figure 2-11**.

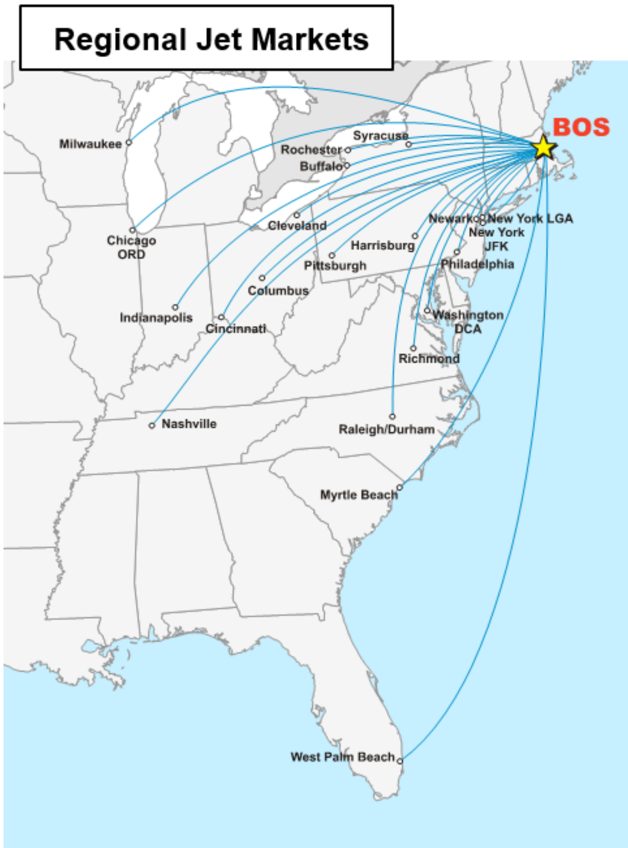
Figure 2-10 Domestic Non-stop Large Jet Markets Served from Logan Airport, July 2017

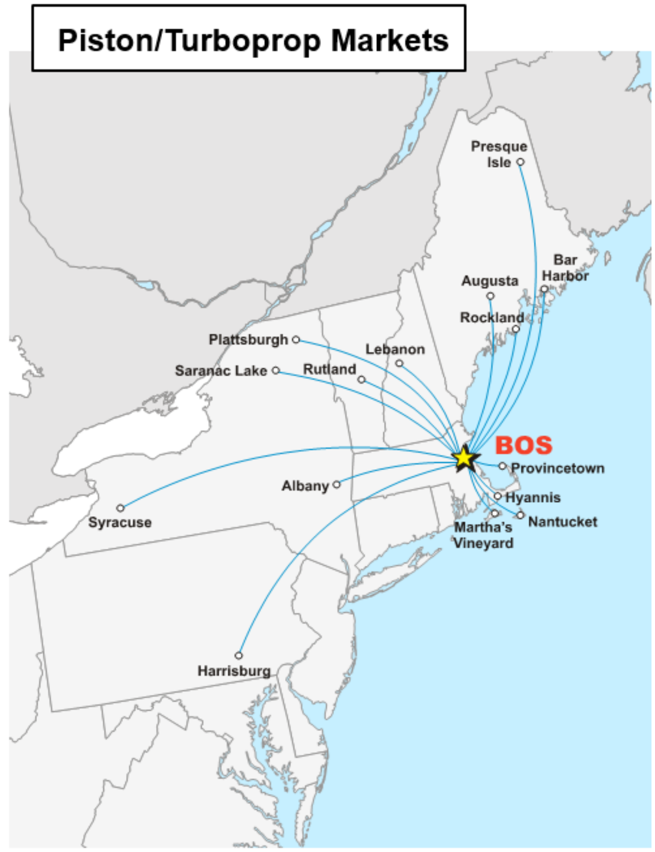


Source: Official Airline Guide Market Files

Note: Delta Air Lines and United Airlines served only two total flights each during September 2016 and 2017 between Logan Airport and Madison, Wisconsin.

Figure 2-11 Domestic Non-stop Regional Jet and Non-Jet Markets Served from Logan Airport, July 2017





Source: Official Airline Guide Market Files

Changes in International Passenger Service

Total scheduled international passenger operations at Logan Airport increased by 17.9 percent in 2016. There were 49,956 scheduled international passenger operations at Logan Airport in 2016, up from 42,378 operations in 2015, as summarized in **Table 2-5** (for details on the changes in operations by carrier, see Appendix E, *Activity Levels*). Canada represents Logan Airport's largest international destination region in terms of aircraft operations, accounting for approximately 36 percent of total scheduled international passenger operations in 2016. This is primarily due to the high frequency service offered by Air Canada, Porter Airlines, and WestJet Airlines using smaller regional jet and turboprop aircraft in Canadian markets. In 2016, passenger operations to Canada increased by 13.5 percent. Passenger operations to Europe and Middle East, Logan Airport's second largest international market in terms of operations and passengers, increased by 23.7 percent in 2016. Operations to the Bermuda/Caribbean market increased by 10 percent. Passenger operations to Asia and Central America increased in 2016 due to non-stop services introduced by foreign carriers over the past two years. Overall, Logan Airport served 55 non-stop international destinations in 2016, compared to 47 in 2015.[23]

23 IATA Innovata Schedules

Table 2-5 Scheduled International Passenger Operations by Market Segment, 2010-2016

Category	2000	2010	2011	2012	2013	2014	2015	2016	Percent change 2015-2016	Avg. Annual Growth (2010-2016)
Canada	26,067	16,399	16,290	16,787	16,125	15,748	15,801	17,929	13.5%	1.5%
Europe/Middle East	13,345	12,750	14,782	13,890	13,530	14,868	16,251	20,099	23.7%	7.9%
Bermuda/Caribbean[1]	3,205	4,116	6,054	6,752	7,031	7,428	7,584	8,339	10.0%	12.5%
Asia	0	0	0	474	646	1,011	1,751	2,156	23.1%	N/A
Central/South America	314	0	0	0	347	730	991	1,433	44.6%	N/A
Total Scheduled International	**42,931**	**33,265**	**37,126**	**37,903**	**37,679**	**39,785**	**42,378**	**49,956**	**17.9%**	**7.0%**

Source: Massport
Notes: Numbers in parentheses () indicate negative numbers.
N/A Not Available.
1 Includes Puerto Rico and U.S. Virgin Islands.

Changes in international service at Logan Airport in 2016 included continued growth of foreign carrier service. Logan Airport has seen a rapid increase in international service in recent years, with a number of new foreign carriers entering the market. In 2015, five new foreign carriers started service at Logan Airport: WOW Air, Cathay Pacific Airways, Aeromexico, El Al Israel Airlines, and Norwegian Air Shuttle. Seven additional foreign carriers launched at Logan Airport in 2016: Air Berlin, Eurowings, Scandinavian Airlines, Qatar Airways, TAP Air Portugal, Thomas Cook Airlines, and WestJet Airlines. New and expanded international passenger service at Logan Airport in 2016 included the following:

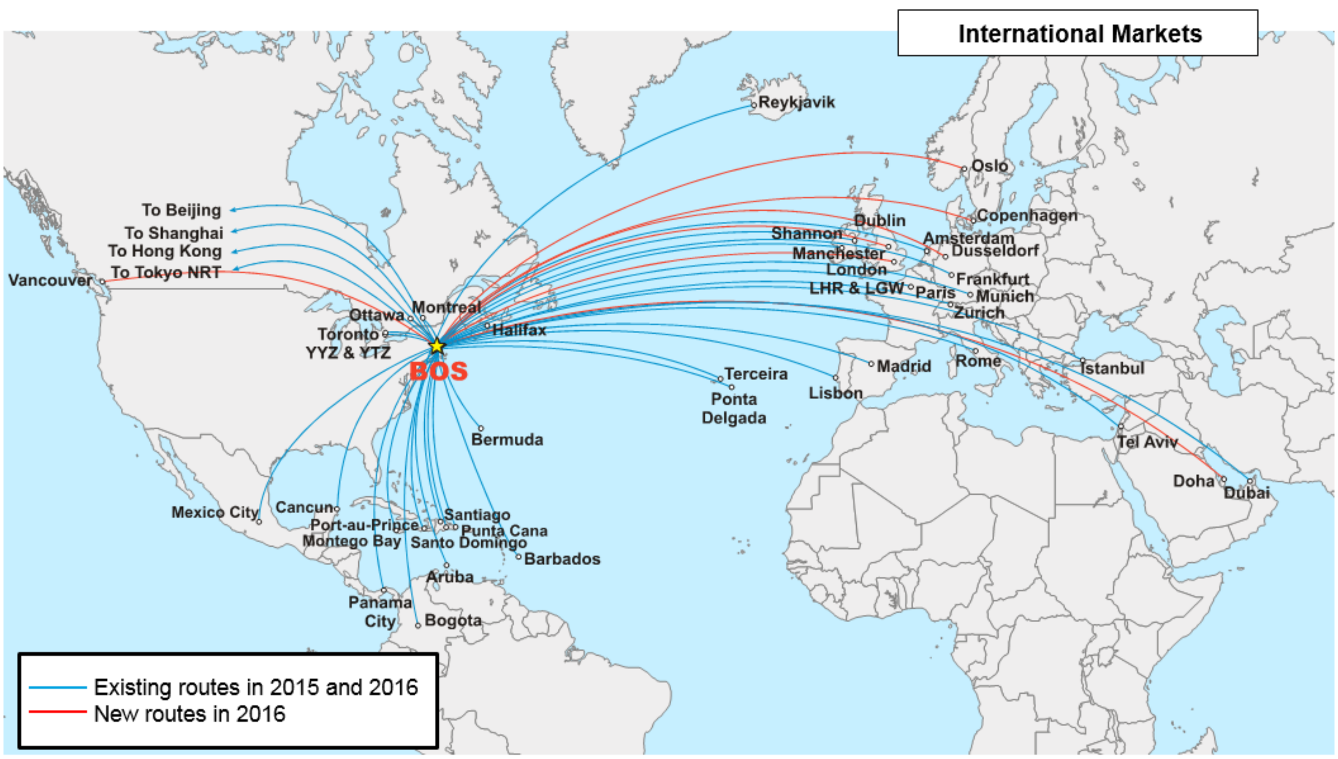
- Air Berlin launched service at Logan Airport in May 2016, providing four weekly non-stop services to Dusseldorf. The flights were offered seasonally through October 2016.
- Eurowings, a subsidiary of the Lufthansa Group, launched seasonal service at Logan Airport in June 2016 with three times weekly non-stop service to Cologne Bonn.
- Scandinavian Airlines launched new non-stop service to Copenhagen in April 2016. The year-round service operated daily until November 2016 when it was reduced to six times per week.
- Qatar Airways launched service at Logan Airport in March 2016, providing non-stop service to Doha. Qatar Airways offered daily service for most of 2016.
- TAP Air Portugal launched service at Logan Airport in June 2016, providing non-stop service to Lisbon. The service was offered daily throughout the summer months and reduced to five times weekly in November 2016.
- Thomas Cook Airlines launched twice weekly non-stop service to Manchester, UK during the summer months of June, July, and August of 2016.
- WestJet Airlines launched service at Logan Airport in 2016 with non-stop flights to Toronto and Halifax on WestJet Encore, the company's regional airline. Service three times per day to Toronto Pearson

International Airport began in March 2016, operated by 74-seat non-jet aircraft. In April, WestJet Encore added non-stop daily service to Halifax, Nova Scotia.

- JetBlue Airways increased its international network at Logan Airport in 2016. Though no international routes were added, JetBlue Airways increased total international capacity by 10.1 percent in 2016.
- Norwegian Air Shuttle significantly increased its network at Logan Airport in 2016. After services to Martinique and Guadeloupe in the Caribbean launched in late 2015, Norwegian Air Shuttle added non-stop service to London Gatwick, Oslo, and Copenhagen in 2016. Norwegian Air Shuttle operated services to the Caribbean through March 2016 before pausing for the summer season. Flights to the Caribbean resumed in November 2016 with twice weekly service to each destination. Norwegian Air Shuttle launched services to new destinations in Europe beginning in April 2016 with once weekly service to Oslo and five times weekly service to London Gatwick. Service to London Gatwick continued through the end of the year while service to Oslo and Copenhagen were offered seasonally through October 2016.

Logan Airport's scheduled international air service markets are shown in **Figure 2-12**.

Figure 2-12 International Non-stop Markets Served from Logan Airport, July 2017



Source: Official Airline Guide Market Files

Note: Air Canada initiated new seasonal service between Vancouver and Boston in June 2017. Eurowings discontinued service between Cologne Bonn and Boston as of August 2016.

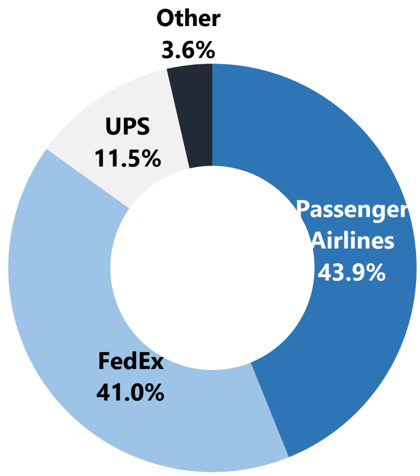
Cargo Activity Levels in 2016

In 2016, Logan Airport ranked 22nd among U.S. airports in total air cargo volume.[24] Total air cargo volume[25] at Logan Airport increased to 640 million pounds in 2016, compared to 606 million pounds in 2015. Air cargo is carried either in the belly compartments of passenger aircraft or by dedicated all-cargo carriers such as FedEx, UPS, and DHL in all-cargo aircraft. The express/small package segment continues to dominate Logan Airport cargo activity, accounting for 57.1 percent of the total non-mail cargo volume in 2016. **Table 2-6** shows all-cargo aircraft operations and cargo volumes at Logan Airport for 1990, 2000, and 2012 to 2016.

In 2016, the number of all-cargo aircraft operations at Logan Airport increased by 10.2 percent while total cargo volume, including mail, increased 5.6 percent (**Table 2-6**). Compared to 2000, all-cargo operations at Logan Airport have declined by 45.6 percent, while total cargo volume has declined by 38.9 percent. A number of factors are responsible for the decline over the last two decades in cargo shipments (including freight, express and non-express mail and packages) at Logan Airport, as well as nationally. Cargo carriers, particularly the integrators that provide door-to-door delivery services, have significantly increased their use of trucks to move cargo in shorter haul markets because it is more cost-effective than air transport. In addition, the widespread acceptance and use of the internet and e-mail has greatly reduced mail volumes overall.

FedEx carried 41 percent of the total cargo volume through Logan Airport in 2016 and was the 14th largest air carrier at the Airport in terms of total flights.[26] UPS was the next largest cargo operator and accounted for 11.5 percent of Logan Airport's cargo volume in 2016. Passenger airlines carried 43.9 percent, or 281 million pounds, of Logan Airport's cargo as belly cargo in 2016, compared to 359 million pounds that were shipped on all-cargo carriers. These numbers are presented in **Figure 2-13**.

Figure 2-13 Cargo Carriers – Share of Logan Airport Cargo Volume, 2016



Source: Massport
Note: Passenger airlines carry cargo as belly cargo; other includes Atlas Air, Air Transport International, and ABX Air (who all fly for DHL).

24 U.S. DOT, T100 Database, YE 3Q 2016. Total cargo volume includes mail.
25 Air cargo includes express/small packages, freight, and mail.
26 Airports Council International. September 2017 *Worldwide Airport Traffic Report*.

Table 2-6 Cargo and Mail Operations and Volume (1990, 2000, and 2010–2016)

	1990	2000	2010	2011	2012	2013	2014	2015	2016	Percent change (2015-2016)	Avg. Annual Growth (2010-2016)
All-Cargo Aircraft Operations	N/A	12,282	6,724	6,270	5,237	5,403	5,711	6,059	6,680	10.2%	(0.1%)
Volume (lbs.)											
Express/ Small Packages	N/A	484,490,143	339,485,424	332,896,322	327,234,464	334,315,119	356,743,626	336,013,472	352,551,369	4.9%	0.6%
Freight	N/A	367,857,011	206,893,979	204,055,228	204,596,956	203,877,671	228,716,329	239,768,129	264,382,330	10.3%	4.2%
Mail	119,818,113	194,902,513	25,904,205	24,566,806	21,546,316	19,407,316	22,087,150	30,556,356	23,215,743	(24.0%)	(1.8%)
Total	**753,253,075**	**1,047,259,667**	**572,283,608**	**561,518,356**	**553,377,736**	**557,600,528**	**607,547,105**	**606,337,957**	**640,149,442**	**5.6%**	**1.9%**

Source: Massport
Note: Numbers in parentheses ( ) indicate negative numbers.
N/A Not Available.

Aviation Activity Forecasts

While this annual report was originally scheduled to be a *2016 Environmental Status and Planning Report* (ESPR), and with prior approval of the Secretary of the Executive Office of Energy and Environmental Affairs, Massport has prepared an EDR for 2016. Logan Airport has been experiencing strong passenger growth since the 2008 recession. As the local and national economy has improved, airlines have expanded service options in response to the increased regional demand. This passenger growth at Logan Airport has continued with increases of over 8 percent in 2016 and nearly 6 percent in 2017. International growth has continued at a faster pace with an increase of 19 percent in 2016 and over 9 percent in 2017.

In addition to rapidly increasing air passenger demand trends and the changing air carrier landscape, ground transportation at Logan Airport has also changed rapidly with the introduction of transportation network companies (TNCs) such as Uber and Lyft. Due to these rapid changes, 2016 does not serve as a reasonable baseline for prediction of longer-range impact assessment. Massport tracks and collects data on TNC growth at Logan Airport in an effort to better understand the changing ground transportation landscape. As part of the ESPR process, Massport typically prepares passenger, operations, and cargo activity forecasts. The *2017 ESPR* forecast will provide the best available information on TNCs.

Logan Airport's passenger traffic reached an all-time high in 2016 with 36.3 million passengers. This peak follows unprecedented, consistent growth since 2010 at a 4.8-percent annual average growth. While the aviation industry has experienced worldwide growth, Logan Airport is one of the fastest growing airports in the U.S. A series of events have combined to produce the record-breaking traffic growth and will continue to contribute to the expected short-term growth at Logan Airport:

- Strong economic conditions in Boston including substantial growth in per capita income compared to the rest of the U.S. and increased overall demand for international travel.
- A tremendous influx of new international non-stop services led by foreign flag carriers, including, but not limited to: Emirates, Qatar Airways, Turkish Airlines, El Al, Cathay Pacific, TAP Air Portugal, Norwegian Air Shuttle, and WestJet Airlines. These airlines have all entered Boston capturing some of the growth in demand, re-directing some of the passengers from existing airlines, and stimulating local inbound and outbound international passenger demand.
- JetBlue Airways' strategy of forging relationships with the foreign flag carriers in order to facilitate increased connections from JetBlue's Boston network. Markets such as Detroit and Raleigh/Durham connect an increasingly significant number of passengers through Boston onto a diverse group of foreign flag airlines.
- Continued growth by JetBlue Airways and Delta Air Lines. Both carriers have indicated they will grow departures 10 percent per year until they reach 200 and 125 daily departures respectively. Southwest Airlines is also expected to gain two additional gates in the near future which will allow it to expand as well.

It is expected that Logan Airport will reach 40 million annual passengers by 2019. Given this continued faster than expected passenger growth, Massport will be updating the Logan Airport long term passenger forecast in the *2017 ESPR* to reflect this growth, revised expectations for the local/national/international economy, and latest industry trends. Preliminary review suggests that future Logan Airport passenger levels could reach about 46 million annual passengers. The *2017 ESPR* will provide more detailed information and updated forecast numbers to 2030/2035. The *2017 ESPR* will consider factors such as those identified above and other significant changes in the transportation industry such as the continuously booming economy and use of TNCs, providing greater accessibility to airports.

This Page Intentionally Left Blank.

3

Airport Planning

Introduction

This chapter describes the status of projects underway or completed at Boston-Logan International Airport (Logan Airport or the Airport) including updates through the filing date of this report. Specific topics include terminal area projects, service area projects, buffer/open space projects, Airport parking projects, airside area projects, high occupancy vehicle (HOV) improvements, and Airport-wide projects.

Logan Airport facilities have been accommodating recent increases in passenger activity and operations on the airside, but the terminal, roadways, and parking facilities are strained by the increase in passengers. Following a two-year strategic planning effort, the Massachusetts Port Authority (Massport) has identified priority planning projects and initiatives to accommodate the increased demand in international and domestic travel, enhance ground access to and from the Airport, as well as improve on-Airport roadways and parking. As discussed in Chapter 1, *Introduction/Executive Summary* of this *2016 Environmental Data Report (EDR),* any proposed project that triggers a threshold under the Massachusetts Environmental Policy Act (MEPA) or the National Environmental Policy Act (NEPA) will undergo the appropriate project-specific state and/or federal environmental review.

In the past few years, national and international passenger demand trends for air travel have been rapidly increasing and the air carrier landscape is changing. Additionally, the ground transportation arena at Logan Airport has also changed rapidly with the introduction of transportation network companies (TNCs) such as Uber and Lyft. With these changes in mind, Massport focused on the following:

- **Terminals:** In conjunction with the ongoing design of Terminal E Modernization, Massport is studying alternatives for connecting the Massachusetts Bay Transportation Authority (MBTA) Blue Line and the terminal area. Enhanced connections between Terminals B and C are being considered to optimize to passenger movements and security, including expanded passenger amenities for current and future passenger needs.
- **Parking:** In accordance with the recent approval by the Massachusetts Department of Environmental Protection (MassDEP) and the U.S. Environmental Protection Agency (EPA) to modify the Logan Airport Parking Freeze, Massport is taking steps to initiate three key Logan Airport ground access studies. These include analyzing the feasibility and effectiveness of the following:
  - Potential measures to improve HOV access;
  - Possible parking pricing strategies; and
  - Potential operational measures to further reduce drop-off/pick-up modes.

- **Roadways:** Looking forward, several projects, which address a comprehensive need for improved operations on both the airside and landside, are planned or being considered. These projects include on-Airport roadway improvements to enhance efficiency and reduce congestion, and roadway and curb improvements in front of Terminal C (arrival and departure levels) to reduce peak hour congestion.
- **Airside and Service Area Planning**: Massport continues to upgrade and improve the airfield to enhance the operational efficiency and safety of Logan Airport while exploring ways of efficiently using the limited land resources in the service areas. Massport is currently working with the Federal Aviation Administration (FAA) on a comprehensive multi-year Runway Incursion Mitigation (RIM) and Comprehensive Airfield Geometry Analysis to identify, prioritize, and develop strategies to help Massport mitigate risk. Runway incursions occur when an aircraft, vehicle, or person enters the Airport's designated area for aircraft landings and take-offs.[1] The (RIM) Study is expected to be complete in 2018. Additionally, Massport is currently exploring options to improve the layout and efficiency of the North Service Area (NSA) by reorganizing the existing uses.
- **Energy and Environmental Resiliency Planning:** Massport is studying opportunities to maximize solar installations across Logan Airport and identifying vulnerabilities and incorporating resilient design standards for existing and future flood levels.

The reporting year was marked by construction of several projects focused on enhancing the passenger experience, accommodating increases in passenger activity levels, and improving ground access. **Table 3-1** presents recent progress on planning initiatives and individual projects at Logan Airport during 2016 (updated to 2017 where possible), as well as planned projects and projects under consideration.

1 Information on FAA's RIM program can be found at https://www.faa.gov/airports/special_programs/rim/.

Table 3-1 Logan Airport Short- and Long-Term Planning Initiatives

		Completion				Completion	
	Status as of Dec. 31, 2017	Short-Term 2020	Long-Term 2035		Status as of Dec. 31, 2017	Short-Term 2020	Long-Term 2035
Terminal Area Projects/Planning Concepts				**Buffer Project/Open Space (Continued)**			
Terminal E Renovations & Enhancements	Complete			Navy Fuel Pier	Complete		
Terminal E Modernization	Design		✈	Bayswater Embankment	Complete		
Convenience and Filling Station/ Taxi Pool/TNC Lot Relocations	Design	✈		Bremen Street Park and Dog Park	Complete		
Terminal B Optimization	Construction	✈		Greenway Connector	Complete		
Terminal C to E Airside Connector	Complete			Community Greenway Enhancements	Complete		
Terminal C, Pier B Optimization	Design	✈		Narrow-Gauge Connector	Complete		
Terminal C Building, Roadway, and Curb Enhancements	Feasibility/ Planning	✈		Piers Park Phase I	Complete		
Terminal A to B Landside Connector	Complete			Piers Park Phase II	Design		
Terminal A to B Airside Connector	Feasibility/ Planning		✈	Piers Park Phase III (*by others*)	Feasibility		✈
Service Area Projects/ Planning Concepts				**Airside Area Projects/Planning Concepts**			
SWSA Redevelopment Program (Rental Car Center)	Complete			Runway 15L-33R RSA Improvement Project	Complete		
North Service Area RPZ Enhancements	Feasibility/ Planning		✈				
Replacement Hangar	Feasibility/ Planning		✈	Runway 4R Light Pier Replacement	Complete		
Cape Air Hangar	Feasibility/ Planning	✈		Runways 22R and 33L Runway Safety Area Improvements/ Runway 33L Light Pier Replacement	Complete		
Relocated CNG Station - NCA	Feasibility/ Planning		✈	Runway Incursion Mitigation (RIM) Study	Planning	✈	
Replacement Cargo Facilities in the NCA	Feasibility/ Planning		✈	De-Icing Pad	Feasibility/ Planning		✈
Receiving and Distribution Facility	Feasibility/ Planning		✈	**Airport Parking Projects/Planning Concepts**			
New/Replacement SRE and GSE Consolidated Facility in the NCA	Feasibility/ Planning		✈	West Garage Parking Consolidation	Complete		
Joint Operations Center (JOC)	Feasibility/ Planning		✈	Logan Airport Parking Project	Permitting	✈	
Buffer Projects/ Open Space				Automated People Mover Concept	Feasibility/ Planning		✈
SWSA Buffer (Phases 1 and 2)	Complete			**Airport-Wide Projects/ Planning Concepts**			
Neptune Road Airport Edge Buffer	Complete			Resiliency Planning	Ongoing		
Navy Fuel Pier	Complete			Logan Airport Sustainability Management Plan	Complete, with Regular Updates		

Notes: Anticipated completion dates and status as of December 31, 2016, as denoted by ✈.
Short-term projects are anticipated to be completed by 2020 and long-term projects are anticipated to be completed by 2035. Details of each project or planning concept are provided in the sections that follow.

CNG – Compressed Natural Gas
NCA – North Cargo Area
GSE – Ground Support Equipment
NSA – North Service Area
SWSA – Southwest Service Area

Terminal Area Projects/Planning Concepts

The terminal area accommodates most of the passenger functions at Logan Airport, including the passenger terminals, terminal area roadways, central parking facilities, and the Hilton Hotel. **Table 3-2** presents information on the status of each ongoing terminal area project. In addition, both Massport and its tenants are proposing projects or exploring planning concepts to modernize and carry out future improvements to the existing terminal facilities. These planning concepts are also detailed in **Table 3-2**. The location of the ongoing terminal area projects and the planning concepts are shown on **Figure 3-1**.

Interior space in the recently completed New Large Aircraft portion of Terminal E (Terminal E Renovation and Enhancements Project). Robb Williams, AECOM Corporate Photographer (lower right image).

FIGURE 3-1 **Location of Projects/Planning Concepts in the Terminal Area**

2016 Environmental Data Report

Notes: See Table 3-2 for a description of the numbered projects. Status as of December 31, 2016 (updated to 2017 where possible).

1. Terminal E Renovation and Enhancements
2. Terminal E Modernization

3a. Relocated Convenience and Filling Station
3b. Relocated Taxi Pool Lot
3c. Relocated TNC Lot

4. Terminal B Optimization Project
5. Terminal C to E Airside Connector
6. Terminal C, Pier B Optimization
7. Terminal C Building, Roadway, and Curb Enchancements
8. Terminal A to B Landside Connector
9. Terminal A to B Airside Connector

0 500 1000 2000 Feet

Table 3-2 Description and Status of Projects/Planning Concepts in the Terminal Area (December 31, 2017)

Description	Status
Massport Projects/Planning Concepts	
1. Terminal E Renovation and Enhancements Project This project includes interior and exterior improvements at Terminal E to accommodate regular service by wider and longer Group VI aircraft. The project does not include any new gates, but does include the reconfiguration of three existing gates to accommodate Group VI aircraft (including the A380 and B747-8 used by international air carriers). Some runway and taxiway shoulders were upgraded to support more frequent Group VI activity.	Massport advanced the Terminal E Renovation and Enhancements Project that focused on upgrading three gates at Terminal E to meet Group VI aircraft requirements. This project helped meet the immediate needs to serve Group VI aircraft, without adding new gates. Planning was initiated in 2014. A federal Environmental Assessment (EA) was filed in July 2016, and the Federal Aviation Administration (FAA) issued a Finding of No Significant Impact (FONSI) on July 29, 2016. Project construction was completed in early 2017.
2. Terminal E Modernization Project (incorporates former West Concourse Project) The Terminal E Modernization Project will add the three gates approved in 1996 as part of the International Gateway West Concourse project (EEA # 9791), but never constructed, and an additional four gates to Terminal E. The facility is planned to be constructed in two phases: Phase 1 will add four gates and Phase 2 will add three gates. The building will be aligned to function as a noise barrier. New passenger handling and passenger holdrooms are being planned, as well as possible additional Federal Inspection Services (FIS) and Customs and Border Protection facilities to supplement the existing FIS areas in Terminal E. The Terminal E Modernization Project will occupy a portion of the North Cargo Area (NCA) and will include terminal gates, aircraft parking, hangars, and cargo facilities. Portions of the NCA will continue to be used for economy parking. As part of Phase 2, a connection between Terminal E and the Massachusetts Bay Transportation Authority (MBTA) Blue Line Airport Station will be constructed to improve passenger convenience. This connection is currently being studied and various approaches are under consideration. Consideration is being given to constructing an Automated People Mover (APM) which ultimately would connect the MBTA Blue Line Station to all the terminals. The APM concept is in the very early stages of feasibility assessment and will be more definitive as the Terminal E Modernization Project moves into Phase 2.	The project, including the MBTA connection, is in the design phase. An Environmental Notification Form (ENF) was filed with the Executive Office of Energy and Environmental Affairs (EEA) in October 2016. A joint draft federal Environmental Assessment/state Environmental Impact Report (Draft EA/EIR) was filed in July 2016 in accordance with the National Environmental Policy Act (NEPA) as well as the Massachusetts Environmental Policy Act (MEPA). Massport filed the Final EA/EIR on September 30, 2016. FAA issued a FONSI on November 10, 2016, and a Record of Decision (ROD) on the project on November 14, 2016, stating that Massport can update the Airport Layout Plan (ALP) with the Terminal E Modernization Project. (For convenience, Massport has provided the Secretary's Certificates on the ENF and Draft EA/EIR, with responses to those comments, in Appendix A, *MEPA Certificates and Responses to Comments,* of this *2016 EDR*.) The project, including the MBTA connection, is in the design phase and initial construction oh Phase 1 will begin in spring of 2019. Future ESPRs and EDRs will provide updates as final design and construction proceed.

Table 3-2 Description and Status of Projects/Planning Concepts in the Terminal Area (December 31, 2017) (Continued)

Description	Status
Massport Projects/Planning Concepts	
3. Convenience and Filling Station/Taxi Pool/TNC Lot Relocations Construction of the Terminal E Modernization Project includes the relocation of the existing on-Airport gas station to the intersection of Tomahawk Drive and Jeffries Street on Massport property (Southwest Service area). Chosen by the community-based Logan Impact Advisory Group, it provides community benefits such as a convenience space for a local vendor, landscaping and beatification enhancements, and traffic-congestion reductions. Another part of the design phase involved Massport further evaluating transportation and land-uses in this area in an effort to mitigate vehicular congestion along Tomahawk Drive associated with the growing TNC mode. As a result, it was determined that the TNC Pool Lot would be relocated to the existing taxi pool at Porter Street because this would minimize Tomahawk Drive traffic and congestion. Similarly, the existing taxi pool lot will be returned to the Blue Lot between the Logan Office Center and the Hyatt Hotel. By relocating the TNC pool and the number of TNCs servicing the Airport, greater operational flexibility and additional routing options are available that will allow Massport to reduce TNC impacts along Tomahawk Drive (shown as 3a, 3b, and 3c in **Figure 3-1**).	The replacement gas station was approved as part of the Terminal E Modernization Project's MEPA and NEPA review process described above. Design is underway and construction is expected to start in 2018 and be complete in 2019 at which time the existing gas station will be demolished. Massport plans to relocate both the TNC and Taxi Pool Lot by the end of 2018. The project will also include traffic signal modifications along Harborside Drive.
4. Terminal B Optimization Project Similar to the recent renovations and improvements at Terminal B, Pier A, Massport is upgrading its facilities on the Pier B side to meet airlines' needs (primarily reflecting the merger of American Airlines and US Airways) and to provide facilities that improve the passenger traveling experience. Planned improvements include an enlarged ticketing hall, improved outbound bag area, expanded bag claim hall, expanded concession areas, and expanded holdroom capacity at the gate. The project will consolidate American Airlines operations to one pier of the terminal (currently operating on two different sides of the terminal); all Terminal B Pier B gates will be connected post security. The project will also consolidate checkpoint operations for better passenger throughput and improved passenger experience.	Massport prepared a Draft EA in May 2017 and a Final EA in June 2017. On June 29, 2017, FAA issued a FONSI. Final design has been completed, and construction is underway. Construction is anticipated to be complete by early 2019.
5. Terminal C to E Airside Connector A connector between Terminals C and E provides a greater post-security connectivity between terminals and to improve flexibility for airlines. In addition, the Terminal C to E Connector provides a post-security connection between Terminals C and E on the Departures Level. The connector provides improved passenger circulation within the post-security concourse(s), additional holdroom space at Terminal E, reconfigured office space, concessions and concessions support, and a new consolidated location for escalators and stairs.	The Terminal C to E Connector was a project component of the Renovations and Improvements at Terminals B & C/E Environmental Assessment approved by FAA in 2012. The Terminal C to E Connector construction was completed in May 2016.

Table 3-2 Description and Status of Projects/Planning Concepts in the Terminal Area (December 31, 2017) (Continued)

Description	Status
Massport Projects/Planning Concepts	
6. Terminal C, Pier B Optimization This project will make improvements within the existing footprint of Terminal C, Pier B. Existing passenger areas will be renovated and a second level of less than 5,000 square feet will be added. A jet bridge will be installed at an existing aircraft parking position.	This project is in design and construction will begin in 2018.
7. Terminal C Building, Roadway, and Curb Enhancements Massport is currently evaluating multifaceted enhancements that would enhance Terminal C facilities and provide a post-security connector between Terminal B and C, replace aging roadways serving the terminal, and improving the operation of the Terminal C curb. The enhancements also include replacement of the existing canopy on the departures level. The project would enhance Logan Airport's ability to efficiently accommodate current and future passenger volumes by bringing the terminal facilities up-to-date and improving access, egress, and drop-off/pick-up operations.	As of March 2018, the project elements are in early design phase. The curbside and canopy enhancements are undergoing conceptual evaluation, as are various approaches to replacing the aging roadway structures.
8. Terminal A to B Landside Connector As part of the Airport-wide effort to enhance terminal connectivity, Massport completed a sheltered pedestrian connection between Terminals A and B.	The landside connection between Terminals A and B was completed in February 2016.
9. Terminal A to B Airside Connector As part of the Airport-wide effort to enhance terminal connectivity post-security, a secure-side connector between Terminals A and B is under consideration.	The airside connector between Terminals A and B is still being considered, however, this project is not currently in the five-year Capital Program.

Notes: **See Figure 3-1** for the location of terminal area projects/planning concepts.

1 Massachusetts General Laws Chapter 30, Sections 61-62H. MEPA is implemented by regulations published at 301 Code of Massachusetts Regulations (CMR) 11.00 (the "MEPA Regulations").

Service Area Projects/Planning Concepts

Logan Airport's service areas contain airline support businesses and operations. Land uses in the service areas continue to evolve in response to changing airline business, customer and tenant needs, as well as public works projects. Massport continues to explore ways of efficiently using the limited land resources in the service areas. The five service areas at Logan Airport are shown in **Figure 3-2,** and are described below.

- **North Cargo Area (NCA)** is in Logan Airport's northwest corner. It is bounded by the main Logan Airport outbound roadway to the south, Route 1A to the west, Prescott Street to the north, and Terminal E to the east. The NCA, which is adjacent to Logan Airport's airside area, is the Airport's primary airline support area. It accommodates air cargo and essential airline support businesses including hangars, ground support equipment (GSE) maintenance, and aircraft parking. The NCA will remain the most appropriate location for operations that require contiguous airside access. The future Terminal E Modernization Project will eventually occupy a portion of the NCA and will include terminal gates, aircraft parking, hangars, and cargo facilities. Portions of the NCA will continue to be used for economy parking.

- **North Service Area (NSA)** is north of Prescott Street and extends to the Green Bus Depot Site, the MBTA Wood Island Station, and Runway End 15R. The NSA includes two flight kitchens, weather and navigation equipment, the Green Bus Depot, Facilities 2 and 3, Large Vehicle Storage Facility, Hangar 5, BOS Fuel Farm, Water Tanks, Signature FBO, and Logan Airport Greenway among others. The Greenway Connector and Narrow-Gauge Connector both run parallel to the MBTA Blue Line corridor in this section of the Airport. Massport is currently exploring options to improve the layout and efficiency of the NSA by reorganizing the existing uses.
- **Southwest Service Area (SWSA)** is south of Logan Airport's main access roadway and is bounded on the east by Harborside Drive. Because of its proximity to the terminals and the regional highway system, the SWSA functions as Logan Airport's primary ground transportation hub and includes the Rental Car Center (RCC), and the taxi, TNC, and bus/limousine pools. The RCC reduces Airport vehicle miles traveled (VMT) as well as improves roadway and intersection operations through: consolidation of the rental car shuttle bus fleet and some Massport shuttle buses into a unified shuttle route system, resulting in the elimination of eight rental car bus fleets (a net total of 66 buses eliminated); improvement of intersection and roadway infrastructure, including signal coordination and dedicated ramp connections; and establishment of a Ground Transportation Operations Center (GTOC), enabling efficient planning and operation of Airport-wide transit activities. As part of the Terminal E Modernization Project, the existing on-Airport gas station will be relocated to the SWSA.
- **Bird Island Flats (BIF)** is located south of the Logan Airport SWSA. BIF has landside access via Harborside Drive and water access through the system of water taxis that shuttle passengers between downtown Boston, the South Shore, and Logan Airport. BIF development includes the Hyatt Hotel and Conference Center, the Logan Office Center and adjoining garage, an employee parking lot (Lot B), the Water Shuttle Dock, the Logan Airport Rescue and Fire Fighting Facility Marine Dock, and the Harborwalk, a publicly accessible promenade along the harbor's edge.
- **South Cargo Area (SCA)** is located southeast of the Logan Airport SWSA, and is generally bounded on the south by Harborside Drive and on the east and north by Logan Airport's airside area. The SCA, which provides landside access and secured airside access. It is Logan Airport's primary cargo area and accommodates domestic and some international cargo operations.
- **Governors Island** is at Logan Airport's southern tip and is bounded by Runway 14-32 and Boston Harbor to the east and south, by Runway 4R to the west, and Runway 9 to the north. Governors Island has functioned as a storage site for the Central Artery/Tunnel (CA/T) Project and for construction stockpiles. The area also contains an Aircraft Rescue and Fire Fighting Facility training area, parking for snow removal equipment, a biocell remediation area, and FAA aircraft navigation equipment. The area has been considered as a future location of remain overnight (RON) aircraft parking, and potentially other uses.

Table 3-3 presents information on the status of each ongoing project and planning concept in the service areas. Both Massport and Logan Airport tenants are proposing projects or exploring planning concepts to modernize and carry out future improvements to the service areas. The location of the ongoing service area projects and planning concepts that may potentially be constructed in the future are shown on **Figure 3-3**.

FIGURE 3-2 Logan Airport Service Areas | **2016 Environmental Data Report**

Service Areas

0 500 1000 2000 Feet

FIGURE 3-3 **Location of Projects/Planning Concepts in the Service Areas**

2016 Environmental Data Report

Notes: See Table 3-3 for a description of the numbered projects. Status as of December 31, 2016 (updated to 2017 where possible).

1. SWSA Redevelopment Program (complete)
2. North Service Area RPZ Enchancements
3. Cape Air Hangar

Locations To Be Determined

4. Replacement Hangar
5. Relocated CNG Station in the NCA
6. Replacement Cargo Facilities in the NCA
7. Receiving and Distribution Facility
8. New/Replacement SRE/GSE Consolidated Facility in the NCA
9. Joint Operations Center

0 500 1000 2000 Feet

Table 3-3 Description and Status of Projects/Planning Concepts in the Service Areas (December 31, 2017)

Description	Status
Massport Projects/Planning Concepts	
1. Southwest Service Area (SWSA) Redevelopment Program	
The SWSA Redevelopment Program replaced and upgraded existing ground transportation uses within the SWSA. The redevelopment included a consolidated Rental Car Center (RCC) with a four-level garage to accommodate rental car retail operations and storage; support facilities for the car rental operations; a new clean-fuel unified shuttle bus system; a relocated and reconfigured taxi pool; bus and limousine pool; and roadway improvements, pedestrian and bicycle facilities, and site landscaping. It also included a customer service center and four quick turn-around maintenance and service facilities. The RCC achieved Leadership in Energy and Environmental Design (LEED®) Gold certification in 2016.	A Final Environmental Impact Report/Environmental Assessment (EIR/EA) was prepared in accordance with the Secretary of the Executive Office of Energy and Environmental Affairs (EEA)'s Certificate on the Notice of Project Change (NPC). The Final EIR/EA was filed on March 1, 2010. An extended public comment period closed on May 24, 2010. The Secretary's Certificate was issued on May 28, 2010, with finding that the Final EIR adequately and properly complied with the Massachusetts Environmental Policy Act (MEPA). The Federal Aviation Administration (FAA) issued a Finding of No Significant Impact (FONSI) on March 1, 2010. This project was completed in late 2014 and the RCC achieved LEED Gold certification in 2016.
Construction of the RCC was preceded by numerous enabling activities, which reorganized the SWSA through multiple sub-phases to allow for enough of the site to be cleared for staging and construction. Enabling projects included the reorganization of rental car operations within the SWSA; temporary relocation of ground transportation operations for a limited time, including the taxi pool to Lot B, the Cell Phone Lot to an existing open parking lot across from the Logan Airport gas station, and the bus and limousine pool to the North Service Area (NSA); and demolition of the existing flight kitchen to allow the extension of Hotel Drive. Phase 2 of the SWSA Airport Edge Buffer (EEA #14137) was integrated into the proposed SWSA Redevelopment Program (see **Table 3-5**).	The SWSA Airport Edge Buffer was completed in late 2014.

Table 3-3 Description and Status of Projects/Planning Concepts in the Service Areas (December 31, 2017) (Continued)

Description	Status
Massport Projects/Planning Concepts	
1. Southwest Service Area (SWSA) Redevelopment Program (Continued)	
The new Ground Transportation Operations Center (GTOC) within the RCC facility functions as the hub for management of ground transportation at the Airport. GTOC staff's direct responsibilities include: ■ Shuttle bus management and reporting via computer-aided dispatch (CAD) and automatic vehicle location (AVL) technology; ■ Real-time bus and transit information collection and dissemination to Airport users; and ■ Coordination with internal and external agencies related to ground transportation. The GTOC includes a video wall to graphically display information from a variety of sources such as vehicle location and status information from the CAD/AVL system, curbside camera feeds from the Consolidated Camera Surveillance System, flight arrival and departure information from Flight Information Display System, curbside Dynamic Message Signs, emergency alerts, and other information.	Construction of the GTOC was completed in 2013 as part of the RCC project.
2. North Service Area RPZ Enhancements	
Evaluation of safety enhancements in the Runway Protection Zone (RPZ) at the approach end of Runway 15R. This area includes hangars, aircraft parking, the North Gate, aircraft fueling facilities and other airfield maintenance support facilities.	Massport is working with FAA to study the feasibility of implementing RPZ enhancements. Elements of this project could proceed before 2020.
3. Cape Air Hangar	
This project would provide enclosed, climate controlled space for light maintenance that currently is conducted on the open ramp area.	This project could be implemented before 2020.
4. Replacement Hangar (location to be determined) The former American Airlines Hangar has been demolished because it could no longer serve the American Airlines fleet. Plans are underway for a new hangar to accommodate Group V aircraft. The location of the replacement hangar is under consideration.	Demolition of the former American Airlines hangar commenced in 2014, and was completed in August 2016. Prior to demolition, American Airlines relocated to the refurbished Northwest Hangar.
5. Relocated Compressed Natural Gas (CNG) Station in the North Cargo Area (NCA) (location to be determined) This would relocate Massport's existing CNG Station to accommodate the airside operations in the NCA.	Massport continues to examine potential on-Airport parcels for relocation of the existing CNG station. Relocation is not expected to occur before 2020.

Table 3-3 Description and Status of Projects/Planning Concepts in the Service Areas (December 31, 2017) (Continued)

Description	Status
Tenant Projects/Planning Concepts	
6. Replacement Cargo Facilities in the North Cargo Area (NCA) (location to be determined) Construction of new cargo facilities in the NCA would compensate for the loss of cargo facilities due to the Central Artery/Tunnel (CA/T) Project, as well as for the projected growth in cargo demand.	The project remains under evaluation. If a decision were made to proceed with this project, construction would likely commence after 2020.
7. Receiving and Distribution Facility (location to be determined) Massport is planning for a centralized Receiving and Distribution Facility that streamlines inspection of deliveries of food, beverages, and other goods destined for the sterile areas of the Airport. The facility will allow for a centralized location for security inspections before entry, and will also have the benefit of removing trucks from the terminal curbs.	Massport is considering off- and on-Airport locations for this facility including a location in the North Service Area (NSA).
8. New/Replacement Snow Removal Equipment (SRE)/ Ground Support Equipment (GSE) Consolidated Facility in the NCA (location to be determined) This planning concept would provide multi-tenant maintenance facilities for GSE.	Construction would be complete after 2020.
9. Joint Operations Center (JOC) (location to be determined) The JOC is envisioned as a state-of-the-art operations and situational awareness center. The goal of the JOC is to capture the security and response benefits afforded through integrated incident dispatch and mobile response for public safety and security services. The program plans for bringing the Operations Center, State Police Dispatch, Maritime Monitoring (with future Hanscom Field and Worcester Regional Airport monitoring), TSA staff, and camera monitoring within the structure of one common facility.	Development of a common command and control JOC is in the planning phase.

Note: See **Figure 3-3** for the location of service area projects/planning concepts.

Airside Area Projects/Planning Concepts

The airside area includes all Logan Airport land from the edge of the terminal buildings to the Logan Airport harbor boundary, incorporating the Logan Airport apron, runways, gates, and other airfield operating facilities. Airside improvements include upgrades and improvements to the airfield to enhance the operational efficiency and safety of Logan Airport. **Table 3-4** describes the status of projects (as shown on **Figure 3-4**) and planning concepts under consideration for Logan Airport's airside area as of December 31, 2016.

FIGURE 3-4 Location of Projects/Planning Concepts on the Airside

2016 Environmental Data Report

Notes: See Table 3-4 for a description of the numbered projects. Status as of December 31, 2016 (updated to 2017 where possible).

1. Runway 15L-33R RSA Improvement (complete)
2. Runway 4R Light Pier Replacement (complete)
3. Runway 22R and 33L RSA Improvements/ Runway 33L Light Pier Replacement (complete)

Airport-wide

4. Runway Incursion Mitigation Program (not shown)
5. De-icing Pad (location to be determined)

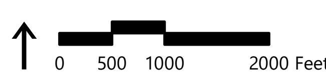


Table 3-4 Description and Status of Projects/Planning Concepts on the Airside (December 31, 2017)

Description	Status
1. Runway 15L-33R RSA Improvement Project	
As part of an ongoing program to improve safety at Logan Airport, and in close coordination with FAA, Massport proposed shifting existing Runway 15L-33R to accommodate an expanded RSA at the westernmost end (Runway 15L approach) of the runway. The project shifted the runway 200 feet to the southeast in order to comply with FAA standards requiring safety areas of 150 feet wide by 300 feet long at both ends of the runway.	FAA issued a Categorical Exclusion on April 1, 2014. The project was completed in late 2014.
2. Runway 4R Light Pier Replacement.	
Massport replaced the aging Runway 4R wooden approach light pier with a new modern structure with concrete pier/pilings.	Following environmental permitting and design, construction was completed in fall 2017.
3. Runway 22R and 33L Runway Safety Area (RSA) Improvements/Runway 33L Light Pier Replacement	
The Federal Aviation Administration (FAA) requires RSAs to accommodate aircraft overruns, undershoots, and veer-offs in emergency situations. Consistent with FAA requirements, Massport is continuously looking for opportunities to increase the margin of safety for all runways and where practicable providing FAA standard for RSAs at all locations. At Logan Airport, FAA standard for RSAs is typically 500 feet wide by 1,000 feet long at each runway end. Where this space is not available, FAA has approved the use of Engineered Materials Arresting System (EMAS) for aircraft overrun protection. EMAS uses a system of collapsible concrete blocks that can stop an aircraft by exerting predictable forces on the landing gear while minimizing aircraft damage. A detailed alternatives analysis was conducted to evaluate options for safety enhancements at both runway-ends. As described in the Final Environmental Assessment/ Environmental Impact Report (EA/EIR), an Inclined Safety Area similar to what was constructed at Runway-End 22L was constructed for Runway End 22R. A pile-supported deck with EMAS approximately 460 feet long by 300 feet wide was approved for Runway End 33L. The Runway 33L timber light pier was constructed in 1960 and extended to the southeast 2,400 feet from the runway end, predominantly over Boston Harbor. The Runway 33L RSA project initially proposed replacing the landward 500 feet of the light pier. During RSA construction, it was determined that the remaining 1,900 feet of the light pier should be replaced due to its advanced age and efficiencies of combining the construction with the RSA project in summer 2012 while the runway was already closed.	Massport filed an Environmental Notification Form (ENF) on June 30, 2009. A Draft EA/EIR was filed on July 15, 2010, and a Final EA/EIR on January 31, 2011, and the Secretary's Certificate was issued March 18, 2011. Remaining environmental permits were obtained by May 2011, and construction of the 33L RSA was completed ahead of schedule in November 2012. Runway End 22R enhancements were completed in late 2014, including replacement of the EMAS installed in 2005. Mitigation measures for eelgrass and salt marsh impacts have been implemented. See Chapter 9, *Project Mitigation Tracking* for more information. Massport filed a Notice of Project Change (NPC) to the Runway 33L Light Pier Replacement project in January 2012. The Secretary's Certificate was issued on March 9, 2012. All local, state, and federal permits were obtained for the additional work in June 2012, and the full replacement was completed in October 2012. As part of this project, the Runway 33L Instrument Landing System (ILS) approach, originally approved in the Airside Improvements Planning Project, was upgraded from Category I to Category III. Reduction in approach minimums on Runway 15R and Runway 33L was implemented in 2013, following the completion of the Runway 33L Light Pier replacement and FAA testing of new ILS equipment.

Table 3-4 Description and Status of Projects/Planning Concepts on the Airside (December 31, 2017) (Continued)

Description	Status
4. Runway Incursion Mitigation and Comprehensive Airfield Geometry Analysis (RIM) Study FAA recently initiated a new nationwide comprehensive multi-year Runway Incursion Mitigation (RIM) program to identify, prioritize, and develop strategies to help airport sponsors mitigate risk. Runway incursions occur when an aircraft, vehicle, or person enters the Airport's designated area for aircraft landings and take-offs.[1] Risk factors may include unclear taxiway markings, airport signage, and more complex issues such as runway or taxiway layout.	Massport is working with FAA to identify areas that need to be addressed and plan for the implementation of safety measures. The study commenced in December 2016, and is expected to be completed by December 2018.
5. De-icing Pad Massport is evaluating the feasibility of constructing a consolidated de-icing pad at Logan Airport.	Massport is working with FAA to determine the feasibility of airfield de-icing pad(s).

Notes: See **Figure 3-4** for the location of airside projects/planning concepts.
1 Information on FAA's RIM program can be found at https://www.faa.gov/airports/special_programs/rim/.

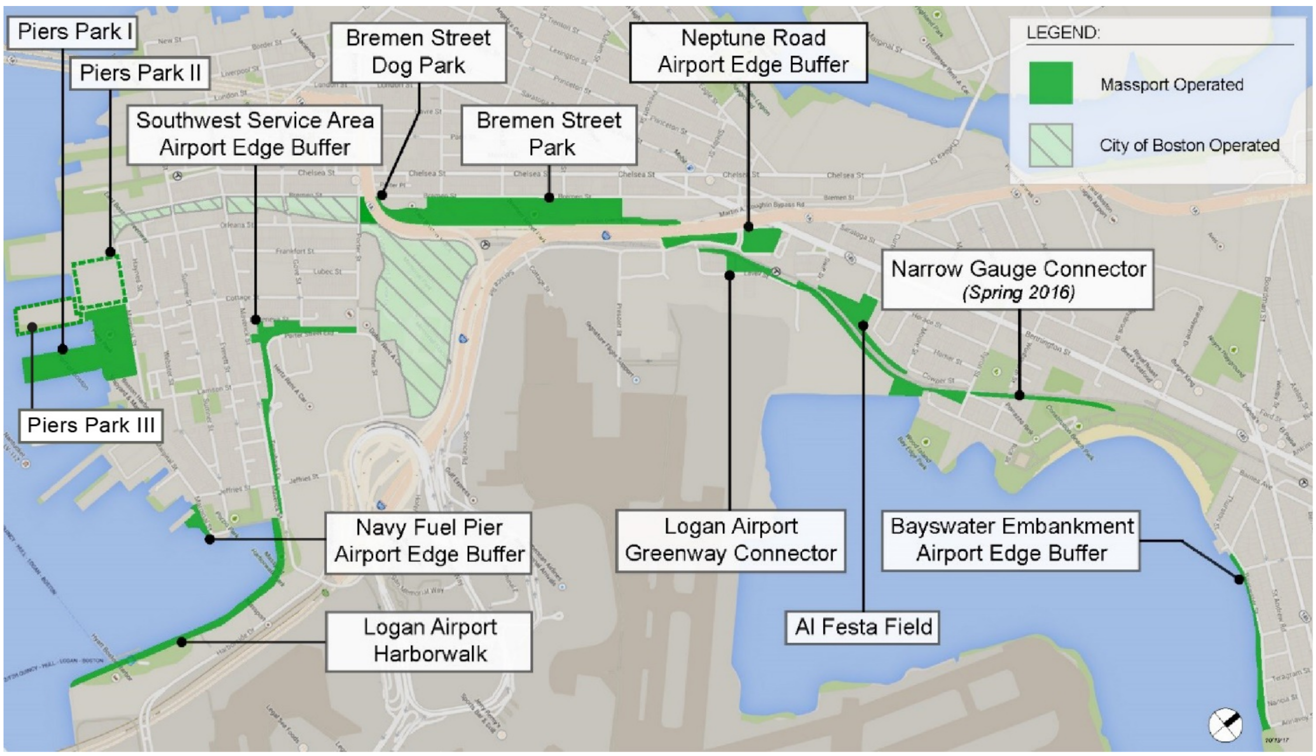
Airport Buffer Areas and Other Open Space

Massport has committed up to $15 million for the planning, construction, and maintenance of four Airport edge buffer areas and two parks along Logan Airport's perimeter (**Figure 3-5**). These buffers have now been completed and include the Bayswater Buffer, Navy Fuel Pier Buffer, SWSA Buffer Phase 1, and the SWSA Buffer Phase 2. Planning and design of the Neptune Road Airport Edge Buffer began in 2012, and it opened in 2016. These areas are located on Massport-owned property along Logan Airport's perimeter boundary, and are intended to provide attractive landscape buffers between Airport operations and adjacent East Boston neighborhoods. The buffer design occurs in consultation with Logan Airport's neighbors and other interested parties in an open community planning process. Today, East Boston enjoys 3.3 miles and more than 33 acres of green space developed or managed by Massport, in partnership with and in response to the East Boston community.

In September 2016, Massport officially opened the Bremen Street Dog Park. The park, the first of its kind in East Boston, provides 22,655 square feet of play space for neighborhood dogs. Other park amenities include exercise equipment for dogs, pet waste stations, and water fountains for both pets and their owners. Massport completed the construction of the Greenway Connector between Bremen Street Park and an overlook at Wood Island Marsh in March 2014. The one-half mile Greenway Connector connects the pedestrian/bicycle path to the City of Boston/Narrow-Gauge Connector to Constitution Beach. In 2016, construction on the Narrow-Gauge Connector was underway by the City of Boston. The Narrow-Gauge Connector is a one-third mile multi-use path and extension of the East Boston Greenway network which will allow pedestrians and cyclists to travel between Piers Park and Constitution Beach. Massport assumed ownership and operation of the Narrow-Gauge Connector when it was completed in 2016. There are pedestrian and bike counters along the Greenway Connector. In 2016, there were 43,787 East Boston Greenway trips that were recorded by the counters.

Adjacent to the current Piers Park, Piers Park Phase II will add approximately 4.2 acres of green space to the East Boston waterfront upon completion. The conceptual design of the Phase II site envisions a fully accessible park with a central lawn area, basketball and volleyball courts, and bicycle and rollerblade tracks. A Request for Proposals for design of Piers Park Phase II was issued by Massport in June 2017. The planning and design process is expected to take 18 months and to be completed by August 2020. Piers Park Phase III is conceived as a 3.8-acre addition of green space to the existing Piers Park on the East Boston waterfront. The Phase III site would be located adjacent to the Phase II site, along Marginal Street in East Boston. Piers Park Phase III is an early-stage planning concept that Massport has proposed to external developers. Massport issued a Request for Proposals for design of Piers Park Phase III in February 2018. Advancement of this concept is dependent on the responses to Massport's Request for Proposals.

Figure 3-5 Parks Owned and Operated by Massport and City of Boston



Source: Massport

To collaborate in East Boston open space planning, Massport also participates in meetings with other agencies including Massachusetts Department of Transportation (MassDOT), the City of Boston, and the MBTA. **Table 3-5** describes the status of ongoing buffer projects and other Massport green space projects under consideration as of December 2016. **Figure 3-6** shows the location of these buffer projects.

FIGURE 3-6 Location of Airport Buffer Projects/Open Space

2016 Environmental Data Report

Notes: See Table 3-5 for a description of the numbered projects. Status as of December 31, 2016 (updated to 2017 where possible).

1. SWSA Buffer (complete)
2. Neptune Road Airport Edge Buffer (complete)
3. Navy Fuel Pier Buffer (complete)
4. Bayswater Embankment (complete)
5. Bremen Street Park and Dog Park (complete)
6. The Greenway Connector (complete)
7. Community Greenway Enhancements (complete)
8. Narrow-Gauge Connector (complete)
9. Piers Park Phase I (complete)
10. Piers Park Phase II
11. Piers Park Phase III

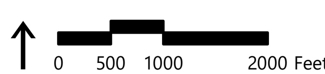


Table 3-5 Description and Status of Airport Edge Buffer Projects/Open Space (Dec. 31, 2017)

Description	Status
1. Southwest Service Area (SWSA) Buffer Phase 1 of this project involved the construction of an approximately half-acre area with landscaping and lighting improvements along Maverick Street that included evergreen and deciduous trees, ornamental shrubs, and groundcovers.	Phase I construction was completed in 2006.
Phase 2 consisted of installing landscaping (i.e., densely planted or planted atop earth berms for enhanced separation) and solid barriers such as fences and walls. The project enhanced bicycle and pedestrian connectivity between Maverick Street and East Boston Memorial Park and Stadium with extensive landscaping including trees, shrubs, flowering perennials, and decorative fences.	Phase 2 of the SWSA Buffer design was integrated with the SWSA Redevelopment Program. Construction of the SWSA Phase 2 Buffer was completed in Fall 2014.
2. Neptune Road Airport Edge Buffer The Neptune Road Airport Edge Buffer (the Neptune Road Buffer) is a Massport community mitigation project intended to buffer the East Boston Neighborhood at Logan Airport's northwestern edge. The 1.5-acre Neptune Road Buffer is at the nexus of Neptune Road, Vienna, and Frankfort Streets and is adjacent to the Massachusetts Bay Transportation (MBTA's) Wood Island Station. The majority of the parcel is located within the runway protection zone (RPZ) for Runway 15R-33L. The project consists of Olmsted-inspired landscape with various interpretive elements that will complement the adjacent North Service Area Roadway Corridor and be a continuation of the Corridor's pedestrian/bicycle path to Bennington Streets. The landscape elements reference Frederick Law Olmsted's original choice of materials and designs for Wood Island Park while preserving some of the existing trees. A pedestrian/bikeway link along Vienna Street to Bennington Street from the North Service Area Roadway Corridor was included, as well as a historical timeline, cast-iron neighborhood sculptures, foundation ghosting of the last two demolished residential structures, and cast-iron house number plaques in the sidewalk along Neptune Road. Additional buffer elements include low stonewalls, concrete sidewalks, bicycle racks, solar trash compactors, fencing, and period light fixtures.	The Neptune Road Buffer was completed in June 2016.
3. Navy Fuel Pier Buffer The Navy Fuel Pier Buffer project began with the U.S. Army Corps of Engineers' remediation of the former Navy Fuel Pier, which was completed in 2001. The project involved beautification of this 0.7-acre property through landscape improvements and stabilization of the waterfront perimeter. An interpretive panel was also installed which details the history of the surrounding area.	Construction of the Navy Fuel Pier Buffer was completed in 2007.
4. Bayswater Embankment This project involved creating a landscaped buffer between Bayswater Street and Boston Harbor.	Construction of this Airport edge buffer was completed in 2003. Massport is currently evaluating options for repairing recent storm-related shoreline damage.

Table 3-5 Description and Status of Airport Edge Buffer Projects/Open Space (Dec. 31, 2017) (Continued)

Description	Status
5. Bremen Street Park and Dog Park The 18-acre park was constructed as part of the Central Artery/Tunnel (CA/T) Project. The park, which is the second largest neighborhood park in East Boston, offers a variety of facilities, a direct pedestrian connection to the Massachusetts Bay Transportation Authority (MBTA) Blue Line Airport Station, and a half-mile segment of the three-mile East Boston Greenway. The park was built on land previously used as off-Airport parking. This 22,655 square-foot park is located on the corner of Bremen and Porter Streets in East Boston.	Construction of the park was completed in 2008. Massport continues to operate the park and provide community facilities. The Dog Park was opened in September 2016.
6. The Greenway Connector The one-half mile pedestrian/bicycle path connects the Bremen Street Park pedestrian/bicycle path to the Narrow-Gauge Connector. Together the Greenway and Narrow-Gauge Connectors provide a continuous path connecting Piers Park, Bremen Street Park, Stadium Park, and Constitution Beach.	Construction of the Greenway Connector between Bremen Street Park and an Overlook at Wood Island Marsh was completed by Massport in 2014.
7. Community Greenway Enhancements Eight street lights were installed along Saratoga Street to improve safety and maintain spacing consistent with what was existing.	The lighting improvements were substantially completed by December 2015.
8. Narrow-Gauge Connector The Narrow-Gauge Connector is a one-third mile multi-use path and extension of the East Boston Greenway network. Now completed, this portion of the East Boston Greenway allows people to continuously walk from Piers Park to Constitution Beach.	Construction of this project was ongoing in 2016 and the Narrow-Gauge Connector was opened in May 2016. The City of Boston completed final plantings in Spring of 2016, and turned the project over to Massport for ownership, maintenance, and security.
9. Piers Park Phase I Formerly a 7-acre industrial site located on the East Boston waterfront, the Phase I site is comprised of three distinct zones: 5.5-acre backland, 1.2-acre pier, and a community sailing facility. The park includes a picnic area, adult fitness course, children's playground and spray park, and an outdoor amphitheater.	Construction was completed in 1995.
10. Piers Park Phase II Piers Park Phase II will add 4.2 acres of green space to the existing Piers Park on the East Boston waterfront. The Phase II site is located adjacent to the Phase I site, along Marginal Street in East Boston. The conceptual design of the Phase II site envisions a fully accessible park with a central lawn area, basketball and volleyball courts, and bicycle and rollerblade tracks. The park is expected to offer landscape features similar to those in the Phase I Park, including brick paved walkways, site furniture, lighting, and plantings. A new 1,200-square foot community/sailing center, located on the waterfront, is designed to replace the existing Sailing Center building while providing additional meeting spaces for the community.	A Request for Proposals for design of Piers Park Phase II was issued in June 2017. The planning and design process is expected to take approximately 18 months.

Table 3-5 Description and Status of Airport Edge Buffer Projects/Open Space (Dec. 31, 2017) (Continued)

Description	Status
11. Piers Park Phase III (*by others*)	
Piers Park Phase III is conceived as a 3.8-acre addition of greenspace to the existing Piers Park on the East Boston waterfront. The site is located adjacent to the Phase II site, along Marginal Street in East Boston.	Massport issued a Request for Proposals in February 2018 for design and construction of Piers Park Phase III, by others. Advancement of this concept is dependent on the responses to Massport's Request for Proposals.

Note: See **Figure 3-6** for the location of Airport edge buffer projects/planning concepts.

Airport Parking Projects/Planning Concepts

As of December 31, 2016, the total number of employee and commercial parking spaces permitted at Logan Airport was limited by the Logan Airport Parking Freeze[2] under the State Implementation Plan (SIP) and MassDEP air quality regulations (310 Code of Massachusetts Regulations 7.30). Parking supply at Logan Airport has varied with respect to the specific locations and sizes of individual lots, the mix of parking spaces for air travelers and employee spaces, and the number of spaces in and out of service at any one time due to construction projects, while at all times remaining in compliance with the Logan Airport Parking Freeze. Chapter 5, *Ground Access to and from Logan Airport* provides additional information on past and current existing supply of parking at Logan Airport.

As one element of its comprehensive transportation strategy, Massport has proposed to build 5,000 new on-Airport commercial parking spaces at Logan Airport. As air traveler numbers have increased, the legally constrained parking supply at Logan Airport, resulting from the Logan Airport Parking Freeze, has periodically had the unintended consequence of causing an increase in environmentally harmful drop-off/pick-up vehicle trips. The goal of the Logan Airport Parking Project is to reduce the use of drop-off/pick-up modes, which generate up to four vehicle trips instead of two. While the intent of the Logan Airport Parking Freeze has been to shift air passengers to HOV travel modes with lower VMT, survey data collected from the 1970s to the present at Logan Airport have consistently shown that when demand for parking starts to exceed supply, a larger share of air passengers shift to drop-off/pick-up travel modes over HOV modes that generate a higher level of VMT and associated air emissions (**Figure 3-7**).

Beginning with the *2017 ESPR*, Massport will introduce a new definition for HOV that takes into account vehicle occupancies of taxi, livery (black car limousine), and transportation network company (TNC) modes.[3] The new definition is the result of an agreement between Massport and the Conservation Law Foundation (CLF) concerning the 2017 Logan Airport Parking Freeze Amendment. Under the current system, Massport counts all taxi as non-HOV and all black car limousines as HOV. Massport is currently and conservatively classifying TNCs as non-HOV. In the future, Massport will estimate HOV and non-HOV breakdowns for taxis, livery services, and

2 310 Code of Massachusetts Regulations 7.30 and 40 Code of Federal Regulations 52.1120.

3 A transportation network company (TNC) is a company that uses an online-enabled platform to connect paying passengers with drivers who provide transportation from their own non-commercial vehicles. TNCs have emerged as a new option mode of transportation with automobile drop-off and pick-up at Logan terminals. The 2016 passenger survey and future documents will analyze trends associated with TNCs.

TNCs, and has committed to a goal of 35.5 percent HOV under the new definition by 2022 and 40 percent by 2027.

Progress toward this goal is measured using the triennial air passenger ground-access survey. The latest survey, which was conducted in 2016, revealed an air passenger ground-access mode share of 30.5 percent for HOV/shared-ride modes, which is a 2.7-percent increase since 2013 and roughly the same as the survey indicated in 2010. Historically, there has not been a significant shift in HOV mode share since 2004. This result demonstrates that Logan Airport has been able to maintain its HOV mode share in concert with improvements to roadway access to the Airport and despite significant increases in air passenger levels.

The construction of additional commercial parking spaces at Logan Airport is predicated on a regulatory change,[4] adopted by MassDEP, whereby MassDEP amended the existing Logan Airport Parking Freeze to allow for 5,000 additional commercial parking spaces at Logan Airport. MassDEP conducted a stakeholder process, which was followed by conducting the formal process to amend the Parking Freeze regulation. To help inform the MassDEP process, Massport initiated a parallel process with the Executive Office of Energy and Environmental Affairs (EEA) by filing an Environmental Notification Form (ENF) for new parking facilities in March 2017. Information provided in the ENF was designed to help inform commenters on the MassDEP regulatory amendment process as to the siting and potential impacts of the Logan Airport Parking Project. **Figure 3-8** shows the proposed sites for new parking garage facilities.

MassDEP issued the amended regulation on June 30, 2017, approving the requested parking increase. On December 5, 2017, the EPA proposed a rule approving the revision of the Massachusetts SIP incorporating the amended Logan Airport Parking Freeze Cap. EPA approved the proposed rule on March 6, 2018, and the rule went into effect April 5, 2018. Massport is beginning to prepare the required Draft Environmental Impact Report (EIR). The Draft EIR will detail the timing and location of the 5,000 spaces and evaluate all project issues described in the Secretary's Certificate on the ENF, issued on May 5, 2017, outlining the Scope of the Draft EIR.

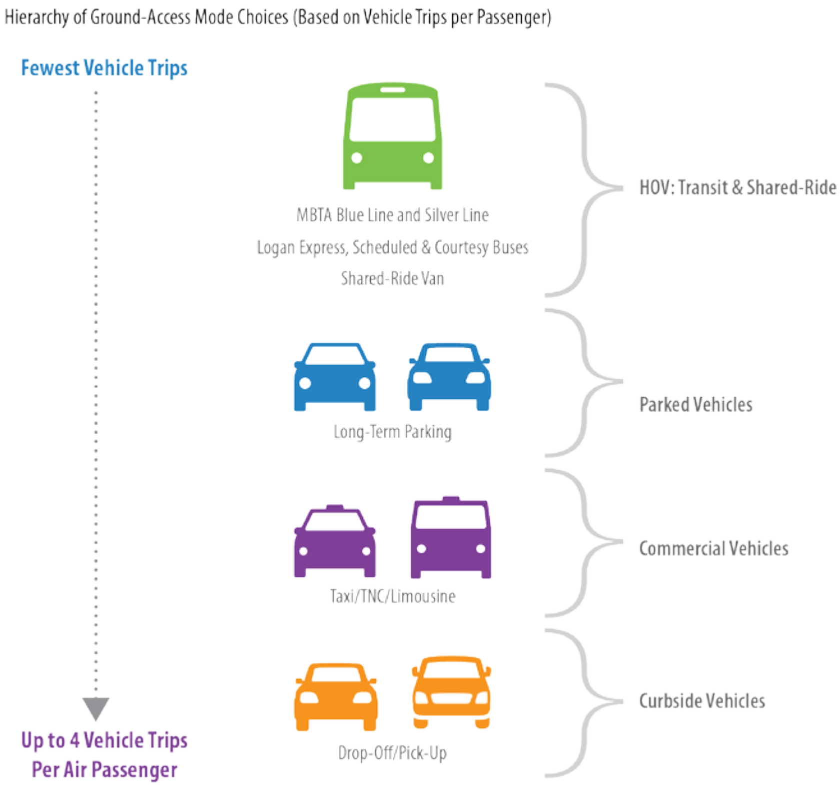
Table 3-6 describes current commercial parking projects at Logan Airport. The locations of parking garages are shown on **Figure 3-8**.

In addition to the Logan Airport Parking Project, Massport is committed to a comprehensive transportation strategy, which includes continued operational and capital commitment to the Logan Express services and the MBTA Silver Line 1 service, as well as continued partnership and marketing of private bus carriers. Eight Silver Line buses, connecting the Airport to South Station, are owned by Massport and operated by the MBTA with Massport paying operating costs. In 2016, Massport funded an approximate $6 million mid-life rebuild of these eight buses. The mid-life rebuild will extend the useful life of each vehicle by approximately eight years. This will allow the MBTA to maintain reliability and quality of operations along the Silver Line today while starting the procurement process to acquire new vehicles in the future. In 2015, Massport acquired the property on which the Braintree Logan Express site is located, furthering its commitment to providing HOV access from key regional nodes. The Braintree Logan Express service had a ridership of 655,158 annual passenger trips in 2016, representing 36 percent of the entire Logan Express system ridership. Approximately half of the Braintree Logan Express riders are Logan Airport employees. The Braintree site is approximately 20 acres (14 acres of

4 310 Code of Massachusetts Regulations 7.30.

usable land area) and has approximately 1,800 lined spaces. Chapter 5, *Ground Access to and from Logan Airport* provides additional information on these efforts.

Figure 3-7 Ground-Access Mode Choice Hierarchy



Source: VHB.
Notes: Short-term parking is included under "drop-off/pick-up"
Rental cars are included in the number of Parked Vehicles.

FIGURE 3-8 Location of Airport Parking Projects/ Planning Concepts

2016 Environmental Data Report

Notes: See Table 3-6 for a description of the numbered projects. Status as of December 31, 2016 (updated to 2017 where possible).

1. West Garage Parking Consolidation Project (completed)

2a. Logan Airport Parking Project - Economy Garage Concept

2b. Logan Airport Parking Project - Terminal E Surface Lot Concept

3. Automated People Mover Concept (not shown)

Table 3-6 Description and Status of Airport Parking Projects/Planning Concepts (December 31, 2016)

Description	Status
1. West Garage Parking Consolidation Project	
Massport consolidated 2,050 temporary parking spaces as an addition to the West Garage and at the existing surface lot between the Logan Office Center and the Harborside Hyatt. The project incorporated sustainable design and resiliency elements.	On March 20, 2014, the Executive Office of Energy and Environmental Affairs (EEA) issued an Advisory Opinion confirming that no review of the Massachusetts Environmental Policy Act (MEPA) was required for the consolidation of existing on-Airport parking spaces. The consolidation project was completed in late 2016.
2. Logan Airport Parking Project	
As one element of its comprehensive transportation strategy, Massport proposes the phased construction of 5,000 new on-Airport commercial parking spaces at Logan Airport in two locations. As air traveler numbers have increased, the constrained parking supply at Logan Airport, resulting from the Logan Airport Parking Freeze,[1] has had the unintended consequence of causing an increase in environmentally harmful drop-off/pick up trips. The goal of the Logan Airport Parking Project is to reduce the use of drop-off/pick-up modes, which generate up to four vehicle trips instead of two. While the intent of the Parking Freeze has been to shift air passengers to high-occupancy vehicle (HOV) travel modes with lower vehicle miles traveled (VMT), survey data collected from the 1970s to the present at Logan Airport have consistently shown that when demand for parking starts to exceed supply, a larger share of air passengers shift to drop-off/pick-up travel modes that generate a higher level of VMT and associated air emissions over HOV modes. In addition to the Logan Airport Parking Project, Massport is committed to a comprehensive transportation strategy, which includes continued operational and capital commitment to the Logan Express services and the Silver Line 1 service, as well as continued partnership and marketing of private bus carriers. Chapter 5, *Ground Access to and from Logan Airport* provides additional information on these efforts. The construction of additional commercial parking spaces at Logan Airport was predicated on a regulatory change, to be adopted by the Massachusetts Department of Environmental Protection (MassDEP) to amend the Logan Airport Parking Freeze. Massport has identified two potential sites for the new parking, Economy Garage (shown as 2a in **Figure 3-8**) and Terminal E Surface Lot (shown as 2b in **Figure 3-8**).	As of December 31, 2016, the Logan Airport Parking Project was in conceptual design and early permitting stages. In response to Massport's 2016 request to consider an amendment to the Logan Airport Parking Freeze (to increase the commercial parking freeze limit by 5,000 spaces), MassDEP conducted a stakeholder process, followed by a public process to amend the Logan Airport Parking Freeze regulation. MassDEP issued the amended regulation on June 30, 2017 approving the requested parking increase. Massport initiated a parallel process with EEA by filing an ENF for new parking facilities on March 31, 2017. A Secretary's Certificate on the ENF was issued on May 5, 2017 establishing the scope for the required Draft EIR. The Draft EIR will provide additional details on the number of spaces per location and planned construction phasing. Initiation of concept design for the parking facilities commenced in late 2017.
3. Automated People Mover Concept	
Massport is considering several potential options for an Automated People Mover (APM). This APM could provide a robust connection between all terminals, Southwest Service Area facilities, and other areas on-Airport.	The feasibility of constructing such a system and the operating parameters that would be required are currently being evaluated.

Notes: See **Figure 3-8** for the location of Airport parking projects/planning concepts.

1 310 Code of Massachusetts Regulations 7.30 and 40 Code of Federal Regulations 52.1120.

Massport-wide Projects and Plans

Massport recently completed or is undertaking several Massport-wide planning initiatives described below.

Resiliency Planning

At the end of 2013, Massport initiated a Disaster and Infrastructure Resiliency Planning Study (DIRP) for Logan Airport, the Port of Boston, and Massport's waterfront assets in South and East Boston. The DIRP Study includes a hazard analysis, modeling sea-level rise and storm surge, and projections of temperature and precipitation and anticipated increases in extreme weather events. The DIRP Study provides recommendations regarding short-term strategies to make Massport's facilities more resilient to the likely effects of climate change. The study was completed and implementation of adaptation initiatives began in late 2014.

In addition to the DIRP Study and its related initiatives, Massport has completed an Authority-wide risk assessment, as part of its strategic planning initiative; issued a Floodproofing Design Guide; and has developed a resilience framework to provide consistent metrics for short- and long-term planning and protection of its critical facilities and infrastructure. Beyond infrastructure resiliency, Massport is also focused on incorporating social and economic resilience into its long-term operational and capital planning. Massport's Floodproofing Design Guide was published in November 2014 and updated in April 2016.

Operational aspects of resiliency strategy include the development of Flood Operations Plans for Logan Airport and Massport maritime facilities. These plans were introduced in 2015 and included the planned deployment of temporary flood barriers to protect up to 12 locations of critical infrastructure in the event of severe weather. Additional locations have been permanently enhanced to prevent flooding. The flood operations plans are evaluated annually to enhance their effectiveness and to adapt to evolving requirements and past experiences. Tabletop planning exercises simulating a hurricane scenario and cross-functional workshops have been conducted to further refine plans and train staff. Finally, the design flood elevation that resulted from the original DIRP Study in 2015 was updated as a result of enhanced storm modelling that was made available to Massport through MassDOT. Adjustments to the prioritized resiliency recommendations were made to accommodate the revised flood elevation.

AquaFence Flood Protection Barrier Systems demonstration to students at Massport.
Source: Massport.

Logan Airport Sustainability Management Plan (SMP)

The purpose of the Logan Airport SMP is to enhance the efficiency and sustainability of Logan Airport's operations and to support the broader sustainability principles of the Commonwealth. In 2013, Massport was awarded a grant by FAA to prepare an SMP for Logan Airport. The Logan Airport SMP planning effort began in May 2013 and was completed in April 2015. The Logan Airport SMP takes a comprehensive approach to sustainability including economic vitality, social responsibility, operational efficiency, and natural resource conservation considerations. The Logan Airport SMP is intended to promote, integrate, and coordinate sustainability efforts across the Authority. The Logan Airport SMP was developed with a framework and implementation plan, with metrics and targets designed to track progress over time. Massport is currently advancing a series of short-term initiatives to help reach its goals in the areas of energy and greenhouse gas emissions; community, employee, and passenger well-being; resiliency; materials, waste management, and recycling; and water conservation. The Logan Airport SMP is available on Massport's website at: https://www.massport.com/massport/business/capital-improvements/sustainability/sustainability-management/.

Logan Airport Annual Sustainability Report

The Logan Airport Annual Sustainability Report provides a progress summary of sustainability efforts at Logan Airport based on Massport's sustainability goals and targets established in the Logan Airport SMP. The first Logan Airport Annual Sustainability Report was published in April 2016. Since the publication of the 2016 report, Massport has continued expanding its sustainability initiatives, which an increased focus on implementing resliency measures to protect Maritime and Logan Airport operations, cirital infrastructure, and workforce. The lastest Annual Sustainability and Resiliency Report highlights Massport's progress towards improving sustainability and enhancing resiliency at its facilities and is available on Massport's website at: http://www.massport.com/massport/business/capital-improvements/sustainabiity/sustainability-management/.

4

Regional Transportation

Introduction

This chapter places Boston-Logan International Airport (Logan Airport or Airport) in the context of the New England region's intermodal transportation system and reports on the status of the region's airports and other intermodal facilities in 2016. Logan Airport, one of three airports[1] owned and operated by the Massachusetts Port Authority (Massport), is the primary international and domestic airport operating within a larger network of New England regional airports.[2] This chapter focuses on 2016 and specifically describes passenger and aircraft activity levels at New England regional airports[3] including:

- Changes in airline service levels and other factors that have contributed to trends in regional airport activity;
- The status of current improvement plans and projects at the regional airports;
- Massport's initiatives and joint efforts with other transportation agencies to improve the efficiency of the New England regional transportation system; and
- Regional long-range transportation planning efforts.

New England Regional Airport System

As shown in **Figure 4-1**, the New England region is anchored by Logan Airport and a system of 10 other commercial service, reliever, and general aviation (GA) airports (regional airports).[4] Together, these 11 airports accommodate approximately 98 percent[5] of New England's air travel demand. Logan Airport serves a major domestic origin and destination (O&D) market and the primary international gateway for the region. The regional airports range in role and activity levels from Bradley International Airport, which served over six million commercial passengers in 2016, to Hanscom Field, which does not currently handle any scheduled commercial flights, but serves as New England's largest GA facility (**Table 4-1**).

Even as overall national and regional passenger activity levels have increased, aircraft operation activity levels have declined substantially since 2000, as part of ongoing trends of larger aircraft size, higher aircraft load factors, and reduced service in less profitable markets. Total aircraft operations in the region declined from 1.6 million in 2000 to approximately one million in 2016.

1 Massport owns and operates Boston-Logan International Airport, Hanscom Field, and Worcester Regional Airport.
2 A regional airport is an airport serving traffic within a small or lightly populated geographical area.
3 A review of passenger and operations activity levels at Logan Airport is provided in Chapter 2, *Activity Levels*.
4 The New England Regional Airport System Plan (NERASP), which was published by the FAA in 2006, includes Logan International Airport and these 10 regional airports: Bangor International, Bradley International, Burlington International, Hanscom Field, Manchester-Boston Regional, Portland International, Portsmouth International, T.F. Green, Tweed-New Haven, and Worcester Regional airports.
5 Federal Aviation Administration. Final CY 2016 Passenger Boarding Data.

Figure 4-1 New England Regional Transportation System

Massport owns and operates two of the regional airports: Hanscom Field and Worcester Regional Airport. Both of these airports play important roles in the New England regional transportation system, as described below.

Hanscom Field (BED)

Hanscom Field is a full-service GA airport that accommodates a wide variety of GA activities, including corporate aviation, private flying, commuter air services, as well as charters and light cargo. Located in Bedford, MA, approximately 20 miles northwest of Logan Airport, Hanscom Field is New England's premier facility for business/corporate aviation, and serves a critical role as a GA reliever airport for Logan Airport. In 2016, Hanscom Field accommodated 120,891 GA operations, approximately four times the number of GA operations that occurred at Logan Airport. Consistent with Hanscom Field's role as a premier corporate airport, new hangars are being built to accommodate the need for corporate jet services. In addition to its role as a GA facility, in the past, Hanscom Field has also accommodated niche scheduled commercial airline services.

Table 4-1 Passenger Activity at New England Regional Airports and Logan Airport, 2011-2016

	Passenger Levels (millions)[1]								Percent Change
Airport	**2000**	**2010**	**2011[2]**	**2012[2]**	**2013[2]**	**2014[2]**	**2015[2]**	**2016[2]**	**(2015-2016)**
Bradley International	7.34	5.34	5.61	5.38	5.42	5.88	5.93	6.06	2.1%
T.F. Green	5.43	3.94	3.88	3.65	3.80	3.57	3.57	3.65	2.4%
Manchester-Boston Regional	3.17	2.81	2.71	2.45	2.42	2.10	2.08	2.02	(2.7%)
Portland International Jetport	1.34	1.71	1.68	1.62	1.68	1.67	1.73	1.79	3.3%
Burlington International	0.90	1.30	1.29	1.25	1.23	1.22	1.19	1.21	1.5%
Bangor International	0.38	0.39	0.43	0.46	0.48	0.49	0.54	0.55	2.2%
Worcester Regional	0.11	0.07	0.11	0.03	0.02	0.12	0.12	0.12	(0.8%)
Portsmouth International	0.07	0.00	0.01	0.03	0.04	0.09	0.09	0.13	51.1%
Tweed-New Haven Regional	0.08	0.07	0.08	0.08	0.07	0.07	0.07	0.06	(17.3%)
Hanscom Field	0.16	0.00	0.01	0.01	0.0[3]	0.0[3]	0.0[3]	0.0[3]	-
Regional Subtotal	**18.98**	**15.63**	**15.80**	**14.95**	**15.17**	**15.19**	**15.30**	**15.58**	**1.8%**
Logan Airport	**27.73**	**27.43**	**28.91**	**29.24**	**30.22**	**31.63**	**33.45**	**36.29**	**8.5%**
Total	**46.71**	**43.06**	**44.71**	**44.19**	**45.39**	**46.82**	**48.75**	**51.87**	**6.4%**

Source: Massport and individual airport data reports.
Notes: Data for Logan Airport includes domestic, international, and general aviation passengers.
1 All passengers in millions. Passenger levels are enplaned plus deplaned passengers (where available) or enplaned passengers times two.
2 Reflects most updated passenger statistics for Burlington International, Bangor International, and Portsmouth International airports based on latest available airport records as of June 2017.
3 Indicates fewer than 5,000, but more than zero, scheduled commercial passengers. Hanscom Field also reported annual non-scheduled passenger enplanements above 10,000 between 2011 and 2016.

Worcester Regional Airport (ORH)

Worcester Regional Airport is located in central Massachusetts, approximately 50 miles west of Logan Airport. Worcester Regional Airport is an important aviation resource that accommodates both corporate GA activity and commercial airline services. Massport assumed operation of Worcester Regional Airport in 2000 and later acquired the airport from the City of Worcester in June 2010. Aircraft operations at Worcester Regional Airport totaled 35,254 operations in 2016, with GA accounting for over 90 percent of aircraft activity. Worcester Regional Airport is an important aviation resource that accommodates corporate GA activity and limited commercial airline service. Massport continues to invest in Worcester Regional Airport by modernizing the airport to serve better the commercial airline travel demands of the central Massachusetts region. Together with the City of Worcester, Massport will invest $100 million over the next 10 years to revitalize and grow commercial operations at Worcester Regional Airport. Massport, in conjunction with the City of Worcester and other community stakeholders, actively promoted the reintroduction of scheduled airline service at Worcester Regional Airport and successfully secured new service provided by JetBlue Airways. This service has proven to be highly popular, with JetBlue Airways achieving consistently high load factors (over 81 percent[6]) and handling over 114,000 passengers in 2016. To date, JetBlue Airways has served nearly 500,000 passengers at ORH. On November 7, 2013, JetBlue Airways commenced non-stop services to Orlando International and Fort Lauderdale-Hollywood airports using 100-seat Embraer 190 aircraft. Starting in May 2018, JetBlue Airways will offer flights to JFK International Airport in New York, NY. Additionally, American Airlines will offer flights to Philadelphia International Airport starting in October 2018.

Massport recently completed Worcester Regional Airport's Category (CAT) III Instrument Landing System to elevate operational conditions and enhance safety to a level equal to that of all other commercial airports in New England. This project will significantly improve Worcester Regional Airport's all-weather reliability, a long-standing impediment to greater utilization of this airport.

Other Regional Airports

Apart from Hanscom Field and Worcester Regional Airport, the regional airports closest to Logan Airport are T.F. Green Airport in Warwick, RI and Manchester-Boston Regional Airport in Manchester, NH. Because of their proximity to Logan Airport and overlapping market areas, these airports may be convenient choices for some passengers in the Greater Boston Area. The New England Regional Airport System Plan (NERASP) Study, published in 2006, identified a high degree of cross-airport utilization within the Greater Boston airport system, which encompasses Logan Airport, T.F. Green Airport, and Manchester-Boston Regional Airport. In effect, the three airports act as a system of airports, with significant numbers of passengers choosing the most convenient airport in terms of access, airfares, and available air services depending on their individual air travel needs.[7] **Table 4-2** depicts the distribution of air passengers at these airports.

6 JetBlue Airways services at Worcester Regional Airport had an average load factor of 84 percent in 2015 and 81 percent in 2016 (U.S. DOT, T100 Database).

7 Federal Aviation Administration. 2006. *New England Regional Airport System Plan (NERASP)*.

Table 4-2 Passenger Activity Levels at Logan Airport and T.F. Green and Manchester-Boston Regional Airports, 1995 and 2016 Comparison

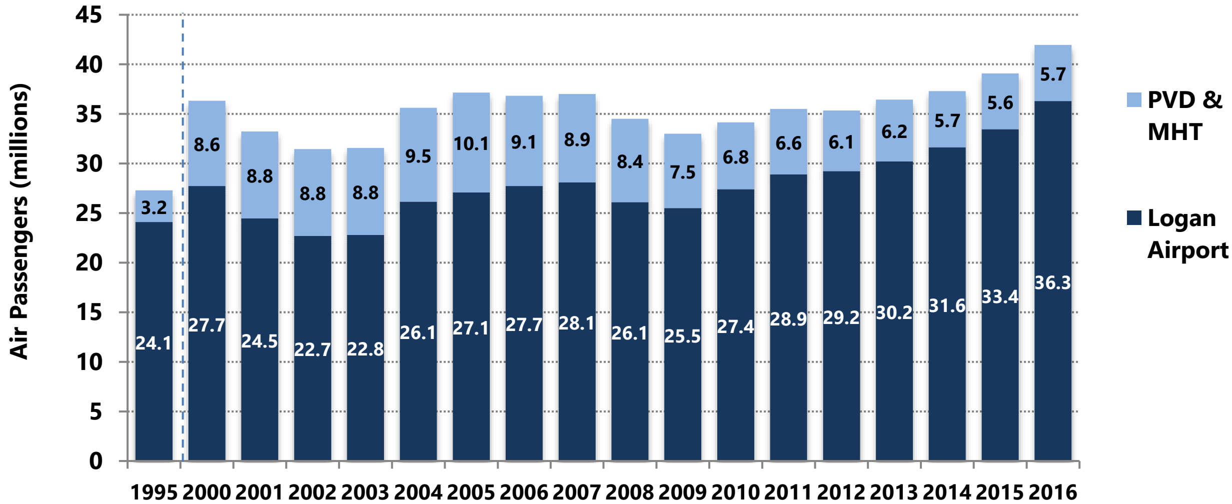
	Market Share (passengers in millions)		Change (passengers in millions)	Percent Change
	1995	**2016**	**1995-2016**	**1995-2016**
Logan Airport	24.1	36.3	12.2	50.6%
Manchester-Boston Regional Airport and T.F. Green Airport	3.2	5.7	2.5	78.1%
Total	**27.3**	**42.0**	**14.7**	**53.8%**
Percent Logan Airport	**88.3%**	**86.4%**	**(1.9)**	

Source: Massport and individual airport data reports.

Logan Airport is well-positioned in terms of access, competitive airfares, and available air services to meet the demands of the core Boston air passenger market. Passenger traffic at T.F. Green Airport and Manchester-Boston Regional Airport peaked in 2005. After the 2005 peak, there was an industry-wide trend of airline service reductions at smaller airports. In 2016, the overall number of passengers accommodated at T.F. Green and Manchester-Boston Regional airports increased. The number of passengers at T.F. Green Airport increased by 2.4 percent in 2016, compared to 2015, while the number of passengers at Manchester-Boston Regional Airport decreased by 2.7 percent (see **Table 4-2**). T.F. Green Airport and Manchester-Boston Regional Airport remain well situated to serve their own catchment areas.

In 2016, T.F. Green and Manchester-Boston Regional Airports' combined share of the Greater Boston passenger market continued the declining trend from recent years. In 2016, the two airports served 13.6 percent (5.7 million) of the combined passengers at the three main commercial airports serving the Greater Boston area, down from 14.4 percent (5.6 million) in 2015 and a high share of 27.9 percent (8.8 million) in 2002. **Figure 4-2** depicts the historical distribution of air passengers for Logan Airport, T.F. Green Airport, and Manchester-Boston Regional Airport.

Figure 4-2 Passenger Activity Levels at Logan Airport and T.F. Green (PVD) and Manchester-Boston Regional (MHT) Airports, 1995-2016



Source: Massport and individual airport data reports.

In addition to Logan Airport and the regional airports discussed above, a third tier of commercial airports serves relatively isolated communities or provides seasonal or niche commercial air services in New England. These airports include:

- Hyannis Airport, Martha's Vineyard Airport, Nantucket Memorial Airport, New Bedford Regional Airport, and Provincetown Municipal Airport in MA;
- Augusta State Airport, Bar Harbor Airport, Rockland Airport, and Northern Maine Regional Airport in ME;
- Lebanon Municipal Airport in NH;
- Block Island State Airport and Westerly State Airport in RI; and
- Rutland Southern Vermont Regional Airport in VT.

These third-tier airports support frequent commercial service to Logan Airport and, in some instances, T.F. Green Airport during the summer months. Most of these third-tier airports are not in close proximity to Logan Airport and are isolated due to geographic factors. Because of their remoteness and/or limited market areas, many of these airports are unlikely to attract passengers that now fly from Logan Airport. Instead, many of these airports are dependent on Logan Airport for connecting services.

Air Passenger Trends

The following section provides an overview of air passenger trends for the regional airports over the last decade.

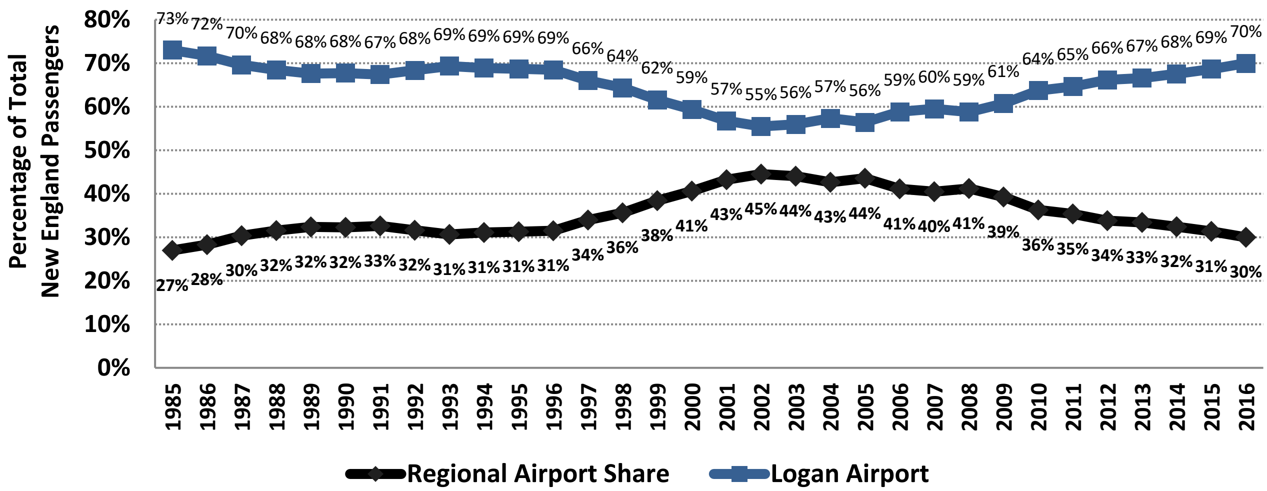
Regional Airport Passengers

In 2016, New England's 11 commercial airports accommodated a combined total of 51.9 million passengers. As shown in **Table 4-2**, total air passenger activity at New England airports increased by 6.4 percent between 2015 and 2016. Passenger activity at New England airports in 2016 represents a historic high, exceeding the previous record of 48.8 million in 2015. Overall, passenger traffic growth at the New England airports increased by 3.1 percent in 2016, resulting in a higher growth rate than the overall U.S. passenger market.[8] This New England passenger growth was driven by increases at some New England regional airports and Logan Airport. Nationally, U.S. passenger traffic exceeded pre-recession levels in 2014, then continued to show growth and reached a new peak in 2016.

Passenger traffic growth in the New England region continued to be driven by growth at Logan Airport. In 2016, Logan Airport saw passenger growth of 8.5 percent compared to 2015, while total passenger traffic at other New England airports increased by only 1.8 percent. The 10 regional airports accounted for a total of 15.6 million passengers in 2016, compared to 15.3 million passengers in 2015. The 10 regional airports' share of total New England passengers decreased to 30.1 percent in 2016, compared to 31.4 percent in 2015 (see **Figure 4-3**). The decline in passenger share at the regional airports in recent years reflects the volatile operating environment facing U.S. airlines and is consistent with the national trend at secondary and tertiary airports. The 2008/2009 global economic downturn resulted in decreased passenger demand and widespread airline capacity reductions, particularly at smaller regional airports. Airlines eliminated less profitable routes, cut frequencies in smaller markets, and reduced flying with small regional jets (RJs), which had become uneconomical to operate given high fuel prices. Though the economy has recovered in recent years, airlines continue to monitor capacity growth carefully, with a new emphasis on profitability.

8 U.S. DOT, Bureau of Transportation Statistics for total U.S. scheduled passenger traffic. 2016.

Figure 4-3 Regional Airports' Share of New England Passengers, 1985-2016



Source: Massport and individual airport data reports.

Among the regional airports, Bradley International Airport, T.F. Green Airport, Burlington International Airport, Portland International Jetport, Bangor International Airport experienced some passenger traffic growth in 2016, while Portsmouth International Airport experienced a substantial increase in passenger levels due to increased service from Allegiant Air. Traffic at other regional airports either remained flat or slightly declined in 2016. Manchester-Boston Regional Airport, Worcester Regional Airport, and Tweed New Haven Airport saw a decline in passenger levels compared to the previous year.

Aircraft Operation Trends

This section reports on recent aircraft operations trends for the regional airports, including passenger aircraft operations, GA operations, all-cargo aircraft operations, and aircraft load factors.

Regional Airports Aircraft Operations

As shown in **Table 4-3**, total aircraft operations in the New England region (including Logan Airport) saw an increase of 2.6 percent in 2016, from 991,041 operations in 2015[9] to 1,016,466 operations in 2016. An increase in aircraft operations at Logan Airport was accompanied by an overall increase in aircraft operations at the 10 regional airports. Total operations at Logan Airport in 2016 increased by 4.9 percent (an increase of 18,292 operations), compared to 2015, while total operations at the regional airports increased by 1.2 percent (an increase of 7,133 operations).

Commercial operations in the New England region increased from 588,374 operations in 2015 to 614,632 operations in 2016, representing an increase of 4.5 percent between 2015 and 2016. Commercial operations at Logan Airport increased by 4.5 percent in 2016, and by 4.3 percent at the other regional airports. This reflects the trend of airlines gradually increasing capacity and services in more profitable markets. These trends are

9 Reflects updated CY 2016 aircraft operation statistics for some regional airports based on updated FAA tower counts since the publication of the *2015 EDR*. See Table 4-2 for more details.

seen across the industry. In 2016, total U.S. air carrier activity increased by 4.8 percent over 2015,[10] while total U.S. passenger traffic increased by 3.1 percent year-over-year.[11]

Overall, the combined GA operations at the New England Airports totaled 369,533 operations in 2016, a decrease of 0.6 percent from the previous year. However, the continued decline of crude oil prices in 2016 resulted in falling jet fuel prices and this helped to boost GA activity at Logan Airport and a number of the regional airports in 2016. GA operations at Logan Airport, which remain a small portion of the Airport's total aircraft operations, increased by 9.3 percent (an increase of 2,614 operations) in 2016. Overall GA operations at the regional airports decreased by 1.5 percent (a decrease of 4,999 operations). Military operations at the regional airports increased by 4.8 percent (an increase of 1,552 operations) in 2016.

GA operations continue to be the dominant type of aircraft activity at the regional airports. In 2016, GA accounted for 54.2 percent of total aircraft operations, or 338,753 operations, at the regional airports. In comparison, GA represented only 7.9 percent of aircraft activity, or 30,780 operations, at Logan Airport, which primarily accommodates the region's domestic and international commercial airline operations. Commercial airline operations accounted for 40.7 percent of total operations, or 254,190 operations, at the regional airports in 2016. In comparison, commercial operations accounted for 92.1 percent of total operations, or 360,442 operations, at Logan Airport in 2016.

Overall, the regional airports accommodated a much greater share of the region's aircraft operations than their share of air passengers due to high levels of GA traffic. In 2016, the regional airports accounted for 30.1 percent of the region's passenger traffic, but 61.5 percent of aircraft activity. On average, there were approximately 24.9 passengers per aircraft operation at the regional airports, compared to 92.8 passengers per operation at Logan Airport in 2016, largely reflecting aircraft sizes.

Total aircraft operations in the region in 2016 were well below the region's level of aircraft operations in 2000. Total aircraft operations decreased by approximately 38 percent, falling from approximately 1.6 million operations in 2000 to one million operations in 2016. There were similarly large reductions in all three categories of activity – commercial, GA, and military. A number of factors have contributed to the declining trend in commercial airline operations, including a shift to larger capacity aircraft, higher passenger load factors, and a concurrent reduction in airline services at smaller regional airports. Factors negatively affecting GA activity include increased fuel prices through the past decade, a declining private pilot base, economic recessions, and periods of slow economic growth. Military operations have also declined, consistent with nationwide trends.

Annual aircraft operations by airport from 2000 to 2016 are summarized in **Table 4-3**. More details are provided in Appendix F, *Regional Transportation*.

10 Federal Aviation Administration. *FAA Aerospace Forecast Fiscal Years 2017-2037*. https://www.faa.gov/data_research/aviation/aerospace_forecasts/.

11 U.S. DOT. 2016. Bureau of Transportation Statistics for total U.S. scheduled passenger traffic.

Table 4-3 Aircraft Operations by Classification for New England's Airports, 2015 and 2016

	2000				2015				2016			
Airport	**Commercial[1]**	**GA[2]**	**Military[2]**	**Total**	**Commercial[1]**	**GA[2]**	**Military[2]**	**Total**	**Commercial[1]**	**GA[2]**	**Military[2]**	**Total**
Bradley International[3]	132,062	31,863	5,811	169,736	76,425	14,402	2,680	**93,507**	77,174	14,460	3,178	**94,812**
T.F. Green[3]	103,750	52,184	2,764	158,698	42,417	22,700	430	**65,547**	43,659	26,032	397	**70,088**
Manchester-Boston Regional	61,506	45,740	586	107,832	38,060	12,934	811	**51,805**	40,589	14,447	501	**55,537**
Portland International Jetport	47,609	56,571	2,072	106,252	30,415	17,916	567	**48,898**	32,171	18,334	488	**50,993**
Burlington	45,745	59,377	10,241	115,363	25,178	41,576	5,912	**72,666**	26,405	38,614	6,114	**71,133**
Bangor[3]	21,446	34,831	26,507	82,784	13,618	16,487	10,684	**40,789**	14,603	16,965	11,337	**42,905**
Portsmouth International	6,104	31,601	9,973	47,678	8,547	26,848	7,499	**42,894**	9,512	28,341	8,191	**46,044**
Tweed-New Haven	5,260	56,200	328	61,788	6,316	27,711	685	**34,712**	7,195	28,811	683	**36,689**
Worcester Regional[3]	4,029	46,518	495	51,042	2,414	35,711	889	**39,014**	2,616	31,858	780	**35,254**
Hanscom Field[3]	6,572	204,512	1,287	212,371	220	127,467	592	**128,279**	266	120,891	632	**121,789**
Subtotal	**434,083**	**619,397**	**60,064**	**1,113,544**	**243,610**	**343,752**	**30,749**	**618,111**	**254,190**	**338,753**	**32,301**	**625,244**
Logan Airport	452,763	35,233	0	487,996	344,764	28,166	N/A	**372,930**	360,442	30,780	N/A	**391,222**
Total	**886,846**	**654,630**	**60,064**	**1,601,540**	**588,374**	**371,918**	**30,749**	**991,041**	**614,632**	**369,533**	**32,301**	**1,016,466**

	Percent Change (2000-2016)				Percent Change (2015-2016)			
Airport	**Commercial[1]**	**GA[2]**	**Military[2]**	**Total**	**Commercial[1]**	**GA[2]**	**Military[2]**	**Total**
Bradley International[3]	(42%)	(55%)	(45%)	(44%)	1.0%	0.4%	18.6%	**1.4%**
T.F. Green[3]	(58%)	(50%)	(86%)	(56%)	2.9%	14.7%	(7.7%)	**6.9%**
Manchester-Boston Regional	(34%)	(68%)	(15%)	(48%)	6.6%	11.7%	(38.2%)	**7.2%**
Portland International Jetport	(32%)	(68%)	(76%)	(52%)	5.8%	2.3%	(13.9%)	**4.3%**
Burlington	(42%)	(35%)	(40%)	(38%)	4.9%	(7.1%)	3.4%	**(2.1%)**
Bangor[3]	(32%)	(51%)	(57%)	(48%)	7.2%	2.9%	6.1%	**5.2%**
Portsmouth International	56%	(10%)	(18%)	(3%)	11.3%	5.6%	9.2%	**7.3%**
Tweed-New Haven	37%	(49%)	108%	(41%)	13.9%	4.0%	(0.3%)	**5.7%**
Worcester Regional[3]	(35%)	(32%)	58%	(31%)	8.4%	(10.8%)	(12.3%)	**(9.6%)**
Hanscom Field[3]	(96%)	(41%)	(51%)	(43%)	20.9%	(5.2%)	6.8%	**(5.1%)**
Subtotal	**(41%)**	**(45%)**	**(46%)**	**(44%)**	**4.3%**	**(1.5%)**	**5.0%**	**1.2%**
Logan Airport	(20%)	(13%)	NA	(20%)	4.5%	9.3%	N/A	**4.9%**
Total	**(31%)**	**(44%)**	**(46%)**	**(37%)**	**4.5%**	**(0.6%)**	**5.0%**	**2.6%**

Sources: Federal Aviation Administration (FAA) tower counts; Massport and individual airport data reports.
Notes: Ranked by commercial operations. FAA tower counts used for all airports except Logan Airport and Portsmouth International.
Numbers in parentheses ( ) indicate negative numbers.
NE - New England, GA – General Aviation
1 May include some Air Taxi operations by fractional jet operators. FAA tower counts combine some fractional jet operations with small regional/commuter airline operations.
2 Includes itinerant and local operations at the regional airports. Military operations at Logan Airport are negligible and not included in Massport counts.
3 Reflects updated CY 2016 aircraft operation statistics based on updated FAA tower counts since the publication of the *2015 EDR*.

Airline Passenger Service in 2016

Airlines can adjust service at an airport or on a specific route in two ways: by increasing or decreasing the number of flights operated and/or changing the size of the aircraft flown on the route. Changes in flight frequency and in aircraft size affect the number of seats available to passengers, also known as seat capacity. Airline services are therefore discussed in terms of seat capacity as well as the number of flight departures.[12] This section examines changes in airline departures and seat capacity and provides an overview of new and discontinued routes at the regional airports in 2016.

Service Developments at the Regional Airports

In 2016, a total of 15 airlines provided scheduled passenger service from the 10 regional airports to 44 non-stop destinations.[13] Bradley International Airport, T.F. Green Airport, Portland International Jetport, Burlington Airport, Bangor Airport, and Portsmouth International Airport saw an increase in scheduled commercial services in 2016, while some of the other airports experienced service declines. The steep airline service cuts seen after 2007 due to the 2008/2009 economic recession and high fuel prices have largely come to an end. However, airlines continue to be conservative in growing capacity and continue to reduce frequencies on less profitable routes.

Table 4-4 shows the share of scheduled domestic departures for Logan Airport and the 10 regional airports for the August peak travel month from 2011 to 2016. In 2016, Logan Airport accounted for 63.4 percent of domestic departures in the New England region with 3,361 weekly departures during the month of August. Medium-size airports – Bradley International Airport, T.F. Green Airport, and Manchester-Boston Regional Airport – accounted for 23.4 percent of the region’s domestic departures with 1,243 weekly departures during the same time period. Smaller New England airports accounted for 13.2 percent of the region’s domestic departures with 702 weekly departures. Overall, the regional airports’ combined share of scheduled domestic departures in the New England region declined from 37.2 percent in 2015 to 36.6 percent in 2016. The share for the medium-size airports fell from 24.1 percent in 2015 to 23.4 percent in 2016, while the smaller airports saw a slight share increase from 13.1 percent to 13.2 percent. Details of scheduled passenger operations by market and carrier for the regional airports for the years 2000 to 2016 are presented in Appendix F, *Regional Transportation*.

12 A departure is an aircraft take-off at an airport. While aircraft operations include both departures and arrivals, airline services are typically described in terms of departures, as the number of scheduled departures generally equals the number of scheduled arrivals. Changes in departures translate to changes in overall operations.

13 Includes Allegiant Air, which serves Bangor International Airport (Sanford and St. Petersburg/Clearwater service), Burlington International Airport (Sanford service), and Portsmouth International Airport (Fort Lauderdale, Punta Gorda, St. Petersburg/Clearwater and Sanford service).

Table 4-4 Share of Scheduled Domestic Departures – Logan Airport and the 10 Regional Airports, 2011-2016 (for August peak travel month)

	2010	2011[1]	2012[1]	2013[1]	2014[1]	2015	2016
Logan Airport	57.8%	57.5%	59.6%	60.8%	61.0%	62.8%	63.4%
Bradley International Airport; Manchester-Boston Regional Airport; T.F. Green Airport	29.5%	29.1%	27.6%	26.3%	25.8%	24.1%	23.4%
Bangor International Airport; Burlington International Airport; Hanscom Field; Portland International Jetport; Portsmouth International Airport; Tweed-New Haven Airport; Worcester Regional Airport	12.7%	13.4%	12.8%	12.9%	13.2%	13.1%erio	13.2%

Sources: OAG Schedules; U.S. DOT T100
Notes: Allegiant Air does not report to OAG; Allegiant Air average weekly scheduled departures from T100.
1 Updated since the publication of the *2014 EDR* report to reflect scheduled departures for Allegiant Air not reported to OAG.

Worcester Regional Airport

Worcester Regional Airport in Worcester, MA is currently served by JetBlue Airways with non-stop service to Fort Lauderdale and Orlando. Prior to the entry of JetBlue Airways, Worcester Regional Airport was served only by Direct Air, which operated regularly scheduled charter services from 2008 to 2012. When Direct Air filed for Chapter 7 bankruptcy in April 2012, Worcester Regional Airport no longer provided commercial service. A concerted marketing effort on the part of Massport and the local Worcester community resulted in the launch of JetBlue Airways at the Airport in November 2013. In 2016, JetBlue Airways maintained daily service on 100-seat Embraer 190 aircraft to Fort Lauderdale and Orlando, with no change in operations from 2015. In February 2017, JetBlue Airways announced daily service to New York JFK, which will commence in May 2018 following the recent completion of CAT III Instrument Landing System. Additionally, American Airlines will offer flights to Philadelphia International Airport starting in October 2018. Worcester Regional Airport has experienced consecutive growth between 2013 and 2017 serving a cumulative total of over 475,000 passengers.

Bradley International Airport

Annual departing seat capacity at Bradley International Airport in Windsor Locks, CT increased by 4.4 percent in 2016. The capacity increase was driven by service increases by both American Airlines (3.9 percent increase in seats), Air Canada (24.9 percent increase in seats, mostly driven by seats to Toronto), and United Airlines (24.5 percent increase in seats with new service to Denver). In 2015, American Airlines continued to integrate operations with US Airways and adjust its network. After discontinuing non-stop service to Los Angeles in 2014, American Airlines resumed service to Los Angeles in 2016. American Eagle removed services to Pittsburgh. During September 2016, Ireland’s flag carrier, Aer Lingus, began to fly direct daily flights to Dublin. Southwest curtailed service to Atlanta. United Airlines launched daily services to Denver in May 2016. OneJet, which is a regional airline that caters to business customers, offered non-stop services to Pittsburgh. The number of passengers at Bradley International Airport increased by 2.1 percent in 2016, compared to 2015. In 2017, the number of passengers increased by over 6 percent. This growth marks the fifth straight year of passenger traffic growth between 2012 and 2017 (see **Table 4-2**).

T.F. Green Airport

T.F. Green Airport in Warwick, RI saw an overall seat capacity increase of 5.5 percent in 2016. American Airlines, Delta Air Lines, Southwest, and TACV Cabo Verde Airlines increased available seat capacity at the airport, with American Airlines and TACV Cabo Verde Airlines implementing the most significant increases on a year-over-year basis. American Airlines increased capacity and began daily service in April 2016 to Chicago O'Hare using regional jets. In 2016, T.F. Green Airport reintroduced international service by a new carrier, Azores Airlines (formerly SATA International), for seasonal summer service to Ponta Delgada, Portugal. Southwest introduced twice-daily non-stop service to Washington National. Cape Air's service to Block Island, Martha's Vineyard, and Nantucket were no longer provided in 2016. The number of passengers at T.F. Green Airport increased by 2.4 percent in 2016, compared to 2015 (see **Table 4-2**). In 2017, with the addition of service from Frontier Airlines and Norwegian Air Shuttle, passenger counts increased by nearly 8 percent or approximately 285,000 passengers.

Manchester-Boston Regional Airport

Manchester-Boston Regional Airport in Manchester, NH saw an overall increase in departing seat capacity as American Airlines increased departing seats in Charlotte and Washington National and decreased departing seats in Philadelphia. Southwest Airlines discontinued services to Fort Lauderdale and Las Vegas; however, it increased frequencies to Baltimore, Chicago Midway, Tampa, and Orlando. Delta Air Lines and United Airlines reduced seat capacity by 1.3 percent and 3.5 percent, respectively, compared to 2015. Delta Connection reduced frequencies to New York LaGuardia, and United Airlines trimmed serves to Chicago O'Hare and New York Newark.

Portland International Jetport

Portland International Jetport in Portland, ME experienced a 2.9 percent increase in airline seat capacity in 2016 due to service increases by American Airlines, Delta Air Lines, United Airlines, and Southwest Airlines. American Airlines increased scheduled seats by 2.3 percent, adding frequencies in the Charlotte and Washington National markets. United Airlines, Southwest Airlines, and Delta Air Lines also increased seat capacity by 2.9 percent, 6.3 percent, and 4.0 percent, respectively. JetBlue Airways reduced seat capacity at Portland International Jetport in 2016, with reduced frequencies to New York JFK. In 2016, the airport gained new services to Bar Harbor, Islip, Melbourne, and Sarasota/Bradenton by Elite Airways.

Burlington International Airport

Burlington International Airport in South Burlington, VT experienced an overall increase of 2.1 percent in airline seat capacity in 2016. JetBlue Airways, United Airlines, and American Airlines increased departing seat capacity at the airport, while Delta Air Lines, Allegiant Air, and Porter Airlines reduced departing seat capacity in 2016. Delta Air Lines reduced seat capacity by 4.8 percent, decreasing scheduled seats to New York La Guardia. JetBlue Airways increased seat capacity and frequency in the New York JFK market. United Airlines increased capacity to New York Newark and Washington Dulles. Seasonal service to Toronto City Airport by Porter Airlines was adjusted to a more limited winter schedule in 2016, with a 44 percent reduction in scheduled departures. American Airlines began non-stop service to New York LaGuardia and increased overall seat capacity at Burlington by 3.8 percent in 2016. Allegiant Air saw declining growth in 2016, decreasing scheduled frequencies in its Orlando/Sanford market.

Bangor International Airport

Bangor International Airport in Bangor, ME saw an overall seat capacity increase of 3 percent in 2016. United Airlines, Allegiant Air, and American Airlines all increased scheduled seats in 2016, while Delta Air Lines had a slight decrease in overall capacity at the airport. American Airlines introduced services to New York LaGuardia, and United Airlines started flying to New York Newark. Allegiant Air discontinued its recently launched non-stop service to Punta Gorda but increased frequencies in its Orlando/Sanford and St. Petersburg/Clearwater markets.

Tweed-New Haven Airport, Portsmouth International Airport, and Hanscom Field

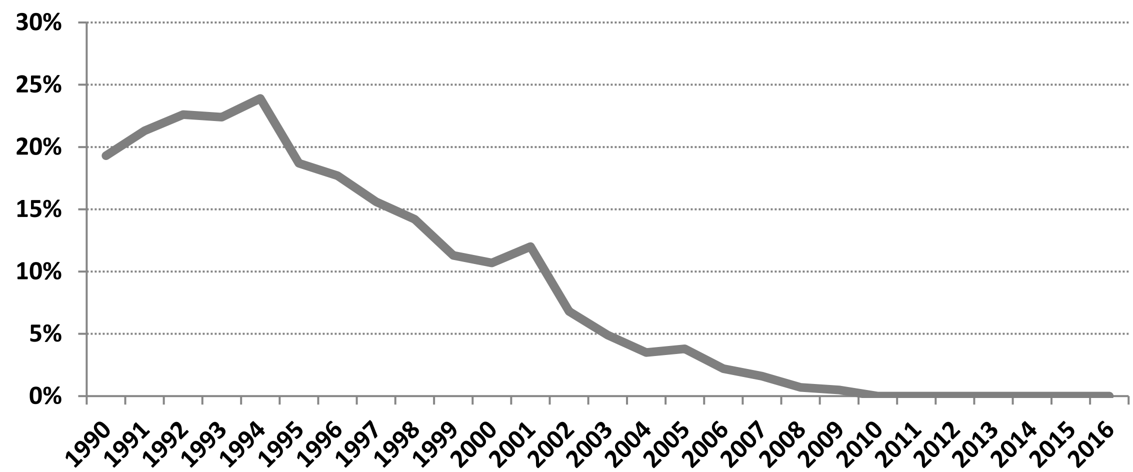
Among the other smaller regional airports, Tweed-New Haven Airport (CT) and Portsmouth International Airport (NH) are both served by a single carrier, while Hanscom Field (MA) has no scheduled commercial service. In 2016, Tweed-New Haven Airport saw reduced departing frequencies of 8.3 percent as American Airlines reduced service to Philadelphia, the only commercial market served from the airport. Portsmouth International Airport lost scheduled commercial service in 2008 when Allegiant Air discontinued services but regained commercial service in 2013 when Allegiant Air re-entered the market with non-stop service to Orlando/Sanford. Allegiant Air has continued to expand at the airport in recent years, adding Punta Gorda as a second destination in 2014 and Fort Lauderdale as a third destination in late 2015. In 2016, St. Petersburg/Clearwater was added. Portsmouth International Airport saw seat capacity growth of 31.8 percent in 2016 due to Allegiant Air's increased service. Hanscom Field does not have scheduled commercial service; public charter carrier, Streamline, introduced regularly scheduled service on turboprop aircraft from Hanscom Field to Trenton, NJ in 2011, but this service was discontinued in 2012.

Regional Reliance on Logan Airport

Despite the service reductions at the regional airports in 2016, the trend of decreased reliance on connecting service through Logan Airport continued. **Figure 4-4** shows that the share of flights between the regional airports and Logan Airport has been declining steadily since the mid-1990s. In the early 1990s, scheduled service to Logan Airport represented over 20 percent of regional airport flights. This share dropped as regional airports gained more non-stop service to both O&D airports and airline connecting hubs. In 2010, the last scheduled flights from the regional airports to Logan Airport were eliminated, reducing pressure on Logan Airport to provide connecting service for small planes from small communities to other destinations. This trend results in more convenient air service routings for passengers and opens capacity at Logan Airport for transcontinental and international flights.

However, while service between the 10 regional airports and Logan Airport has been eliminated, other remote communities in New England continue to rely on Logan Airport for connecting services. Logan Airport acts as a connecting hub for a number of other New England airports, such as the Cape Cod and Island Airports. Logan Airport remains the sole commercial air service destination for some communities, such as Augusta, Presque Isle, and Rockland, ME, as well as Rutland, VT.

Figure 4-4 Share of Flights Originating at Regional Airports with Logan Airport as Destination, 1990-2016



Source: OAG Schedules (August for each year).
Note: Includes Bangor International, Bradley International, Burlington International, Hanscom Field, Manchester-Boston Regional, Portland International, Portsmouth International, T.F. Green, Tweed-New Haven, and Worcester Regional airports.

Regional Aviation Economic Impact Study

In 2014, the Aeronautics Division of the Massachusetts Department of Transportation (MassDOT) completed a wide-ranging economic impact study[14] of the statewide airports system's (the 39 public use airports, including Logan Airport) contribution to the economy of Massachusetts. The analysis found that Massachusetts public use airports generated $16.6 billion in total economic activity, including $6.1 billion in total annual payroll resulting from 162,250 jobs that can be traced to the aviation industry. In particular, the analysis noted that Massport's three airports make significant contributions to the regional economy, generating approximately $15.1 billion, or 91 percent of the overall economic benefits generated by the Massachusetts airport system. Specifically, Logan Airport supported approximately 132,000 jobs in Massachusetts, and the total economic impact of Logan Airport is now estimated at approximately $13.4 billion per year. Worcester Regional Airport supported 360 jobs, with a total economic impact of $46.4 million, while Hanscom Field supported 1,745 jobs, with a total economic impact of $349 billion. For every $100 spent by aviation-related businesses, an additional multiplier impact of $56 is created within Massachusetts, according to the study. While the economic impact of the region's airports was the focus of the study, it also noted qualitative benefits of the state's airports including:

- Facilitating emergency medical transport;
- Providing police support;
- Supporting aerial surveying, photography, and inspection operations;
- Conducting search-and-rescue operations;
- Supporting the U.S. military and other government operations; and

14 Massachusetts Department of Transportation Aeronautics Division. (2014). *Massachusetts Statewide Airport Economic Impact Study Update Executive Summary*. http://www.massdot.state.ma.us/portals/7/docs/airportEconomicImpactSummary.pdf.

- Providing youth outreach activities.

Regional Airport Facility Improvement Plans

The following section describes significant airport improvements that are planned or under construction at the regional airports in the near future.

Hanscom Field (BED)

Massport continues to invest in Hanscom Field to improve and upgrade facilities and maintain a safe, secure, and efficient airport. Past and future capital investments ensure that Hanscom Field can continue to serve its role as a GA reliever to Logan Airport as well as a premier business aviation facility for the region. In FY 2016, Massport invested $6.5 million in airfield, terminal, equipment, and other facility improvements at Hanscom Field. These airport improvement projects are summarized in the annual reports on *The State of Hanscom*.[15]

Massport's recent capital investment projects at Hanscom Field included:

- Massport rehabilitated the Runway 23 safety area, beyond the runway end, and a portion of Taxiway Juliet, south of Taxiway Tango.
- Massport removed vegetation obstructions on all four runway ends using recommendations in the 2014 to 2018 *Vegetation Management Plan* update.
- Massport Fire-Rescue began operations in November 2015, while U.S. Air Force Fire continues to provide support for structural fires and secondary support for emergency response. Construction to add a vehicle bay to the existing Massport maintenance garage was competed. In 2017, the design of the new Airport Rescue and Firefighting Facility (ARFF)/United States Customs and Border Protection (CBP) permanent facility continued. Construction is estimated to begin in 2019.
- Massport continued to implement all aspects of its *Wildlife Hazard Management Plan* for BED. Massport installed a wildlife exclusion fence near the headwaters of the Shawsheen River to prevent wildlife from entering the airfield. Upgrades to airfield perimeter fencing are also planned.
- Massport installed signage and landscaping at the entrance to Hanscom Drive.
- Massport also finalized replacement of the field maintenance garage roof, which was at the end of its useful life.

Upcoming projects include:

- Replacement of the airfield lighting control system;
- Continued airfield pavement rehabilitation;
- Rehabilitation of the T-Hangar roof;
- Periodic replacement of T-Hangars in the terminal area;
- Rehabilitation of landside roadways;
- Improvements to airfield drainage;

15 Massport. March 2016. *The State of Hanscom*. https://www.massport.com/media/427753/StateOfHanscom-2016.pdf.

- New ARFF;
- New U.S. CBP facility; and
- Updating aging infrastructure, including new corporate hangars, new Boston MedFlight hangar, and planning for replacement of hangars in the Pine Hill area and North Ramp.

In addition to Massport's investments, the Authority solicits third-party development of facilities that support and enhance Hanscom Field's role in the regional transportation system. Many of the hangars at Hanscom Field are owned or leased by tenants who are responsible for maintaining them.

On-going third-party projects at Hanscom Field include:

- In 2012 and 2013, Jet Aviation undertook the planning and design process to replace Hangar 17 with a more modern facility. In 2013, Jet Aviation submitted an Environmental Assessment (EA) to FAA to begin the permitting process. FAA issued a Finding of No Significant Impact (FONSI) in April 2014. In 2014, the permitting process continued, and MassDEP approved the project in March 2015. In 2015, Jet Aviation began phase 1 of construction, which includes two parking lots, an access road, and underground infrastructure to support the new parking lots. In 2017, Jet Aviation completed construction of the hangar, fixed base operator (FBO), and ramp.
- In 2015, the lease for Hangar 12A expired. Massport issued a Request for Proposal (RFP) for the re-development of the parcel and, in 2016, accepted a proposal from Boston MedFlight. In 2017, Boston MedFlight began construction activities to re-develop Hangar 12A.
- Massport continues working with General Services Administration to acquire a parcel of land north of the airfield, which is currently owned by the U.S. Navy. If transferred, Massport would issue a RFP for redevelopment of the property and existing Navy Hangar.

Worcester Regional Airport (ORH)

Massport is committed to the long-term support of Worcester Regional Airport as demonstrated by the following initiatives:

- Massport is investing $100 million over the next 10 years to revitalize and grow commercial operations at Worcester Regional Airport. As a result of this collaboration, JetBlue Airways has already handled over 500,000 passengers at Worcester Regional Airport since commencing operations in late 2013. Starting in May 2018, JetBlue Airways will offer flights to JFK International Airport in New York, NY. Additionally, American Airlines will offer flights to Philadelphia International Airport starting October 2018.
- Massport recently completed the Worcester Regional Airport's all-weather capability, including upgrading the Runway 11 Instrument Landing System from a CAT I to a CAT III system, and its associated required infrastructure and navigation aids, along with a partial parallel taxiway. This project, which will allow aircraft to land on Runway 11 during virtually all-weather conditions, is a safety and operational priority for Worcester Regional Airport. Massport submitted an Environmental Notification Form (ENF) for the *Worcester Regional Airport CAT-III Instrument Landing System and Taxiway Project* to the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) in January 2014, in accordance with the Massachusetts Environmental Policy Act (MEPA). It was determined that no further review was required, which allowed the project to advance into the detailed permitting phase. In

February 2015, FAA issued a FONSI. All local, state, and federal permits were secured by late 2015, and construction was completed in early 2018. The CAT III system became fully operational after FAA certification in March 2018.

- In January 2012, Massport approved a proposal by Rectrix Commercial Aviation Services, Inc. (Rectrix) to develop an aircraft hangar and office space at Worcester Regional Airport. FAA issued a FONSI on August 13, 2013. Construction started on the $6.7 million project in August 2013. The project includes 27,000 square feet of hangar and office space that will house large corporate jets and a regional aircraft maintenance facility. Rectrix offers private jet charters and FBO services, including transient aircraft parking and fueling services from the new facility. The FAA issued a FONSI on April 4, 2014. Construction was completed in November 2015.

T.F. Green Airport (PVD)

In September 2011, FAA issued a Record of Decision (ROD) approving the Preferred Alternative for the T.F. Green Airport Improvement Program, which entailed an extension to the airport's main runway, Runway 5-23, to allow non-stop flights to the West Coast as well as runway safety area improvements on the crosswind runway, and other safety and efficiency projects. The crosswind runway safety area projects were substantially completed in 2015. Construction of the Runway 5-23 extension began in 2016 and will be complete by December 2017. The Main Avenue relocation on the Runway 5 End, an enabling project for the runway extension, began in 2015 and was completed in 2016. The Airport Improvement Program includes the following projects:

- The Runway 16 End Safety Area improvements involved installation of Engineered Material Arresting System (EMAS), airfield electrical improvements on the Runway 16 end, and reconfiguration of the taxi lane from the northeast ramp to the Runway 16 end. This project is complete.
- The demolition of Hangar 1, an obstruction to airspace on the Runway 16 End, was completed in July 2014.
- Construction of the Runway 34 End Safety Area improvements began in 2014. Major elements of the project included EMAS construction at the Runway 34 End, partial reconstruction of Taxiway C, and construction of the associated airport service road. Construction was substantially completed at the end of 2015.
- The Runway 5 End extension began in the summer of 2016 and was completed by the end of 2017. This project involved extension of the primary runway from its current length of 7,166 feet to 8,700 feet, which will allow for non-stop flights to West Coast destinations. The project also involved an extension of the parallel Taxiway M and construction of an EMAS at the Runway 5 end. The Main Avenue relocation (an enabling project for the runway extension) began in August 2015 and was completed in the fall of 2016.

- The Runway 5 extension required the relocation of Winslow Park, which commenced in June 2014 and was completed in 2015. Work included replacement of the existing soccer and softball fields, playground facility, concession and restroom facilities, as well as roadway calming treatments and landscaping improvements.

Separate from the T.F. Green Airport Improvement Program, construction of a Deicer Management System, which allows for the collection and treatment of glycol used to de-ice aircraft at T.F. Green, began in 2013 and was put into operation in 2015.

Manchester-Boston Regional Airport (MHT)

Since the early 1990s, over $500 million was invested in Manchester-Boston Regional Airport to improve and develop landside and airside facilities and infrastructure. Projects included a 158,000-square foot passenger terminal and two subsequent 75,000-square foot terminal additions, a 4,800-space parking garage with an elevated pedestrian walkway connection to the terminal, roadway improvements, runway safety area improvements, and extensive runway reconstruction and lengthening. Customer service enhancement initiatives have included the construction of a cell phone lot in 2007 for motorists waiting to pick up passengers and various concessions improvements through 2008 and 2009.

Manchester-Boston Regional Airport completed an Airport Master Plan Update in 2011. The Airport Master Plan Update provides a blueprint for development and improvement of airport facilities and infrastructure through 2030. Recent and on-going improvement projects at the airport include:

- The Terminal Ramp Replacement Project, to rehabilitate the concrete apron areas adjacent to the terminal building, began in 2012 and was completed in 2013.
- Demolition of structures in the runway protection zone (RPZ) of Runway 06 will remove buildings with usages deemed non-compatible with RPZs, as defined by FAA. Elements of the project include demolishing the Highlander Inn and Conference Center and associated buildings.
- Upgrades to the terminal building HVAC systems will address certain deficiencies in the terminal cooling system and will provide significant improvements to customer comfort levels within areas of the terminal building.
- Parking Lot A access improvements.
- Overlaying a portion of Taxiway M.

Other potential projects over the coming years include: wireless network and support services; rental car customer service facility; security checkpoint consolidation; operations and maintenance of the in-line baggage handling system, and passenger boarding bridge.

Bradley International Airport (BDL)

A $200-million airport modernization project at Bradley International Airport was completed in 2010. The modernization project included a refurbished and expanded Terminal A with an additional 260,000 square feet of new concourse, ticket counters and waiting areas, major gate renovations, and a state-of-the-art security and communications system. A 28,000-square foot international arrivals building was also completed.

In 2011, the Connecticut Airport Authority was established to oversee the operation and development of Bradley International Airport. The Connecticut Airport Authority, a quasi-public agency consisting of an 11-member board, manages day-to-day operations at Bradley International Airport, as well as at five GA airports in Connecticut (Danielson, Groton/New London, Hartford Brainard, Waterbury-Oxford, and Windham airports). The goal of the Connecticut Airport Authority is to transform Bradley International Airport and the five GA airports into economic drivers for the state. Bradley International Airport was previously run by a board under the Connecticut Department of Transportation.

A three-year renovation project for the Sheraton Bradley Airport Hotel was completed in 2011, featuring newly outfitted guest rooms, a redesigned lobby, and an expanded fitness center and pool. More recently, the Connecticut Airport Authority has announced the completion of a food court renovation as well as the opening of a new cell phone waiting lot. The 2010 to 2013 *Bradley International Airport Strategic Plan* highlights several airport improvement projects between 2012 and 2013. These projects include:

- A sound insulation program;
- Rehabilitating Taxiway C North;
- Rehabilitating Taxiway C South;
- Utility relocation and obstruction removal;
- Demolishing old Murphy Terminals and designing of new Terminal B; and
- Constructing roadway realignment.

The Airport's $280-million capital improvement program for FY 2014 through FY 2018 includes the following projects:

- A consolidated rental car facility;
- Demolishing the Murphy Terminal;
- Roadway demolition and re-alignment;
- Utility relocation; and
- Airfield improvements.

Local and Regional Long-Range Transportation Planning

A balanced regional intermodal transportation network would reduce reliance on Logan Airport as the region's primary transportation hub and provide New England travelers with a greater range of viable transportation options. This section highlights efforts to achieve this balance through cooperative transportation planning at a broad array of transportation agencies and concerned parties to promote an integrated, multimodal regional transportation network.

In 2009, MassDOT was created to unify the various organizations and agencies that plan, build, own, operate, and maintain the Commonwealth's transportation infrastructure. The creation of MassDOT was intended to help integrate, coordinate, and prioritize multimodal transportation policy and investment in Massachusetts, resulting in a more effective, efficient, equitable, rational, and innovative transportation system. As a fundamental part of the transportation framework in the Boston metropolitan area, and for all of New England, Massport supports an integrated multimodal transportation policy to improve the efficient use of transportation infrastructure on both a metropolitan and a regional scale. In 2015, the MassDOT Board expanded from a five-member board of directors to an 11-member board of directors and a separate five-member Massachusetts Bay Transportation Authority (MBTA) Financial Management Control Board.[16]

Logan Airport's functional role is New England's premier commercial airport, providing an essential connection between the New England states and the global economy. Recent studies have indicated that there is a significant lack of usable aviation capacity in the coastal mega-regions[17] (although not in Boston itself) and identified a need for access to alternative forms of short-distance travel across these regions.[18]
Since the construction of a second major Boston airport has been judged impractical in the past, the potential of high-speed rail is increasingly viewed as an important complementary component in the regional transportation system and aviation planning.[19] Given the comparable travel times, proximity of service to downtown Boston, and the potential for highly efficient electrified propulsion, high-speed rail could provide efficient intercity connectivity for city-pairs in a corridor up to 600 miles long that would be competitive with air travel.[20] Boston's South Station is undergoing planning and design for expansion that would support current and future rail mobility in Massachusetts and along the Northeast Corridor (NEC), including supporting future high-speed rail. In 2012, Amtrak services in the NEC had a 54-percent share[21] of the Boston-New York City markets (excluding traffic by other surface modes such as private car and bus).

Massachusetts Statewide Airport System Plan

In 2010, the MassDOT Aeronautics Division completed the *Massachusetts Statewide Airport System Plan*.[22] The plan provides guidance to state policy makers for the long-term development of the Commonwealth's airport system. It documents the status of the current airport system; provides a long-term vision for the system; identifies system goals and related improvements; establishes priorities for system and airport funding; and provides supporting data and materials.

16 Massport remains an independent authority with its own board, including the Secretary of MassDOT as an ex-officio member, and is focused on airport and seaport needs.

17 The coastal mega-regions are the continuously urbanized areas along the east and west coasts of the U.S. (Washington, DC, Philadelphia, New York City, Hartford, and Boston).

18 FAA. *Capacity Needs in the National Airspace system 2007-2025* (commonly referred to as FACT-2). https://www.faa.gov/airports/resources/publications/reports/media/fact_2.pdf; TRB. ACRP Report 31: Innovative Approaches to Addressing Aviation Capacity Issues in Coastal Mega-regions. http://rsginc.com/files/publications/24.RSG_ACRP_Report31.pdf.

19 Transportation Research Board. *ACRP 03-23: Integrating Aviation and Passenger Rail Planning*. http://rsginc.com/files/publications/24.RSG_ACRP_Report31.pdf.

20 America 2050. *Where High-Speed Rail Works Best.* http://www.america2050.org/pdf/Where-HSR-Works-Best.pdf. Pages 1-2.

21 Latest available statistics from Amtrak; nothing more recent has been released.

22 MassDOT. *Massachusetts Statewide Airport System Plan*. http://www.massdot.state.ma.us/aeronautics/StatewideAirportSystemPlan.aspx.

Boston and Statewide Long-Term Transportation Vision

Long-Range Transportation Plan of the Boston Region Metropolitan Planning Organization (MPO)

In July 2015, the Boston MPO published its quadrennial long-range plan for the region and its transportation network, titled *Charting Progress to 2040*.[23] The plan focuses on six goals: safety; preservation of the existing system; capacity management/mobility; clean air/clean communities; transportation equity; and economic vitality. It envisions the use of new technology and prioritizes safety, equitable access, mobility, and varied transportation options.

The plan also envisions the Boston metropolitan region as continuing to be an economic, educational, and cultural hub, which will also continue contributing to a high quality of life. A high quality of life is supported by a well-maintained transportation system consisting of safe, healthy, efficient, and varied transportation options. An improved and diverse transportation system increases access to educational opportunities, jobs, and services, creating options for many communities including those dependent upon affordable housing. Increased opportunities to use active or high occupancy modes of transportation can reduce emissions, improving air quality and reducing the overall environmental impact attributable to the transportation sector. This vision is possible through attentive maintenance, cost-effective management, and strategic investment in the region's transportation system. This vision is broad-based; more specifically for the Airport, the long-range vision finds that support for air cargo is critical.

As a member of the MPO Board, Massport is an active participant in the development of the Boston MPO's long-range transportation plan.

weMove Massachusetts

In 2014, MassDOT developed the Commonwealth's first multimodal long-range transportation plan known as *weMove Massachusetts*.[24] The most recent federal transportation reauthorization requires that each state develop performance-based long-range transportation plans. It also responds to requirements in the 2009 Massachusetts transportation reform law to create such a plan.

The philosophy behind *weMove Massachusetts* is that MassDOT should make logical, defensible, and smart choices on how to invest the agency's limited resources. The goals of *weMove Massachusetts* are: to engage stakeholders, including internal agency stakeholders, through a bottom-up approach in a discussion about the present and future needs of the transportation system; to build action-oriented policies based on stakeholder feedback that can serve as a bridge among MassDOT's values and investments; and to develop a forward thinking, data-driven, decision-making methodology to assist MassDOT in implementing its priorities transparently and measurably.

23 Boston Region Metropolitan Planning Organization. *Charting Progress to 2040*. http://www.ctps.org/lrtp.

24 Massachusetts Department of Transportation. *weMove Massachusetts.* https://www.massdot.state.ma.us/wemove/Home.aspx.

Focus40

Focus40 is the 25-year investment plan for the MBTA to meet the needs of the Boston Region through the year 2040. The plan considers all rapid transit, commuter rail, bus, ferry, and paratransit services.[25] The plan will develop "a long-term investment strategy that recognizes both today's infrastructure challenges as well as the shifting demographics, changing climate, and evolving technologies that may collectively alter the role the MBTA will play in the Greater Boston of the future."[26] Massport is actively participating in the Focus40 planning process to provide input on the role of Logan Airport and other Massport assets.

Massachusetts State Freight Plan

In 2016, MassDOT began the process of preparing a new, comprehensive Massachusetts State Freight Plan to look at the near-term and long-term vision for the freight system in Massachusetts. MassDOT released a draft plan for comment in 2017 and plans to release the final document in 2018. The new plan will include all freight modes, including air, rail, truck, and maritime. This plan will help document and guide Massport's freight planning work at Logan Airport, the Port of Boston, and Massport's other assets. Part of the plan includes the designation of new miles of Critical Urban and Rural Freight Routes to the National Highway Freight Network, improving connections to Logan Airport and Massport maritime facilities. The State Freight Plan will also assist in identifying cargo trends. For example, the 2010 Massachusetts State Freight Plan[27] found that air freight shipping will grow more quickly than any other shipping mode. Massport is actively engaged in the Statewide Freight Plan public process as a member of the leadership Freight Advisory Committee.

Massachusetts State Rail Plan[28]

In 2010, MassDOT developed the first State Rail Plan to guide planning and investment in freight, commuter, and passenger rail services across Massachusetts. The current plan lays out a 20-year vision and a four-year action plan describing policies, planning, infrastructure, and investment to guide the state's rail system. MassDOT is currently in the process of updating the plan with a proposed release date in 2018. Massport has supported and advised MassDOT on this plan.

Regional Cooperative Planning Efforts

Massport participates in regional transportation planning efforts, which are listed below.

New England Regional Airport System Plan (NERASP) – Commercial Service Airports

In fall of 2006, FAA New England Region, in concert with the New England Airport Directors and New England State Aviation Directors, completed the NERASP.[29] The results of this study describe the foundation of a

25 Transportation for persons with disabilities to supplement public transportation systems.
26 Massachusetts Department of Transportation. Focus40. https://www.mbtafocus40.com/.
27 Massachusetts Department of Transportation. September 2010. State Freight Plan. https://www.massdot.state.ma.us/portals/17/docs/freightplan/MAFreightPlanSeptember2010v2.pdf.
30 Massachusetts Department of Transportation. State Rail Plan. https://www.mass.gov/service-details/rail-plan.
29 The New England Regional Airport System Plan (NERASP), which was published by the FAA in 2006, includes Logan International Airport and these 10 regional airports: Bangor International, Bradley International, Burlington International, Hanscom Field, Manchester-Boston Regional, Portland International, Portsmouth International, T.F. Green, Tweed-New Haven, and Worcester Regional airports.

regional strategy for the air carrier airport system to support the needs of air passengers through 2020. To date, the development of that strategy has been instrumental in facilitating the investment and development of the primary commercial airport system in New England.

New England Regional Airport System Plan – General Aviation (NERASP-GA)

During preparation of the 2006 NERASP study, which analyzed the primary commercial airports in New England, the group recognized that a similar evaluation of GA would also prove useful. It would provide state aviation officials with a greater understanding of airport roles and infrastructure investment. Faced with the current economy, rising airport and aircraft operational costs, declining operational activity, an aging infrastructure, and with limited state and federal funds to address improvements, the importance of developing both a short-range and long-range perspective on the future performance of the New England GA airport system is clear.

The New England state aviation officials, in partnership with the FAA, are currently conducting a study of the GA airport system in New England, including primary commercial service airports that service a GA component. This assessment of the New England GA airport system will provide state aviation officials with a common understanding of their state airport systems in relation to the New England region as a whole. Assisted by this information, the FAA will be better positioned to make decisions regarding priority capital investments. Moreover, the NERASP study proved that the geographic boundary of the New England region, as well as its cultural identity, makes an overall study of New England an effective planning approach. Information on the NERASP-GA study can be found at http://www.nerasp-ga.com.

At a local level, Massport engages with municipalities, particularly the City of Boston, to coordinate on transportation planning and land use issues. Three recent plans, released by the City of Boston and discussed below, provide a relevant policy framework.

Imagine Boston 2030

Imagine Boston 2030, the City of Boston's comprehensive plan, commenced in the fall of 2015 and was published in July 2017. This new citywide plan provides a policy framework for future development in Boston, addressing key themes including: housing, mobility, climate adaptation, open space, equity, arts and culture, design and placemaking, and health. Many themes addressed in this plan will inform Massport's planning efforts and conversely, Massport continues to engage with the City of Boston and other stakeholders to shape the implementation of relevant strategies.

GoBoston 2030

The City of Boston's long-range transportation plan, GoBoston 2030, is intended as both a visioning and action plan to guide transportation planning policy and infrastructure investments until 2030. The plan expresses three guiding principles: equity, economic opportunity, and climate responsiveness establishing primary goals and aspirational targets. These targets include expanding access to transportation options, improving safety, reducing commute times, and promoting mode shift. To meet these aspirational targets, the plan prioritizes capital investments in transportation improvements. Many of these transportation planning initiatives will impact Massport's facilities and include projects where Massport is a key stakeholder and a member of working groups evaluating implementation options.

Climate Ready Boston

Climate Ready Boston is the City of Boston's comprehensive action plan to guide Boston toward a more affordable, equitable, connected, and resilient future. The four components of the Climate Ready Boston plan are updating climate projections (e.g., extreme temperatures, sea level rise, and precipitation), completing vulnerability assessments, identifying impacts to focus areas, and creating more climate resiliency initiatives through policy, planning and financial initiatives. Climate Ready Boston is coordinated with the Imagine Boston 2030 long range transportation plan. In December 2016, the study report was released. It will be followed in 2017 and 2018 with neighborhood implementation strategies.

Conference of New England Governors (CONEG) and the Conference of New England Governors and Eastern Canadian Premiers (NEG/ECP)

The Conference of New England Governors (CONEG) is a formally established body that coordinates regional policy programs in the areas of economic development, transportation, environment, energy, and health, among others. The CONEG also provides secretarial support to the separate Conference of New England Governors and Eastern Canadian Premiers (NEG/ECP). The latter coordinates policies of common interest across borders including infrastructure, energy, the environment, economic development, and trade. The CONEG offers a forum for policy on aviation and intercity passenger rail, particularly in the northeastern coastal mega-region, as part of a larger transportation system that needs modal balance. Efficient use of this multi-state network affects the overall viability of the highway, aviation, freight, and commuter rail transportation networks that serve the region and the nation. Improved planning coordination between airports and intercity passenger rail services and related ground transportation offers the potential to achieve complementary investments in airport and rail capacity and services.

MassDOT has a representative on the NEG/ECP Transportation and Air Quality Committee, which covers regional transportation issues and infrastructure development, use, and efficiency. The NEG/ECP and other policy decision makers throughout the region have been able to utilize strategies and information developed in the NERASP, which provides a framework for integrated regional aviation policy and planning. This organization serves an important function to help achieve a greater balance between air, rail, and auto trips, and ultimately help to increase overall transportation capacity without overburdening Logan Airport and the New England aviation system.

In 2015, the NEG/ECP passed and implemented the *Climate Change Action Plan* which provided direction on reducing greenhouse gas emissions and a target range of at least 35 to 45 percent below 1990 levels by 2030.[30] Since 1973, the six New England states and the five Eastern Canadian provinces have worked cooperatively to address their shared interests across the border. Through the annual conferences of governors and premiers and discussions of joint committees, NEG/ECP encourages cooperation by:

- Developing networks and relationships;
- Taking collective action;

30 Conference of New England Governors and Eastern Canadian Premiers. Resolution 39-1, *Resolution Concerning Climate Change*. August 30, 2015.

- Engaging in regional projects;
- Undertaking research; and
- Increasing public awareness of shared interests.

Among the topics recently addressed by the governors and premiers are:

- Ensuring a clean, efficient and reliable energy future for the region;
- Energy innovation for a competitive economy;
- Changing global energy markets and the region's energy landscape;
- Cross-border partnerships for economic development and trade;
- Transportation and air quality;
- Climate change action plans and greenhouse gas emission reduction strategies;
- Energy efficient vehicle and infrastructure technologies; and
- Cross border mutual aid in emergency planning.[31]

Regional Rail Transportation Initiatives

This section reports on recent developments and current rail service originating in Boston, the status of air-rail linkages in the NEC, and the expanding Pilgrim Partnership, which provides commuter rail between Massachusetts and Rhode Island.

Amtrak Northeast Corridor (NEC)

Amtrak's NEC is an intercity rail line that operates between Boston-South Station and Washington, DC via New York City. Other major destinations served by the route include Providence, RI; New Haven, CT; Philadelphia, PA; and Baltimore, MD. Logan Airport passengers can connect directly to Boston-South Station via Silver Line bus rapid transit (BRT) service or via taxi or other unscheduled mode. Amtrak operates two services between Boston and Washington, DC: the Acela Express (high-speed, limited-stop service) and the Northeast Regional (lower-speed service that makes local stops along the route). Travel times on the Acela Express range from approximately 3.5 hours from Boston to New York to approximately 6.75 hours from Boston to Washington, DC. Travel times on the Northeast Regional range from about 4.25 hours from Boston to New York to approximately 7.75 hours from Boston to Washington, DC. On weekdays, a total of 19 daily departures are offered from Boston-South Station to New York-Penn Station, of which about half are Acela Express. On Saturdays and Sundays, a total of 12 departures and 15 departures are offered from Boston-South Station to New York, respectively. Most trips continue south to Washington, DC, and a smaller number of Northeast Regional trains continue further south to Central and Eastern Virginia.

System-wide Amtrak ridership was 31.3 million one-way trips in FY 2016, an increase of 400,000 over the previous year.[32] In FY 2016, the NEC carried 11.9 million passengers on its Acela Express and Northeast

31 New England Governors/Eastern Canadian Premiers. http://www.coneg.org/negecp.
32 Amtrak. November 2016. Amtrak Media Center. https://media.amtrak.com/2016/11/amtrak-delivers-strong-fy-2016-financial- results/.

Regional services, up 2 percent from the prior year. Acela Express accounted for nearly 3.5 million passengers, while the Northeast Regional accounted for 8.4 million passengers. Overall NEC ridership reached a new record in 2016, surpassing 2015 record levels. Amtrak's share of the Northeast total passenger market has increased substantially since the introduction of Acela Express service in 2000.

Northeast Corridor Infrastructure Master Plan and Next-Generation High Speed Rail Plan

The *Northeast Corridor Infrastructure Master Plan*, a regional rail planning study, was released in May 2010. The Master Plan[33] documents NEC growth needs through 2030, including expanded capacity and improvements in Boston-New York and New York-Washington intercity travel times. A 76-percent increase in rail ridership from 13 million to 23 million,[34] a 36-percent increase in train movements from 154 average weekday to 210 average weekday, and the need for $52 billion in additional capital investment is forecasted over the 20-year study period. The Federal Railroad Administration (FRA) is currently preparing a future plan for the NEC. In December 2016, the FRA released a Tier 1 Final Environmental Impact Statement for NEC FUTURE, which includes a Preferred Alternative for the FRA's recommended plan for growing passenger rail service on the NEC, available online at: http://www.necfuture.com/tier1_eis/feis/.

To follow up on the release of the *Northeast Corridor Infrastructure Master Plan*, Amtrak also unveiled a next-generation high-speed rail proposal in September 2010, titled *A Vision for High-Speed Rail in the Northeast Corridor*. The proposal outlines a brand-new 427-mile two-track corridor running from Boston to Washington, offering high-speed rail service with sustained maximum speeds of 220 mph. Operations simulations estimate 83-minute trip times between Boston and New York by 2040 and 3-hour and 23-minute trip times between Boston and Washington. Under this Next-Generation high-speed rail plan, the New York City – Boston market would see a further shift in demand from auto and air to rail due to the dramatic improvements in rail travel times, and the air market between the two city-pairs is projected to be nearly eliminated by 2050.[35] This plan states that traveler's shift to high-speed rail would reduce delays on competing modes (air and auto) and the shift away from shorter and smaller intraregional flights would free up air transport capacity for higher-value transnational and international flights.[36]

An update to the *Northeast Corridor Infrastructure Master Plan* and *A Vision for High-Speed Rail in the Northeast Corridor* was released in July 2012. Since these two documents were released, the two programs have been integrated into a single coherent service and investment program, called the Northeast Corridor Capital Investment Program. The Northeast Corridor Capital Investment Program would advance the near-term projects outlined in the Master Plan to benefit the NEC, while incrementally phasing improvements to the Acela Express high-speed service to support the proposed next-generation high-speed rail.[37] The near-term NEC improvements are identified to occur between 2012 and 2025 and the long-term Next-Generation High-Speed Rail improvements are identified to occur between 2025 and 2040. The publication of the 2012

33 The NEC Master Plan Working Group. *The Northeast Corridor Infrastructure Master Plan*. https://www.amtrak.com/ccurl/870/270/Northeast-Corridor-Infrastructure-Master-Plan.pdf.

34 Includes ridership on Amtrak and state rail lines, but excludes ridership on commuter rail lines.

35 Amtrak. September 2010. *A Vision for High-Speed Rail in the Northeast Corridor*. Page 21. https://www.amtrak.com/ccurl/214/393/A-Vision-for-High-Speed-Rail-in-the-Northeast-Corridor.pdf.

36 *Ibid.*

37 Amtrak. July 2012. *The Amtrak Vision for the Northeast Corridor: 2012 Update Report*. https://www.amtrak.com/ccurl/453/325/Amtrak-Vision-for-the-Northeast-Corridor.pdf.

update is the first step in "improving the NEC for all users in order to sustainably support the population and economic growth facing the Northeast over the next 30 years," but a considerable amount of additional planning work is required by all stakeholders.[38]

In 2011, the U.S. DOT awarded Amtrak and the New York State DOT $745 million for two high-speed rail projects on the NEC. A major upgrade to tracks and overhead wires will be conducted along a 23-mile stretch in New Jersey, allowing for an improvement in Acela Express train speeds from 135 mph today to 160 mph. Improvements to the Harold railroad interlocking in Queens, NY will also be completed, eliminating delays and reducing commuting time for Amtrak riders.

In 2015, the Rhode Island Department of Transportation (RIDOT) and Amtrak began work on the Kingston Station Capacity Expansion. The project will improve train operations and the passenger experience along the Rhode Island stretch of the Northeast Corridor. The project features the construction of a third track at Kingston Station, which will enable higher speed Acela trains to safely bypass regional trains. The project was completed in 2017.[39]

RIDOT is also planning improvements to Providence Station, including interior and exterior station enhancements. This project will also analyze improvements that may provide new capacity for high-speed services.[40]

Northern New England Intercity Rail Initiative

The Northern New England Intercity Rail Initiative is an interstate, interagency collaboration between the Massachusetts Department of Transportation, the Vermont Agency of Transportation, and the Connecticut Department of Transportation to examine "the opportunities and impacts of more frequent and higher speed intercity passenger rail service on two major rail corridors."[41] The studied corridors are the Inland Route (between South Station and Western Massachusetts via Worcester and Springfield) and the Boston to Montreal Route. The study will evaluate ridership, environmental impacts, and service plans along the 470 miles along these two corridors.

Boston-South Station Expansion

In support of the Northeast Corridor Capital Investment Program, MassDOT is planning to expand Boston's South Station Rail Terminal capacity and related layover capacity to meet current and anticipated future (2035) high-speed, intercity, and commuter rail services needs on the NEC and on the MBTA's South Side commuter rail system. At present, South Station operates above its design capacity for efficient train operations and orderly passenger queuing. Operating with only 13 tracks, South Station constrains the current and future rail

38 *Ibid.*
39 Amtrak. *NEC Projects, Kingston Station Capacity Expansion.* https://nec.amtrak.com/content/kingston-station-capacity-expansion.
40 Amtrak. *NEC Projects, Providence Station Improvements.* https://nec.amtrak.com/content/providence-station-improvements.
41 Massachusetts Department of Transportation. Northern New England Intercity Rail Initiative. http://www.massdot.state.ma.us/northernnewenglandrail/Home.aspx.

mobility within Massachusetts and throughout New England and the NEC.[42] The proposed South Station Expansion Project will result in a number of benefits to rail mobility:[43]

- Enable growth in passenger rail transportation along the NEC and within the Commonwealth of Massachusetts;
- Improve service reliability through updates to rail infrastructure and related layover capacity;
- Improve the passenger capacity and experience of using South Station;
- Promote city-building in a key area of Boston; and
- Allow for Dorchester Avenue to be reopened for public use and enjoyment for the first time in decades.

The MEPA environmental review process for this project concluded with the issuance of a Secretary's Certificate on August 12, 2016 on the Final Environmental Impact Report (FEIR).[44] The National Environmental Policy Act (NEPA) environmental review process for this project concluded with the issuance of a Final EA and Section 4(f) Determination and FONSI on October 27, 2017.[45] FRA and MassDOT collected comments on the Draft EA and Draft Section 4(f) Determination for a 30-day public comment period, which concluded May 27, 2017. The draft document was circulated to agencies, project stakeholders, and individuals on the project distribution list for review and comment. Written responses to comments were provided in the FONSI.

North-South Rail Link

Boston is served by two commuter rail systems, one extending to the north of the city, the other to the south. They are disconnected from each other, and neither connects fully to the subway system. The North-South Rail Link is a proposed pair of rail tunnels that would connect North and South Stations in downtown Boston. MassDOT completed a Draft Environmental Impact Report (DEIR) between 1995 and 2003, but the project was not pursued at that time. MassDOT is currently undertaking a Feasibility Reassessment for the North South Rail Link Project to update the prior work and determine if further technical and financial analysis is needed. MassDOT anticipates completion of this Feasibility Reassessment in 2018.[46]

Commuter Rail Services

The Pilgrim Partnership is an arrangement between the MBTA and RIDOT, under which RIDOT allocates some of its federal funding to the MBTA in return for commuter rail service between Boston and Rhode Island. On weekdays, 20 round trips are provided between Boston and Providence. On Saturdays, nine round trips are provided between Boston and Providence, while seven round trips are provided on Sundays. Expanded weekday commuter rail service to T.F. Green Airport in Warwick, RI was introduced in December 2010. Travel

42 Massachusetts Department of Transportation. *About this Project.* http://www.massdot.state.ma.us/southstationexpansion/Home.aspx.

43 Massachusetts Department of Transportation. October 2017. *South Station Expansion Final Environmental Assessment and Section 4(f) Determination* https://www.massdot.state.ma.us/southstationexpansion/Documents/FinalEnvironmentalAssessment.aspx

44 Massachusetts Department of Transportation. June 2016. *South Station Expansion Final Environmental Impact Report.* http://www.massdot.state.ma.us/southstationexpansion/Documents/FEIR.aspx.

45 Massachusetts Department of Transportation. October 2017. *South Station Expansion Final Environmental Assessment and Section 4(f) Determination and Finding of No Significant Impact.* https://www.massdot.state.ma.us/southstationexpansion/Documents/FinalEnvironmentalAssessment.aspx.

46 Massachusetts Department of Transportation. *About this Project.* http://www.massdot.state.ma.us/planning/Main/CurrentStudies/NorthSouthRailLink.aspx

time between Boston and Warwick is approximately 1.25 to 1.5 hours. On weekdays, seven of the 20 daily outbound trips from Boston to Providence currently continue on to Warwick as well as Wickford, RI. Expanded weekday service to Wickford, RI commenced in 2012, with a potential extension further into South County as service in the state expands and ridership grows. Additionally, RIDOT, in cooperation with the City of Pawtucket, is currently procuring a Design-Build contractor to design and construct a new commuter rail station in Pawtucket, RI. The station is scheduled to open at the end of 2019.

The expansion of commuter rail service into RI enhances ground access options from the Boston metropolitan area to T.F. Green Airport. The passenger catchment areas of T.F. Green Airport and Logan Airport overlap, and this commuter rail service has the potential to attract passengers in the overlapping catchment area, living along the MBTA's Providence Line service to T.F. Green Airport.

Other Regional Cooperative Planning Efforts

Recognizing that Logan Airport is a substantial trip generator and key transportation resource in the metropolitan area, Massport participates in several interagency transportation planning forums pertaining to enhancing a variety of travel modes.

Healthy Transportation Compact

The Healthy Transportation Compact interagency initiative brings together the state departments of Health and Human Services, Energy and Environmental Affairs, the Commissioner of Public Health, the MassDOT Highway Division, and the MassDOT Rail and Transit Division, with the intention of facilitating transportation decisions that balance the needs of all transportation users, expand mobility, improve public health, support a cleaner environment, and create stronger communities. Actions include facilitating better accommodations for those with mobility limitations; increasing opportunities for physical activities; increasing bicycle and pedestrian travel through additional, safer, and better-connected bicycle and pedestrian infrastructure; a statewide complete streets policy; implementing health impact analyses for transportation decisions; and the federal Safe Routes to School program.

Massport activities at Logan Airport will support the Healthy Transportation Compact through its ongoing development of the Southwest Service Area and North Cargo Area. The projects include an improved pedestrian environment for employees, neighborhood residents, and visitors. Streetscape improvements and new pedestrian and bicycle routes strengthen connections between the neighborhoods, terminals, mass transit, the Harborwalk (a multimodal off-road path), Bremen Street Park, and the Greenway Connector, as well as the Logan Office Center and the on-Airport shuttle bus. Pedestrian actuated crossings are planned at signalized intersections along Harborside Drive and sidewalks provided along Harborside Drive, Jeffries Street, and Porter Street. Midblock crossings or crosswalks at unsignalized intersections will consider street and pedestrian level lighting, as well as advanced warning signs and/or systems, as necessary. As described previously, bicycle access and parking is planned in secured locations for public and employee use.

South Boston Waterfront Transportation Plan

Massport, the City of Boston, MassDOT, and the Massachusetts Convention Center Authority all participate in and manage the new sustainable transportation plan for the South Boston Waterfront. The resulting plan, featuring an unprecedented collaboration of the private and public sectors, is a blueprint for improving the growth of the Waterfront, proposing solutions to meet the growing and changing transportation needs of the district, and improving the public realm of the area, all the while preserving the quality of life for the surrounding neighborhoods. The plan benefitted from the input of area stakeholders through five community meetings and more than 50 outreach meetings throughout the process. Massport continues to engage in implementation of recommendations from this plan, in collaboration with other agency partners.

Water Transportation Advisory Council and Ferry Study

Massport participates in planning for water transportation in the Boston region as a member of state Water Transportation Advisory Council, convened by MassDOT. Massport also participates in a comprehensive study of commuter, recreational, and landside access needs to support water transportation in Boston Harbor. Massport is a steering committee member for this study led by Boston Harbor Now with support from MassDOT and other stakeholders.

Boston Metropolitan Planning Organization (Boston MPO)

Massport supports multimodal transportation planning and improving integration with its facilities through its permanent voting membership on the Boston MPO, providing input on policy and programming decisions.

MPOs are established in large metropolitan areas and are responsible for conducting a federally required cooperative, comprehensive, and continuous metropolitan transportation planning process. Based on this planning, MPOs determine which surface transportation system improvements will receive federal capital (and occasionally, operating) transportation funds. The Boston MPO´s mission is to establish a vision and goals for transportation in the region and then develop, evaluate, and implement strategies for achieving them.

Massport plays an active role on the MPO's decision-making board, participating in policy decisions related to the *Long-Range Regional Transportation Plan* and project programming for the Transportation Improvement Program. The MPO also guides the work conducted by Central Transportation Planning Staff (CTPS) via its Unified Planning Work Program. CTPS is also used by Massport to support its ground transportation planning initiatives.

Metropolitan Area Planning Council (MAPC)

Massport is also an ex-officio member of MAPC, a regional planning agency that serves the people who live and work in the cities and towns of Metropolitan Boston. The MAPC mission is to promote smart growth and regional collaboration, which includes protecting the environment, supporting economic development, encouraging sustainable land use, improving transportation, ensuring public safety, advancing equity and opportunity among people of all backgrounds, and fostering collaboration among municipalities. MAPC membership includes 101 municipal government representatives, 21 gubernatorial appointees, 10 state officials (including Massport), and three City of Boston officials. A staff of approximately 40 individuals supports the Council and its Executive Committee of 25 selected members.

This Page Intentionally Left Blank.

5

Ground Access to and from Logan Airport

Introduction

The Massachusetts Port Authority (Massport) has a comprehensive strategy to diversify and enhance ground transportation options for passengers and employees for travel to and from Boston-Logan International Airport (Logan Airport or Airport). The ground transportation strategy is designed to offer passengers with a choice of a broad range of high-occupancy vehicle (HOV), transit, and shared-ride options for travel to and from Logan Airport and to minimize vehicle trips by providing convenient transit, shuttle, bike, and pedestrian connections to the Airport. The strategy also aims to provide on-Airport parking for air passengers choosing automobile access modes and/or who have limited HOV options. Massport aims to limit impacts to the environment and community, while providing air passengers and employees with many alternatives for convenient and reliable travel to and from Logan Airport. In addition to highlighting recent changes to ground transportation services, operations, and pricing, this chapter reports on ground access conditions and activity levels in 2016, which are compared to past conditions. Activity levels include measures of ridership on various ground access modes and traffic volumes. The chapter provides an overview of parking demand and its impacts under Logan Airport's constrained parking supply.

Massport is implementing a multi-pronged trip reduction strategy to limit impacts to the environment and to reduce the number of private vehicles that access Logan Airport and, in particular, the associated environmentally undesirable drop-off/pick-up modes, which generate up to four vehicle trips instead of two.[1] Massport continues to invest in and operate Logan Airport with a goal of maintaining and increasing the HOV mode share – the number of passengers (and Airport employees) arriving by transit or other HOV/shared-ride modes. Logan Airport continues to rank at the top of U.S. airports in terms of HOV/transit mode share, with the current HOV mode share just over 30 percent.[2] Because of the different demographics of Logan Airport air passenger travelers, no single measure alone will accomplish the goal to increase the HOV mode share. Measures implemented by Massport to increase HOV use include initiatives related to pricing (incentives and disincentives), service availability, service quality, marketing, and traveler information.

1 Drop-off/pick-up modes can include private vehicles, taxis, Transportation Network Companies (TNCs), and black car services. For example, if an air passenger is dropped off when s/he departs on an air trip and is picked up upon their return, that single air passenger generates a total of four ground access trips: two for the drop-off trip (one inbound to Logan Airport, one outbound from Logan Airport) and two for the pick-up trip (one inbound to Logan Airport, one outbound from Logan Airport). The air passenger may be dropped off and picked up in a private vehicle or in a taxi, TNCs, or black car that may not carry a passenger during all segments of travel to and from Logan Airport.

2 According to the *2016 Logan Airport Air Passenger Ground-Access Survey*, 30.5 percent of air passengers accessing Logan Airport used HOV modes of travel.

Improving the multimodal connectivity of the Airport can provide traffic and environmental benefits by reducing vehicle trips, miles traveled, and greenhouse gas (GHG) emissions associated with travel to and from Logan Airport. The cost, speed, convenience, safety, and reliability of all modes of transportation connecting to the Airport affect how passengers and employees choose among these access modes. Offering a range of ground access options also improves customer service for air passengers, employees, and other Airport users.

Regional transportation efforts, as they relate to the Airport, and planning efforts to diversify transportation options in the New England region (primarily through commuter, passenger, and high-speed rail), are discussed in Chapter 4, *Regional Transportation.*

Ground Transportation Modes of Access to Logan Airport

The Logan Airport Environmental Data Reports (EDR) and Environmental Status and Planning Reports (ESPR) provide over two decades of tracking and reporting on ground access and ground transportation at the Airport. For the purposes of tracking ground access mode share over the years, Massport historically uses the following definitions:

HOV (Shared-Ride) Modes

- Public transit (Massachusetts Bay Transportation Authority (MBTA) Blue Line subway, Silver Line bus rapid transit, other MBTA buses, and water transportation);
- Logan Express scheduled bus service;
- Scheduled buses and vans;
- Courtesy shuttle buses;
- Charter buses; and
- Unscheduled private limousines and vans.

Non-HOV (Automobile) Modes

- Private automobiles;
- Taxis (regardless of the number of passengers in a vehicle);
- Rental cars; and
- Transportation Network Companies (TNCs), such as Uber and Lyft.

Although private automobiles, taxis, TNCs, and rental cars often carry multiple occupants, they are not categorized as HOV modes.[3] The *Ground Access Planning Considerations* section later in this chapter includes further discussion of the Logan Airport HOV mode share.

3 The *2016 Logan Airport Air Passenger Ground-Access Survey* indicates that the average occupancy of these automobile modes (private automobiles, taxis, TNCs, and rental cars) is 1.66 persons per vehicle, indicating that Massport is somewhat conservative in the calculation of the HOV/SOV split. The HOV mode share goal is based on modal categories and not on actual vehicle occupancies.

Massport is rethinking the relationship among the different ground access modes and focusing on the trip generation associated with each of these modes. Air passengers have three major options for getting to Logan Airport: (1) transit and shared-ride HOV services; (2) drive to Logan Airport and park; or (3) drop-off/pick-up mode, which can involve a private vehicle, taxi, limousine, or TNCs. In this categorization, the major "modes" are:

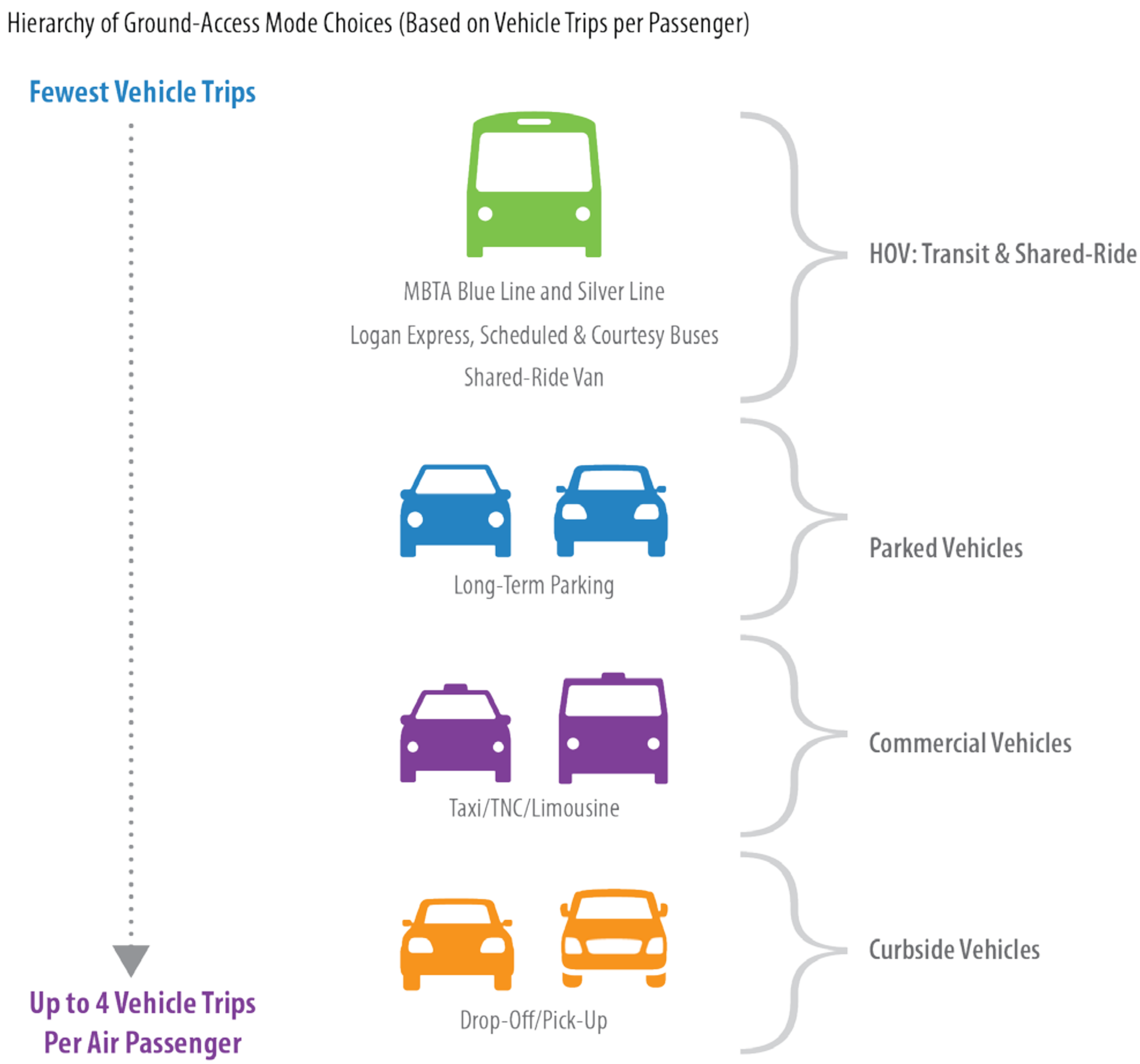
- Transit and shared-ride:
  - MBTA services (Blue Line, Silver Line, bus, and ferry) and water taxis;
  - Massport services (Logan Express); and
  - Private operators (scheduled coach express bus, charter bus, shared-ride vans, and courtesy shuttles).
- Private vehicles that are parked for the duration of the trip.
- Vehicles that drop-off or pick-up air passengers at the terminal curbs, but do not necessarily remain on-Airport:
  - Private vehicles that do not park for the duration of a passenger's trip;
  - Taxicabs or TNCs; and
  - "Black car" limousines.[4]

Mobile application ride-booking services, such as Uber and Lyft, are increasingly becoming a mode of choice for ground access at airports throughout the country. Data from the *2016 Logan Airport Air Passenger Ground-Access Survey* show a number of departing air passengers choosing TNCs. Pursuant to Massachusetts state law, An Act Regulating Transportation Network Companies (Bill H.4570), and Massport Rules for Safe and Efficient Operation of TNCs at Logan Airport, beginning in February 2017, in cooperation with state regulators, Massport began allowing TNCs to pick-up arriving air passengers via a TNC pool lot. This is a service that is being tracked for reporting in 2017.

As noted in **Figure 5-1**, transit and shared-ride modes are designed for use by multiple travelers. With a higher occupancy, the Airport vehicle trips per passenger for the transit and shared-ride modes is relatively low. Private vehicles that park at the Airport (or an off-Airport lot) generate a single vehicle trip to the Airport for the departing air passenger (and a single vehicle trip from the Airport for the arriving air passenger). Vehicles that do not remain on the Airport for an air passenger's trip duration, such as those private vehicles that have dropped off an air passenger at the curb, generate a trip to and a trip from the Airport for a departing air passenger. In the case of taxicabs, TNCs, and black-car limousines, many of these depart Logan Airport empty after dropping off an air passenger or arrive at the airport empty to pick-up air passengers. As **Figure 5-1** shows, when measured in terms of vehicle trips generated, the most environmentally desirable mode is HOV (transit and shared-ride), followed by drive-and-park, with the least desirable mode being drop-off/pick-up**.**

4 Private limousines are included in the definition of HOV. For the purposes of discussing three major options for getting to Logan Airport, however, scheduled "black car" limousines are classified as drop-off/pick-up.

Figure 5-1 Ground Access Mode Choice Hierarchy



Notes: Short-term parking is included under "drop-off/pick-up."
Rental cars are included in the "Parked Vehicles" category.

On-Airport Vehicle Traffic: Volumes and Vehicle Miles Traveled (VMT)

This section reports on Logan Airport's traffic-related activity for 2016, specifically:

- Traffic volumes
- VMT calculations

Central to these components is Massport's leadership in and commitment to developing, promoting, and providing alternative means of ground transportation for access to and from Logan Airport. The diverse range of environmentally responsible transportation modes to access the Airport by air travelers, employees, and other Airport users has reduced reliance on automobile travel, thus reducing traffic congestion and contributing to improvements in air quality. **Figure 5-2** shows the roadway infrastructure at Logan Airport in 2016.

Gateway Traffic Volumes

Gateway roadways are defined as access points to/from Logan Airport, which primarily include the Route 1A roadway ramps, the Interstate-90 Ted Williams Tunnel ramps, and Frankfort Street/Neptune Road.

Data Collection and Annual Average Daily Calculation Method

All of the Airport's gateway roadways are equipped with permanent traffic count stations, as part of the Airport-wide Automated Traffic Monitoring System (ATMS). These stations provide data to calculate:

- Annual average daily traffic (AADT);
- Annual average weekday daily traffic (AWDT); and
- Annual average weekend daily traffic (AWEDT).

Since the data are collected continuously throughout the year, seasonal adjustment factors are only necessary when significant gaps in the data occur (typically due to equipment failure/malfunction or construction activity). When seasonal adjustment factors are used, these are generally based on a combination of the seasonality (monthly variation) of counts from other ATMS stations or the same station in the previous year.

Annual Average Daily Activity Levels

Table 5-1 summarizes the daily gateway traffic volumes at Logan Airport for the years 2012 through 2016. It includes AADT, AWDT, AWEDT, and annual air passengers, for reference.

The AADT entering and departing Logan Airport via its gateway roadways increased by 5.4 percent between 2015 and 2016. The change in average daily traffic can be attributed primarily to:

- An 8.5-percent increase in air passenger activity in 2016;
- A 5.1-percent increase in taxi dispatches in 2016; and
- The impact of TNCs, for which ridership data were not comprehensively available for 2016.

Although daily traffic volumes on the airport roadway system have been increasing, it is important to place this growth in the context of overall Airport activity and Massport's successful efforts to promote HOV ground access. In 2016 air passenger volumes were 32.3 percent higher than in 2010; while AADT, AWDT, and AWEDT volumes grew at only 27.2, 27.0, and 26.5 percent, respectively, over the same time period. Growth in gateway traffic volumes is also partially attributable to growth in non-air passenger activity such as air cargo, aviation services, and other Airport activities. Thus, gateway traffic volume is growing at a lower rate than air passenger growth, reflecting Massport's decade-long commitment to improving and supporting HOV access to the Airport, which saw HOV mode share rise to 30.5 percent in the *2016 Logan Airport Air Passenger Ground-Access Survey* in contrast to 27.8 percent in the previous survey in 2013.

Table 5-1 Logan Airport Gateways: Annual Average Daily Traffic, 2010 - 2016

	AADT		AWDT		AWEDT		Annual Air Passengers	
Year	Volume	Percent Change	Volume	Percent Change	Volume	Percent Change	Level of Activity	Percent Change
2010	94,179	4.9%	98,968	5.5%	82,595	4.5%	27,428,962	7.5%
2011	99,449	5.6%	104,863	6.0%	85,879	4.0%	28,907,938	5.4%
2012	99,281	(0.2%)	104,439	(0.4%)	86,494	0.7%	29,235,643	1.1%
2013	102,771	3.5%	107,656	3.1%	90,822	5.0%	30,218,970	3.4%
2014	108,172	5.3%	113,564	5.5%	94,881	4.5%	31,634,445	4.7%
2015[1]	113,623	5.0%	119,288	5.0%	99,415	4.8%	33,449,580	5.7%
2016	**119,750**	**5.4%**	**125,728**	**5.4%**	**104,471**	**5.1%**	**36,288,042**	**8.5%**

Source: Massport.
Notes: Numbers in parentheses ( ) represent negative numbers.
1 After a review of additional available data, Massport has updated 2015 average annual traffic since the 2015 EDR filing.
AADT Annual average daily traffic.
AWDT Annual average weekday daily traffic.
AWEDT Annual average weekend daily traffic.

On-Airport Vehicle Miles Traveled (VMT)

On-Airport VMT is calculated based on the total number of miles traveled by all vehicles on the Logan Airport roadway system. VMT is an important metric because it is used to calculate motor vehicle air quality emissions, and it is also one indication of the levels of traffic on roadways in specific areas and at specific times.

Calculation Method and Model Description

In 2011, Massport upgraded its modeling capabilities and began using an on-Airport VISSIM[5] model to estimate VMT. This model can be adapted to reflect changes in the evolving Logan Airport roadway transportation network and is more robust than the previous model developed in 1994, which was based on the prior terminal roadway system. The study area of the VISSIM model roadway network can be found in Appendix G, *Ground Access*. The VISSIM model not only estimates VMT associated with curbside activity and parking, but also with Logan Airport operations, rental car activity, and hotel activity.

The model is calibrated to existing evening peak hour volume data, which is generally the peak hour of the airport roadway system. Adjustment factors were determined to calculate morning peak hour, highest 8-hour, and average weekday VMT from the VISSIM model. The adjustment factors for the 2016 VMT calculations were determined by using 2011 to 2016 gateway, Airport roadway, and parking volume averages. Tables provided in Appendix G, *Ground Access,* compare existing and simulated traffic volumes at Logan Airport for the 2016 condition.

Estimated VMT Calculations and Modeling Results

Consistent with previous years, the following specific time periods were analyzed for 2016:

- Morning peak hour (AM Peak Hour);
- Evening peak hour (PM Peak Hour);
- Highest consecutive 8-hour (High 8-Hour); and
- Average weekday VMT.

Table 5-2 summarizes the VMT estimates for Logan Airport-related traffic from 2010 through 2016. The change in average weekday VMT between 2015 and 2016 was approximately 4.8 percent, despite higher increases in passenger levels (8.5 percent) and traffic volume (5.4 percent) during the same time period, as noted above. Absent any major shift in traffic volumes entering the gateways, the change in VMT is expected to closely mirror the change in traffic volume, as it did in 2016. Details of the 2016 VMT modeling results are presented in Appendix G, *Ground Access.*

5 PTV America. (2011). Verkehr In Städen Simulationsmodell- VISSIM version 5.40 [computer software]. Portland, OR.

Table 5-2 Airport Study Area Vehicle Miles Traveled (VMT) for Airport-Related Traffic, 2010 - 2016

Analysis Year	AM Peak Hour	PM Peak Hour	High 8-Hour	Average Weekday	Average Weekday Percent Change
2010	8,451	10,887	78,185	162,885	4.8%
2011	8,391	10,978	76,920	167,647	2.9%
2012	8,387	10,974	76,883	167,564	(0.05%)
2013	9,006	11,407	80,088	177,094	5.7%
2014	8,155	10,107	71,361	158,443	(10.5%)[1]
2015	8,580	10,660	76,058	168,791	6.5%
2016	**9,009**	**11,101**	**79,234**	**176,841**	**4.8%**

Source: VHB and Massport.
Notes: Numbers in parentheses ( ) represent a reduction in VMT.
1 The 10.5-percent decrease in 2014 VMT can be attributed to the addition of the Rental Car Center (which consolidated the rental car shuttle bus fleet and some Massport shuttle buses into a unified shuttle route system), the relocation of the taxi and bus/limousine pools closer to the terminals, and terminal curbside reallocations.

Since 2000, the highest average weekday VMT estimated at Logan Airport was in 2007, when weekday VMT was modeled to be 184,613. Current weekday VMT calculations remain about 4.4 percent lower than 2007 VMT, despite the 29.1 percent increase in air passenger traffic during the same time period. This is partially attributed to Massport's dedication to promoting HOV modes and reducing unnecessary on-airport vehicle trips whenever possible. A direct and quantifiable comparison between VMT values prior to 2011 is difficult to make because the current VMT model (adopted in 2011) includes a larger on-Airport study area than the previous model, which was limited to terminal access roads.

Parking Conditions

Massport manages the on-Airport parking supply at Logan Airport to promote long-term rather than short-term parking (thus reducing the number of daily trips to Logan Airport), support efficient use of parking facilities, provide good customer service, and comply with the provisions of the Logan Airport Parking Freeze. Details on current conditions are presented in the following sections.

Massport has a comprehensive parking monitoring and management program including tracking of:

- On-Airport parking conditions, including parking facilities and supply, demand, and parking rates; and
- Parking programs (including preferred parking for hybrid vehicles).

FIGURE 5-2 Logan Airport Roadway Network

2016 Environmental Data Report

Parking Garages

Terminal Buildings

Airport Roadways

0 450 900 1800 Feet

Logan Airport Parking Freeze[6]

The number of commercial and employee parking spaces allowed at Logan Airport is regulated by the Logan Airport Parking Freeze (310 Code of Massachusetts Regulations 7.30), which is an element of the Massachusetts State Implementation Plan (SIP) under the Federal Clean Air Act (42 U.S.C. §7401 et seq. [1970]). As required, Massport submits semi-annual filings to the Massachusetts Department of Environmental Protection (MassDEP) demonstrating Massport's compliance with the Logan Airport Parking Freeze. The reports for March and September of 2016 are provided in Appendix G, *Ground Access*.

The Logan Airport Parking Freeze sets an upper limit to the supply of commercial and employee parking spaces at Logan Airport. As permitted (and encouraged) by the Parking Freeze provisions, Massport has converted employee spaces to commercial spaces, within the overall limit imposed by the Logan Airport Parking Freeze. As explained in **Table 5-3**, Massport has also transferred Airport-related park-and-fly spaces managed under the East Boston Parking Freeze[7] to be managed under the Logan Airport Parking Freeze. **Table 5-3** presents the total number of parking spaces permitted on-Airport and the allocation of those spaces between commercial and employee spaces through 2016.

Under the Logan Airport Parking Freeze regulation, Massport must monitor the number of commercial and employee vehicles parked on-Airport and ensure that the total number of parked commercial and employee vehicles do not exceed the Parking Freeze limits. If the number of commercially parked vehicles exceeds the allocated commercial parking limit under the Parking Freeze on any day, those additional vehicles are considered to be using "Restricted Use Parking Spaces." Use of Restricted Use Parking Spaces is allowed under the regulation when Logan Airport experiences "extreme peaks of air travel and corresponding demand for parking spaces" and may be made available for use only at such times, up to ten days in any calendar year. These spaces must be provided free of charge when demand exceeds the limit.

6 310 Code of Massachusetts Regulations 7.30 and 40 CFR 52.1120.

7 310 Code of Massachusetts Regulations 7.31.

Table 5-3 Logan Airport Parking Freeze: Allocation of Parking Spaces

	Type of Spaces		
Year[1]	**On-Airport Commercial Spaces**	**On-Airport Employee Spaces**	**Total Logan Airport Spaces Permitted**
2007- 2010	17,319	3,373	20,692
2010 - 2011	17,619	3,073	20,692
2011 – 2012	18,019	2,673	20,692
2012 – 2013	18,265	2,673	20,938[2]
2013 – 2014	18,415	2,673	21,088[3]
2014 – 2015	18,415	2,673	21,088
2015 – 2016	**18,640**	**2,448**	**21,088**

Source: Massport.

Notes:

1 The range of years represents the number of years that various parking space allocations were in effect. For example, from 2007, 2008, 2009, and 2010 there were 17,319 on-Airport commercial spaces and 3,373 on-Airport employee spaces.

2 In July 2012, Massport acquired property at 135B Bremen Street in East Boston, which supported 246 park-and-fly spaces that were in the East Boston Parking Freeze inventory. Massport's relocation of those park-and-fly spaces from the East Boston Parking Freeze Area to the Logan Airport Parking Freeze Area led to a revised Parking Freeze inventory for Logan Airport and East Boston, respectively.

3 In June 2013, Massport acquired property at 413-419 Bremen Street in East Boston which had 150 park-and-fly spaces that were located within the East Boston Parking Freeze Area. Massport's relocation of those park-and-fly spaces from the East Boston Parking Freeze Area to the Logan Airport Parking Freeze Area led to a revised Parking Freeze inventory for Logan Airport and East Boston, respectively.

The intent of the Logan Airport Parking Freeze is to reduce air emissions by shifting air passengers to travel modes requiring fewer vehicle trips. However, survey data since the 1970s has consistently shown that constrained parking has the unintended consequence of shifting air passengers to travel modes with higher numbers of vehicle trips, despite Massport's extensive efforts to provide and encourage the use of HOV travel modes. According to the *2016 Logan Airport Air Passenger Ground-Access Survey,* if parking was not an option for passengers who parked on-Airport, 77 percent of survey respondents indicated that they would use drop-off/pick-up modes (i.e., dropped off or picked up by private vehicles, taxi, TNC, or black car/limousine service). Prior surveys of Logan Airport air passengers have consistently shown similar results.

As the number of air travelers has increased, the constrained parking supply at Logan Airport may have contributed to an increase in environmentally harmful drop-off/pick-up vehicle activity (which generates up to four vehicle trips per air passenger, compared to two trips for those who drive and park). The potential impact has been mitigated by the successful growth of transit and shared-ride mode ground access, especially Logan Express park-and-ride and private buses. Nonetheless, implementing parking policies and investments to reduce diversion to growing drop-off/pick-up modes remains an Airport priority.

As one element of its comprehensive transportation strategy, Massport proposed to increase the Logan Airport Parking Freeze cap by 5,000 on-Airport commercial parking spaces at Logan Airport. The goal was to provide Massport with the ability to reduce the number of air passengers choosing more environmentally harmful drop-off/pick-up modes by allowing passengers to park on-Airport.

The increase in the Logan Airport Parking Freeze Cap was predicated on the approval of a regulatory change by MassDEP, whereby MassDEP would amend the existing Logan Airport Parking Freeze regulation to allow for an additional 5,000 commercial parking spaces at Logan Airport. [8] As part of the process to amend the Logan Airport Parking Freeze regulation, MassDEP conducted a stakeholder process, which was followed by a public process to amend the Parking Freeze regulation. MassDEP issued the amended regulation on June 30, 2017 approving the requested parking cap increase. Massport initiated a parallel process with the Executive Office of Energy and Environmental Affairs (EEA) by filing an Environmental Notification Form (ENF) for new parking facilities on March 31, 2017. On May 5, 2017, EEA issued its Certificate on the ENF establishing the Scope for the required Draft Environmental Impact Report (EIR). On December 5, 2017, the U.S. Environmental Protection Agency (EPA) proposed a rule approving the revision of the Massachusetts SIP incorporating the amended Logan Airport Parking Freeze Cap. The final rule was issued on March 6, 2018, and became effective on April 5, 2018.

Initiation of concept design for the parking facilities and preparation of a Draft EIR is expected to commence in the Spring of 2018. The Draft EIR will provide additional details on the number of spaces per location and planned construction phasing. Massport has identified two potential sites for the new parking, atop the Economy Garage and the Terminal E Surface Lot (see Chapter 3, *Airport Planning.*)

Parking Space Availability

Table 5-4 provides a summary of the Logan Airport commercial parking space inventory and reported to the MassDEP on a quarterly basis.

Daily Parking Occupancy

On-Airport commercial parking occupancy typically peaks mid-week (Tuesday through Thursday) with lower occupancies occurring Friday through Monday. The number of vehicles parked at Logan Airport in commercial spaces over the course of any 24-hour period was obtained from parked vehicle count data for Tuesdays, Wednesdays, and Thursdays, which are collected throughout the year. The peak daily parking occupancy data are presented in **Figure 5-3**.

Peak day demand for on-Airport parking has been increasing, resulting in daily demand frequently nearing the Logan Airport Parking Freeze cap (see **Figures 5-3** to **5-5**). While Massport continued to be in full compliance with the Logan Airport Parking Freeze[9] in 2016, it was forced to divert vehicles to overflow lots or valet-park passenger vehicles on 116 out of 260 working days. Vehicle diversions primarily occurred on Tuesdays and Wednesdays, during hours of peak parking demand.

8 310 Code of Massachusetts Regulations 7.30.

9 310 Code of Massachusetts Regulations 7.30 and 40 CFR 52.1120.

Table 5-4 Logan Airport Parking Freeze: Allocation of Commercial Parking Spaces, 2010-2016

Location and Facility	March 2010	March 2011	March 2012	March 2013	March 2014	March 2015	March 2016	Sept. 2016	Status
Terminal Area									
Central Garage and West Garage[1]	10,375	10,375	10,344	10,396	10,267	10,267	11,954	11,954	West Garage expansion in 2016
Terminal B Garage	2,235	2,380	2,632	2,553	2,254	2,254	2,212	2,212	Lower level Terminal B garage now used for limousines/taxis/TNCs pick-up
Terminal E Lot 1	269	269	269	269	275	243	237	237	
Terminal E Lot 2	257	257	257	251	248	248	249	249	
Terminal E Lot 3	150	229	222	222	219	219	217	217	
Blue Lot							367	367	
North Cargo Area (NCA)									
Economy Parking Garage	932[2]	2,880	2,789	2,809	2,809	2,809	2,864	2,864	
Overflow/Temp Lots	416	666	-[3]	-[3]	-[3]	832	-	-	Eliminated for West Garage expansion in 2016
North Service Area									
Sky Chef Valet Lot[4]	260	-	-	-	-	-	-	-	
Total in-service revenue commercial spaces	14,894	17,056	16,513	16,505	16,072	16,872	18,100	18,100	Excludes hotel and general aviation (GA) spaces (noted below)
Signature Flight Support (General Aviation)	35	35	35	35	35	35	35	35	
Hotel (Hilton, Hyatt)	-	505	505	505	505	305	505	505	Hilton now primarily accommodated in the West Garage
Total in-service commercial spaces	14,929	17,596	17,053	17,040	16,612	17,212	18,640	18,640	Includes hotel and GA spaces
Total commercial spaces (Freeze limit)[5, 6]	17,319	17,619	18,019	18,265	18,415	18,415	18,640	18,640	Includes in-service and designated spaces

Source: Massport, Parking Freeze Inventory, March 2010, March 2011, March 2012, March 2013, March 2014, March 2015, March and September 2016.

Notes:

1 In 2016, Massport opened the West Garage Expansion, reallocating commerical overflow spaces to in-service commercial spaces and permanently reallocating 225 employee spaces to commercial.

2 Before the Economy Parking Garage was constructed, it was known as Economy Lot 2 in 2010.

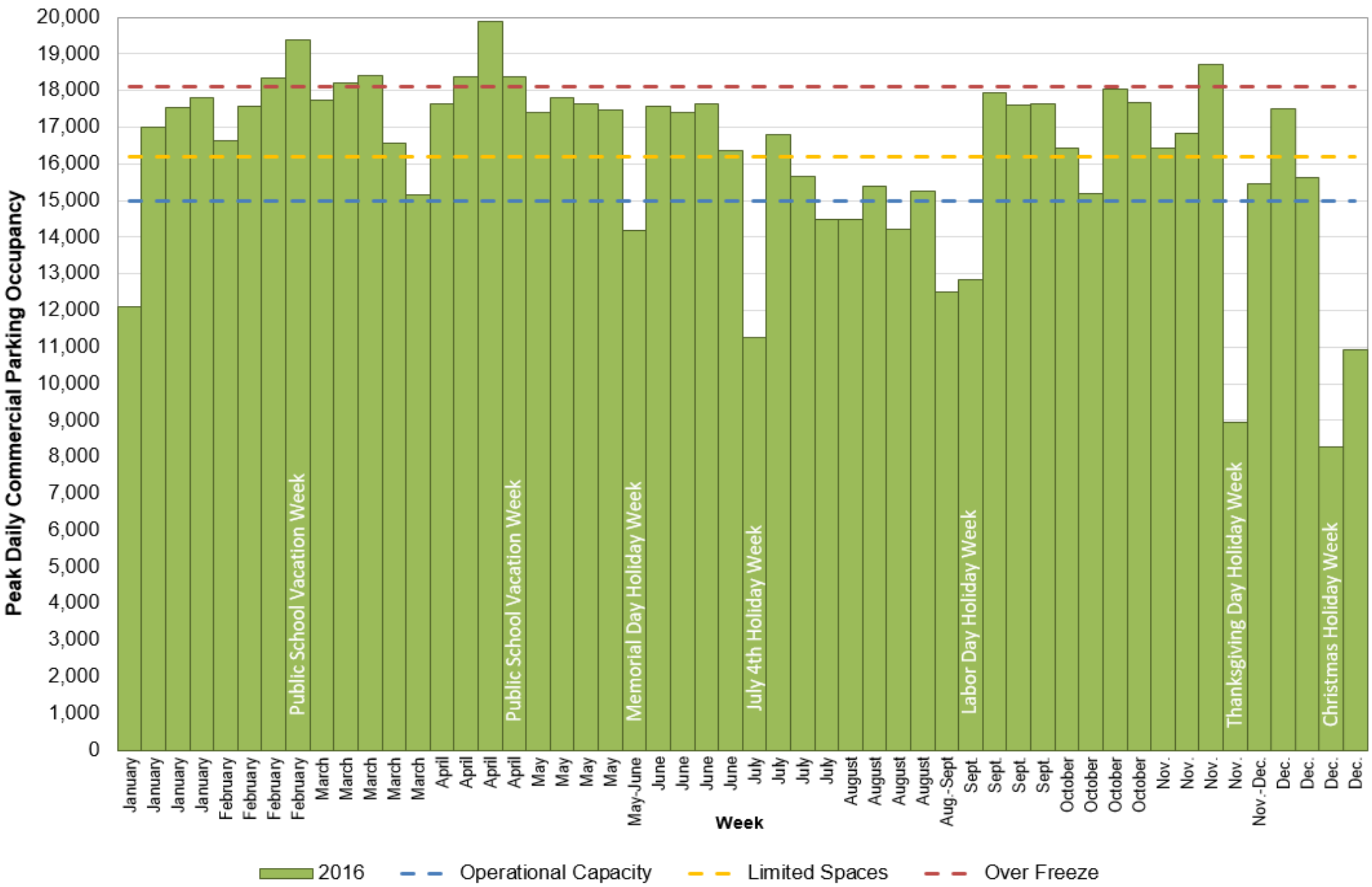
3 In mid-2011 the temporary Southwest Service Area (SWSA) lots were eliminated for Rental Car Center (RCC) construction.

4 Eliminated for construction purposes, November 3, 2010.

5 In July 2012, 246 spaces were transferred from the East Boston freeze allocation to the Logan Airport Commercial Parking Spaces inventory through the acquistion of Paul's Parking at 135B Bremen Street.

6 In June 2013, 150 spaces were transferred from the East Boston Freeze Area to the Logan Airport Parking Freeze Area through the acquistion of Paul's Parking at 413-419 Bremen Street.

Figure 5-3 Commercial Parking: Weekly Peak Daily Occupancy, 2016



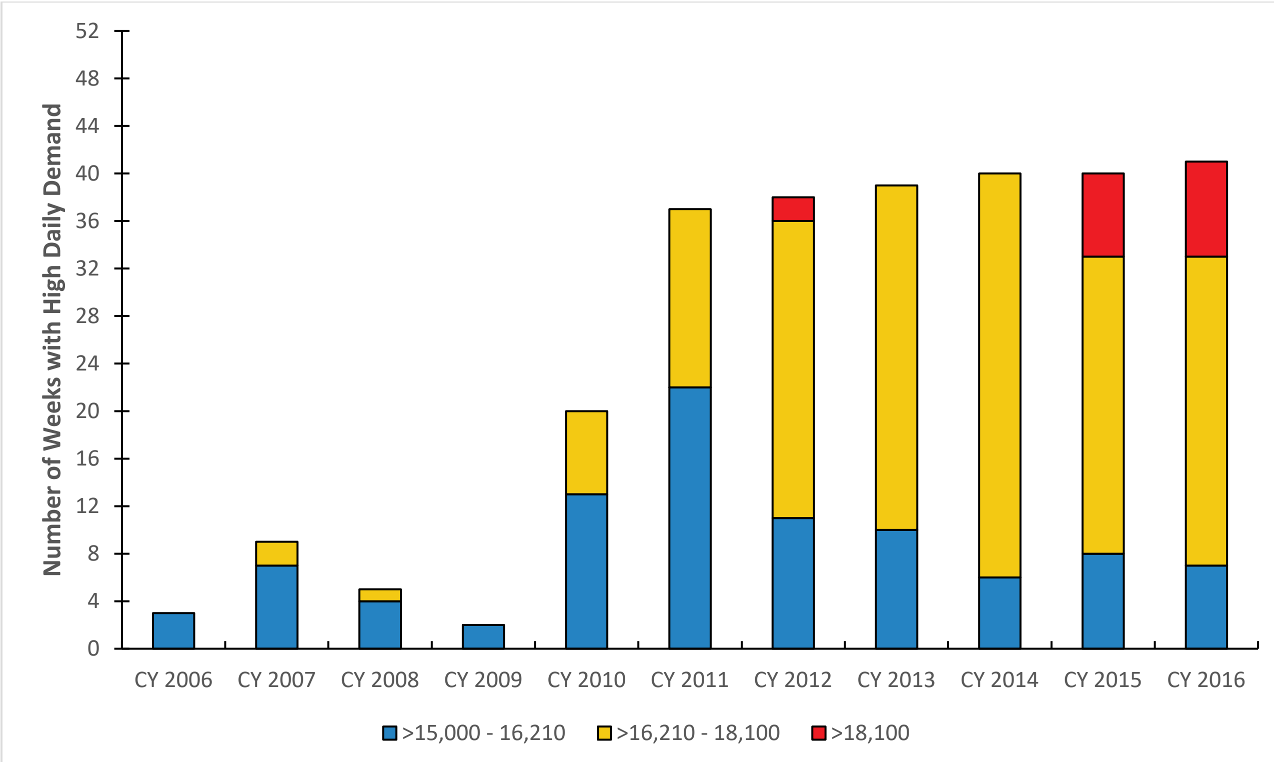
Source: Massport.

Notes: The chart shows the highest daily count for each week in 2016.
In 2016, the operational capacity of in-service commercial spaces was 15,000.
At no time in 2016 did the Parking Freeze limit on Restricted Use Spaces exceed the allowed 10 days. Massport was at all times in full compliance with the Parking Freeze regulations in 2016.

Operational Adjustments to Meet Parking Demand

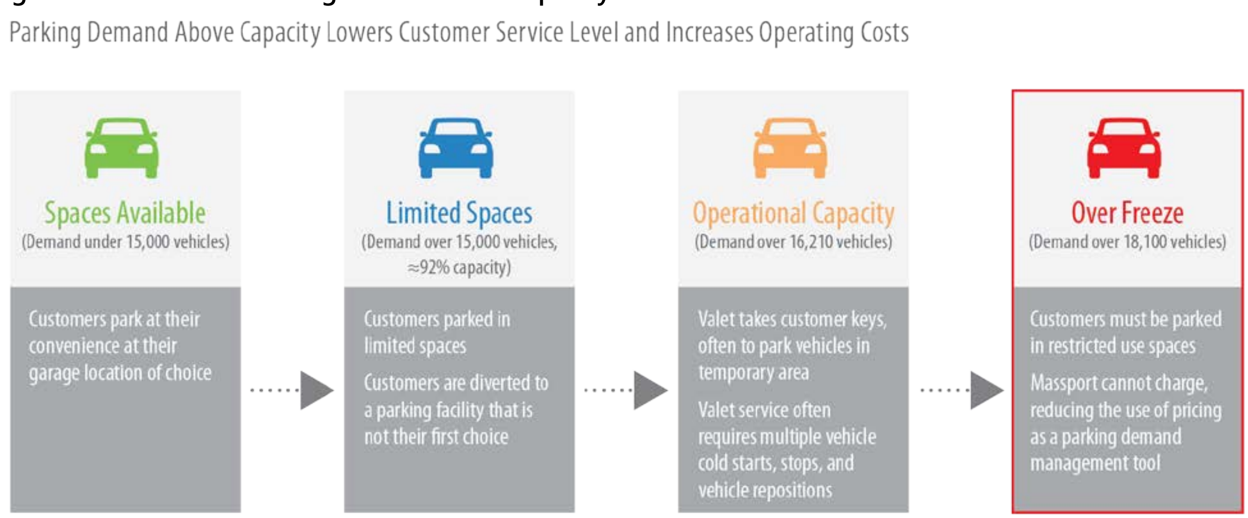
The inadequate supply of parking causes air passengers to circulate on Airport roadways to find parking, and in overflow conditions, cars are diverted or moved to non-garage parking areas, including overflow lots, some of which are located off-Airport. Not only does parking demand activity above capacity lower customer service levels, it also increases on-Airport roadway vehicle emissions related to circulating traffic. Diversions and valeting have become a regular occurrence at Logan Airport. These diversions decrease operational efficiency and compromise customer service.

Figure 5-4 Demand for Parking: Number of Weeks per Calendar Year with High Daily Parking Demand



Source: Massport.

Figure 5-5 2016 Parking Demand and Capacity



Source: Massport.
Notes: 18,100 represents the total number of on-Airport parking spaces allocated within the Parking Freeze in 2016. Hotel and general aviation uses, which are included in the 18,640 Parking Freeze Limit, are excluded from this figure.

These vehicle diversions, in general, increase on-Airport VMT. The peak of valet operations coincides with peak parking demand, requiring Airport operations to use all available spaces to meet parking demand.

Parking Exits by Duration

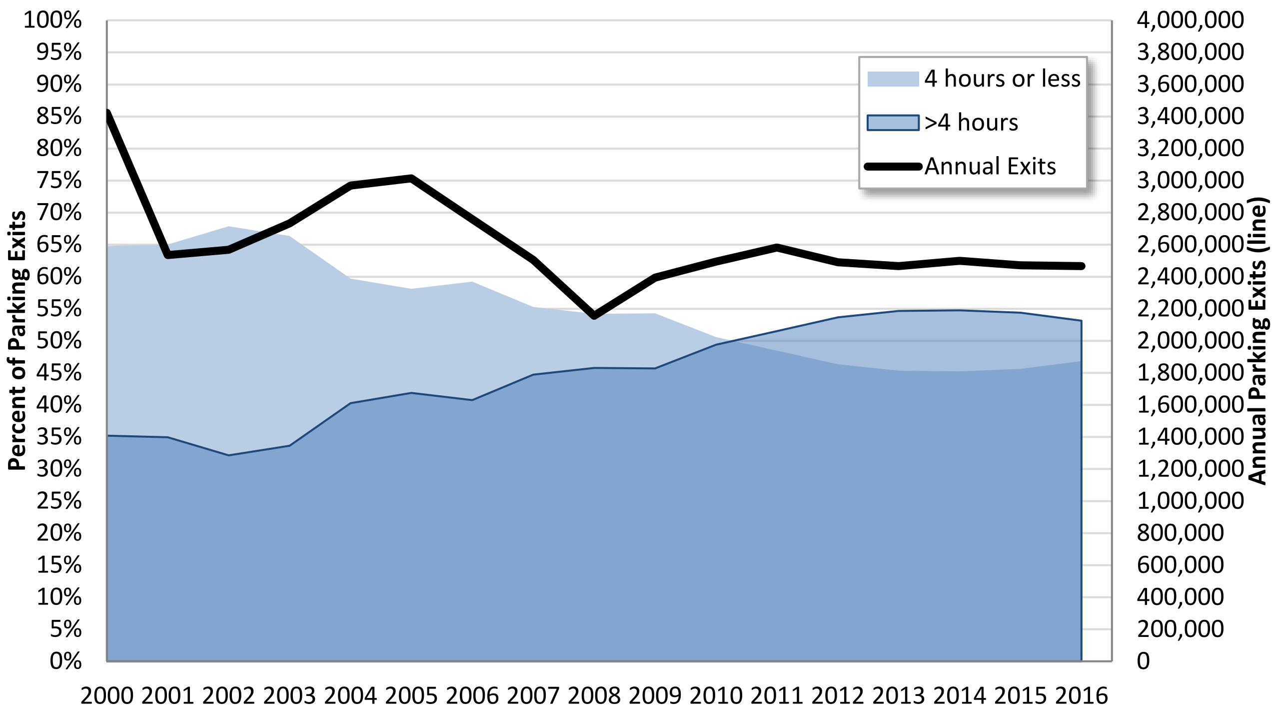
As presented in **Table 5-5**, the total annual parking activity (as defined by revenue parking exits) remained relatively constant in 2016, even as short-term parking durations (less than 4 hours) grew (see **Figure 5-6**). Stagnant growth in overall parking coupled with an increase in the number of vehicles entering the Airport may be a symptom of a shift to drop-off/pick-up modes as a result of constrained parking conditions. The Parking Freeze Amendment will allow Massport the flexibility to build additional parking supply in conjunction with expanding HOV alternatives in order to divert drop-off/pick-up modes.

Table 5-5 Parking Exits by Length of Stay (Parking Duration)

		0-4 hrs.	>4-24 hrs.	>1-4 days	>4 days	Total
2010	Tickets	1,261,813	230,260	741,706	260,240	2,494,019
	Percent	51%	9%	30%	10%	
2011	Tickets	1,251,956	235,039	800,188	295,270	2,582,453
	Percent	48%	9%	31%	11%	
2012	Tickets	1,153,781	215,028	815,266	305,925	2,490,000
	Percent	46%	9%	33%	12%	
2013	Tickets	1,118,218	209,437	823,187	315,295	2,466,137
	Percent	45%	8%	33%	13%	
2014	Tickets	1,130,560	213,567	830,545	324,332	2,499,004
	Percent	45%	9%	33%	13%	
2015	Tickets	1,127,353	219,014	796,228	329,044	2,471,639
	Percent	46%	9%	32%	13%	
2016	**Tickets**	**1,155,606**	**208,537**	**791,319**	**310,740**	**2,466,202**
	Percent	**47%**	**8%**	**32%**	**13%**	
Percent change – 2015 to 2016		**2.5%**	**(4.8%)**	**(<1%)**	**(5.6%)**	**(<1%)**

Source: Massport.
Notes: Numbers in parentheses ( ) represent a reduction. Tickets are representative of revenue parking exits.

Figure 5-6 Percent of Parking Exits by Duration: Short vs. Long-Term Parking



Source: Massport.

2016 Commercial Parking Rates

Massport periodically assesses its parking rate structure to support its ground-access strategy. As detailed in **Table 5-6**, parking rates in the on-Airport garages were increased in July 2016, while the substantially lower parking rates for Logan Express remote parking have been maintained at $7 per day. These policies contributed to growth in Logan Express park-and-ride by 9.4 percent since 2015.[10]

With a pay-on-foot system, Massport requires parking fees to be pre-paid at kiosks inside the terminals and at garage access points at the pedestrian walkways, thus improving parking exit flow and reducing vehicle idling and associated emissions at exit plazas. Pay stations are located in the terminals, at the Massport shuttle drop-off/pick-up location in the Economy Garage and at the pedestrian entrances to the Central Garage, Terminal B garage, and Terminal E parking lot. Approximately 80 percent of parking patrons use the pay-on-foot system to pre-pay their parking fees before exiting.

Several off-Airport parking facilities, such as PreFlight Airport Parking in Chelsea, are privately owned and operated, and they are outside of the Logan Airport Parking Freeze area. Massport has no control over rates at off-Airport parking lots. For 2016, the parking rates for the three major off-Airport parking providers (PreFlight, Park Shuttle & Fly, and Thrifty) vary from $17.95 to $22.50 for daily parking and from $108 to $150 for weekly parking.

10 Overall Logan Express growth was less than 1 percent, but owing primarily to declines in ridership on the Back Bay pilot service for which Massport parking is not available.

Table 5-6 On-Airport Commercial Parking Rates, 2010 - 2016

Terminal Area Facility	2010	2011	2012	2013	2014	2015	2016	Economy Parking	2010	2011	2012	2013	2014	2015	2016
Central/West Parking Garage, Terminal B Garage, Terminal E Lots								Economy Parking Garage							
0 to 30 minutes	$3	$3	$3	$3	$3	$3	$3	Daily Rate	$18	$18	$18	$18	$20	$20	$23
31 minutes to 1 hour	$6	$6	$6	$6	$6	$6	$6	Additional days 0 to 6 hours	$9	$9	$9	$9	$10	$10	$12
1 to 1.5 hours	$9	$9	$9	$9	$11	$10	$12	Additional days 6 to 24 hours	$18	$18	$18	$18	$20	$20	$23
1.5 to 2 hours	$12	$12	$12	$12	$14	$14	$17	Weekly Rate (6-7 days)	$108	$108	$108	$108	$120	$120	$138
2 to 3 hours	$15	$15	$17	$17	$19	$19	$22								
3 to 4 hours	$18	$18	$21	$21	$23	$23	$26								
4 to 7 hours	$22	$22	$25	$25	$27	$27	$30								
7 to 24 hours (Daily)	$24	$24	$27	$27	$29	$29	$32								
Additional days 0 to 6 hours	$12	$12	$14	$14	$15	$15	$16								
Additional day(s) 6 to 24 hours	$24	$24	$27	$27	$29	$29	$32								

Source: Massport; most recent rates effective 2016.

Long-Term Parking Management Plan

In addition to supporting HOV, Massport actively manages parking supply as another strategy to reduce drop-off/pick-up modes. Massport manages the on-Airport parking supply at Logan Airport to: (1) promote long-term rather than short-term parking (thus reducing the number of daily trips to Logan Airport); (2) support efficient utilization of parking facilities; (3) provide good customer service; and (4) comply with the provisions of the Logan Airport Parking Freeze. Massport has substantially reduced the number of on-Airport employee spaces to further reduce VMT, and promotes sustainable transportation options through a Massport-wide newsletter (see **Figure 5-7**).

As part of its ongoing review of ground access and strategic-planning initiatives, Massport has been reviewing recent parking demand trends. That analysis shows that in 2016, Massport diverted or valet-parked private passenger vehicles to various on-Airport locations approximately 116 out of 260 work days. While Logan Airport has experienced diversions in the past, the number of days per year diversions occur has increased over the past several years. As presented in previous EDR/ESPR filings, diverting or valeting cars is inefficient and reduces customer service. The Long-Term Parking Management Plan, which was first included in the *2012/2013 EDR,* lays out a multi-part strategy for efficiently managing parking supply, pricing, and operations – both at Logan Airport and at Massport-controlled off-Airport locations – to maximize transit/shared-ride ground access while minimizing both drive-and-park and drop-off/pick-up modes. The Long-Term Parking Management Plan represents Massport's current strategy to manage parking pricing, supply, and demand within the current Logan Airport Parking Freeze.

Table 5-7 describes each parking plan element and progress to date. Massport is actively working to manage Airport parking and encourage the use of multi-occupant vehicle access to Logan Airport. Additional measures are currently under discussion as part of Massport's strategic planning efforts.

The focus of the Long-Term Parking Management Plan sets out the efforts that Massport has undertaken, and will continue to take in the future, to manage the supply, pricing, and operation of parking.

Table 5-7 Long-Term Parking Management Plan Elements and Progress

Parking Plan Element	Progress to Date
Parking Supply:	
▪ Add revenue-controlled parking spaces in the terminal area to bring supply up to the maximum number of spaces allowed under the Logan Airport Parking Freeze	▪ Massport completed construction of approximately 1,700 commercial parking spaces at the Central Garage in late 2015. This project is consistent with the Logan Airport Parking Freeze and builds out the maximum number of striped spaces under the existing Logan Airport Parking Freeze.
▪ Work to increase the supply of Massport-controlled off-Airport parking at Logan Express sites	▪ A new 1,100 car parking garage opened in Framingham on April 15, 2015, increasing on-site capacity at that location by approximately 550 spaces.

Table 5-7 Long-Term Parking Management Plan Elements and Progress (Continued)

Parking Plan Element	Progress to Date
Parking Pricing:	
▪ Discourage air passengers from driving and parking at Logan Airport by ensuring that the least expensive Massport-controlled parking will be provided at remote Logan Express sites	▪ Massport has reduced parking rates at Logan Express facilities from $11.00 per day to $7.00 per day. The least expensive parking at Logan Airport is $23.00 per day.
▪ Encourage more efficient use of available on-Airport parking by maintaining a meaningful price differential between rates at the Economy Parking Garage and terminal-area parking garages	▪ Economy Parking is $23.00 per day in 2016; Terminal Area garage and lot rates in 2016 are $32.00 per day.
▪ Evaluate increased parking prices for terminal-area parking to encourage Airport passengers and visitors to consider transit and shared-ride alternatives	▪ Ongoing.
Parking Demand:	
▪ Increase alternative HOV mode options to decrease use of private vehicles	▪ Massport implemented Back Bay Logan Express scheduled bus service in May 2014 as a pilot program. ▪ Massport offers discounted parking and bus fares at all Logan Express locations during peak air travel periods. ▪ Massport placed signage in all terminals to help promote the use of the regional express bus carriers. ▪ Massport continues to sponsor free outbound (from Logan Airport) Silver Line bus service. ▪ Massport increased available parking from approximately 550 spaces to 1,100 spaces at its Framingham location to encourage the use of Logan Express. ▪ Massport works with private carriers to increase HOV options to and from Logan Airport. ▪ Massport supports the Sunrise Shuttle, which provided early morning bus service from East Boston and parts of Winthrop and Revere prior to the start of MBTA service.
Employee Parking:	
▪ Continue to work to reduce the number of Airport employees commuting by private automobile and parking at the Airport by providing off-Airport parking both near Logan Airport and at Logan Express sites, and implementing measures to enhance employee commuting options	▪ Massport provides employee parking in Chelsea with free shuttle bus transportation to the Airport. ▪ Massport offers employee rates to encourage the use of Logan Express facilities. ▪ Additional early morning and late-night bus service has been added to Logan Express sites to encourage use and better serve Logan Airport employee schedules. ▪ In April 2016, Massport further decreased the number of on-Airport employee parking spaces from 2,673 to 2,448 employee spaces.

Figure 5-7 Massport Sustainable Transportation Options Newsletter, February 2018

How to Put the Brakes on Driving Alone to Work

TRANSIT AND VANPOOL DISCOUNTS

- All full, part-time, and job share employees are eligible for 50% reduction off the cost of their public transportation commuting costs, up to $100.00 per month.
- Employees can take advantage of this program either through reimbursement or on a pretax basis from your paycheck.
- Eligible mass transportation options include MBTA transit, Inner Harbor Ferry, Logan Express buses, Commuter Boat, Vanpool and privately operated scheduled buses.

For more information, please contact Emily Navarro at x393, except for Vanpools. Matt Carral of Rideshare by Enterprise can be contacted at Matthew.d.carral@ehi.com or 508-259-8959 for information regarding establishing a Vanpool.

MASSPORT SHUTTLES

- Shuttles circulate the airport, making it easy to connect to the Blue Line (Airport Station), the Silver Line, Logan Express, privately operated scheduled buses, and water transportation.
- Shuttles run during the work week between the LOC, Terminal C and the Blue Line every 15 minutes from 7:30 - 9:30 AM and 2:00 - 6:00 PM.

LOGAN EXPRESS

- Employee discounts on fares and parking are available at all Logan Express locations, including Framingham, Braintree, Woburn, and Peabody. Discounts are also available on the Back Bay Logan Express..
- For tickets, please contact Emily Navarro at x3937.
- Click here for schedules: https://www.massport.com/logan-airport/to-and-from-logan/logan-express/

WATER TRANSPORTATION

- Massport employees can ride the water taxi free of charge Monday – Friday from 7:15 – 9:15am and 3:30 – 5:30pm with a Massport badge all-year round.
- Pre-paid vouchers are also available for work-related travel during other hours. For more information, contact Jamila Richardson at x1756.
- Valid for transportation between the following docks: Logan, Long Wharf, Central Wharf, Rowes Wharf, Moakley Court House, and World Trade Center.
- For a map of water taxi pickup/drop-off locations click here: https://www.massport.com/logan-airport/to-and-from-logan/water-transport/

BIKE TO WORK

- Massport offers bike racks around Logan airport and at other facilities for convenient bike parking.
- Shower facilities are available at the LOC (for badged employees) and may be available at other facilities (check with your supervisor for access and availability).

massport

Pedestrian Facilities and Bicycle Parking

Massport has made substantial progress in providing Airport-wide pedestrian access. Sidewalks along Harborside Drive and Hotel Drive connect to the terminals, where a series of overhead, enclosed walkways connect to the Central and West Parking garages as well as the Hilton Hotel. The sidewalks along Harborside Drive, Transportation Way, North Service Road, and the Harborwalk facilitate pedestrian access to the Airport water shuttle boat dock, MBTA Blue Line Airport Station, and the pedestrian and bicycle pathways at Memorial Stadium Park, Bremen Street Park, and the East Boston Greenway.

Bicycle parking at Massport facilities.

Bicycle parking racks are provided at many landside facilities. Generally, these racks are expected to primarily serve employees, but are open for use by air passengers as well. Terminal A, Terminal E, the Logan Office Center, Signature General Aviation Terminal, the Economy Parking Garage, the Green Bus Depot, and Airport MBTA Station all have bicycle racks. The Rental Car Center (RCC) has sheltered bicycle parking racks for use by both employees and passengers. Shower and change facilities were also added to the Logan Office Center for employees.

Pedestrian and bicycle safety is further enhanced through the design of streetscape, intersections, lighting, and defined vehicle zones with new curbing, crosswalks, sidewalks, plantings, and fencing. Bicycle connections are available around Airport Station, Memorial Stadium Park, Bremen Street Park, and the East Boston Greenway. As part of the RCC construction, connections in the SWSA now allow employees and customers of the Airport to arrive via bicycle and park in a secure covered area at the new RCC. Commuters can use the unified bus system or pedestrian connections to the terminals. In the North Service Area, connections to and from Bremen Street Park and the Greenway Connector were completed in early 2015. These improvements connect the existing shared-use path to a new northern connector of the East Boston Greenway (the Narrow-Gauge Connector). The Logan Airport portion of this connection was completed in July 2014. In 2016, a 1/3-mile extension of the East Boston Greenway network was completed by the City of Boston. There are pedestrian and bike counters along the Greenway Connector. In 2016, there were 43,787 East Boston Greenway users that were recorded by the counter. Massport assumed ownership of an additional section of the park, known as the Narrow-Gauge Connector and located beyond the Greenway, in the spring of 2016.

Ground Transportation Ridership and Activity Levels in 2016

This section of the chapter:

- Provides an overview of transportation services available to Logan Airport users from the Boston metropolitan area;
- Reports on 2016 ridership levels and recent historical trends;
- Reports on Massport's progress in meeting ground access goals; and
- Describes Massport's cooperative planning ventures with other transportation agencies in Massachusetts.

Logan Express, MBTA Transit, and Water Transportation Modes

Annual ridership levels for HOV/transit/shared-ride transportation modes serving Logan Airport are summarized in **Table 5-8**.

Table 5-8 Annual Ridership and Activity Levels on Logan Express, MBTA, and Water Transportation Services, 2010 – 2016

	MBTA Transit		Logan Express Bus			Water Transportation[3]	
Year	**Blue Line[1]**	**Silver Line[2]**	**Air Passengers**	**Employees**	**Total**	**MBTA Ferry[3]**	**Private Water Taxis**
2010	2,270,241	831,323	644,412	467,020	1,111,432	34,794	54,382
2011	2,277,311	900,359	649,609	536,513	1,186,122	33,403	58,879
2012	2,442,085	906,177	681,040	624,149	1,305,189	30,337	60,840
2013	2,597,306	N/A	733,005	634,693	1,367,698	21,952	70,378
2014[4]	2,378,965	N/A	941,043	632,011	1,573,054	19,340	67,479
2015	2,122,597	N/A	1,150,999	622,005	1,773,004	7,748	70,798
2016	**2,240,744**	**N/A**	**1,163,201**	**652,468**	**1,815,669**	**7,757**	**74,788**
Percent Change (2015-2016)	**6%**	**N/A**	**1%**	**5%**	**2%**	**<1%**	**6%**

Source: Massport
Notes:
N/A Not available.
1 Airport Station fare gate entrances only. Automatic Fare Collection introduced in January 2007. The Bremen Street Park entrance to MBTA Airport Station opened June 2007; station activity is not limited to only Airport-related passengers.
2 Boardings at Logan Airport. Silver Line: 2012 values are estimates. No information available for 2013 to present.
3 MBTA Ferry is the Harbor Express F2/F2H service, Hingham/Hull-Logan and Long Wharf. Service from Quincy Fore River was suspended in 2013. Private water taxis include: City Water Taxi and Rowes Wharf Water Transport.
4 Back Bay Logan Express introduced.

Figure 5-8 Logan Airport – Logan Express Bus Service Locations and Routes

Massachusetts Port Authority
Strategic and Business Planning
November 2016

Logan Express Bus Service

N

0 1.25 2.5 5 Miles

Projection: Lambert Conformal Conic **Coordinate System:** NAD 1983 State Plane Massachusetts Mainland FIPS 2001 (Meter)

Logan Express Bus Service

Massport provides frequent, scheduled, express coach bus service to Logan Airport for air passengers and Logan Airport employees from park-and-ride lots in Braintree, Framingham, Woburn, and Peabody. Full service bus terminals and secure parking are provided at all four locations. In addition, a pilot service from Back Bay, described in this section, was introduced in April 2014 (May 2014 was its first full month of operation). A new parking facility was opened in Framingham in April 2015 for Logan Express customers. More information related to this facility is described in this section. **Figure 5-8** depicts Logan Express bus locations with respect to the regional transportation network.

The Logan Express park-and-ride location round-trip adult fare is $22; reduced fares are offered to seniors, and children under the age of 17 ride free. To encourage greater ridership, a parking rate restructuring went into effect in 2012, which featured lower parking rates at $7 per day (from $11 per day) at Logan Express parking lots. On weekdays and Sunday afternoons/evenings, scheduled half-hour headways are provided between the Braintree, Woburn, and Framingham locations and Logan Airport; one-hour headways are provided at these locations on Saturdays and Sunday mornings. Scheduled bus service to/from Peabody is provided hourly. Services conforming to these schedules for all four locations are roughly 4:00 AM to 11:00 PM, with some earlier and later buses provided that vary by location and day of the week.

In 2015, Massport acquired the property on which the Braintree Logan Express site is located, furthering its commitment to providing HOV access from key regional nodes. The Braintree Logan Express service had a ridership of 655,158 passenger trips in 2016, representing 36 percent of the entire Logan Express system ridership. Approximately half of the Braintree Logan Express riders are Logan Airport employees. The Braintree site is approximately 20 acres (14 acres of usable land area) and has approximately 1,800 lined spaces.

As illustrated in **Table 5-8**, air passenger ridership on Logan Express increased by approximately 1 percent from 2015 to 2016; however, park-and-ride increased by 9.4 percent. Declining Back Bay pilot program ridership, described later in this chapter, offset much of the park-and-ride gains. Employee ridership increased by approximately 5 percent between 2015 and 2016. A detailed breakdown of the Logan Express ridership is presented in Appendix G, *Ground Access*.

Framingham Logan Express Upgrades

In April 2015, Massport opened a new parking facility in Framingham to serve Logan Express customers. The new four-level, 1,100-car parking garage increased the capacity at the Logan Express facility by approximately 550 spaces (compared to the previous surface lot). The new garage has improved the customer experience by providing secure parking at one central location rather than relying on a series of remote overflow lots. The new garage was built to high environmental standards, with energy-efficient LED lighting, water saving fixtures, bike racks, and priority parking for alternative fuel vehicles. The new facility continues to be successful: 2016 ridership of the Framingham Logan Express increased by 16.4 percent compared to the 2015 ridership, with 498,895 riders in 2016 versus 428,623 riders in 2015.

Back Bay Logan Express (Pilot Project)

On April 28, 2014, Massport initiated the Back Bay Logan Express service with pick-up locations at the Copley MBTA Green Line Station and the Hynes Convention Center. The Back Bay Logan Express operates daily between the hours of 5:00 AM and 10:00 PM. One-way fares are $7.50 per passenger. Riders with a current, valid MBTA pass receive a reduced fare of $3. The Back Bay Logan Express bus service is a pilot program to observe whether a frequent, direct, express bus service from the downtown business area provides a viable alternative mode of transportation to the Airport.

The Back Bay Logan Express Pilot has been valuable in providing an alternative to air passengers and employees who had been impacted by the temporary, two-year MBTA Government Center Station closure (a key connection to the MBTA Blue Line and Logan Airport), and it provides a new transit alternative to the Airport. Ridership in 2016 for the Back Bay Logan Express totaled 216,329 passengers, an average of about 600 riders per day. In 2015, the service average 805 riders per day, with a total of 290,796 passengers. This 26 percent reduction in ridership can be attributed to the re-opening of the Government Center Station in March 2016 and the ending in June 2016 of a temporary initial price promotion that offered free fares for riders with an MBTA pass and reduced fares for all others. The decline in Back Bay Logan Express ridership is possibly reflected in the uptick in Blue Line service turnstile counts at the MBTA Airport Station between 2015 and 2016. The monthly totals for the Back Bay Logan Express service are summarized in **Table 5-9**.

Table 5-9 Monthly Ridership on Back Bay Logan Express Service for 2015 and 2016

Month	2015	2016
January	16,742	18,440
February	14,671	17,120
March	24,930	24,527
April	23,175	22,078
May	27,638	30,369
June	25,655	16,720
July	28,118	17,087
August	28,746	15,208
September	27,311	14,784
October	25,848	14,368
November	25,126	14,945
December	22,838	10,683
Annual Total	**290,798**	**216,329**

Rapid Transit

The MBTA provides direct connections to Logan Airport via the Blue Line subway at Airport Station and via the Silver Line bus to each of the terminals. According to the *2016 Logan Airport Air Passenger Ground-Access*

Survey, these services are used by over 6 percent of Logan Airport's air passengers, a slight reduction from the previous 2013 survey. Almost 15 percent of passengers with trip origins in Boston, Cambridge, Brookline, and Somerville used MBTA public transit to travel to the Airport. Both services are important for reducing automobile travel to the Airport; according to the survey, over three quarters of users of the Blue Line and Silver Line indicated that their alternative mode of travel to Logan Airport would have been a taxi or TNC, or they would have been dropped off at the Airport by private vehicle. **Figure 5-9** illustrates the public transportation options to access Logan Airport.

Blue Line Ridership/Airport Station Activity

Fare gate data indicate that approximately 2.2 million riders entered the MBTA Airport Station in 2016 (see **Figure 5-10**). This is about a 6-percent increase compared to 2015. As noted in previous reports, fare gate data do not distinguish between Airport related riders and East Boston users, nor between Logan Airport air passengers and employees. Therefore, Airport passenger ridership levels on the Blue Line cannot be directly identified.[11] However, it is assumed that the increase in riders this year can be at least partially attributed to the reopening of Government Center Station and improved Blue Line connectivity between downtown Boston and Logan Airport.

Silver Line (SL1) Ridership

The Silver Line bus service to Logan Airport provides a direct connection between South Station and the Airport terminals via the South Boston Transitway and the Interstate-90 Ted Williams Tunnel. The introduction of free boardings of the Silver Line Airport buses (SL1) at Logan Airport has eliminated the need for fareboxes; thus, 2016 figures of passenger boardings are not available (see **Figure 5-10**). Eliminating fare collection allows all three doors to be used for boarding, thus improving curb operations and schedule adherence. Massport is consulting with the MBTA on the potential for Automated Passenger Counting (APC) systems as a means to continue to collect ridership data.

Eight SL1 buses are owned by Massport and are operated by the MBTA with Massport paying operating costs for the SL1. In 2016, Massport funded an approximate $6 million mid-life rebuild of these eight buses. The mid-life rebuild will extend the useful life of each vehicle by approximately eight years. This will allow the MBTA to improve reliability and quality of operations along the Silver Line today while starting the procurement process to acquire new vehicles in the future.

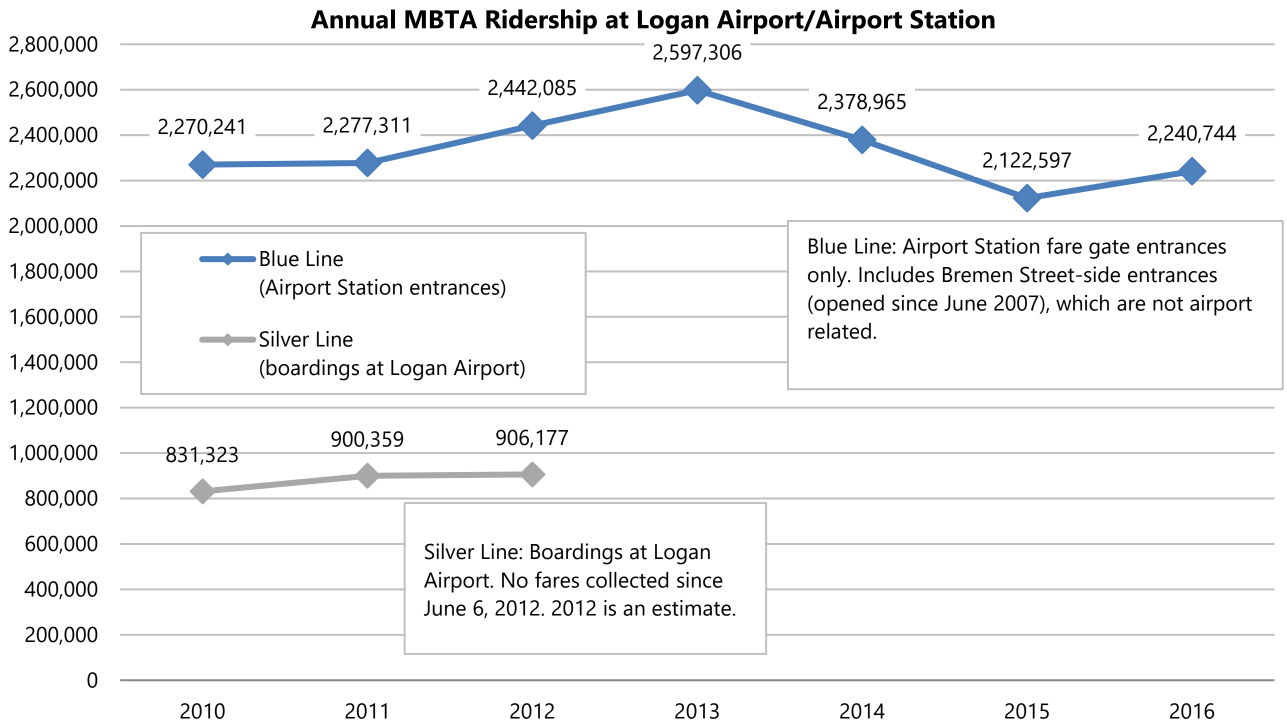
The Silver Line is the only MBTA rapid transit service that provides a direct, one-seat connection to each Airport terminal (the Blue Line requires a second-seat ride on a free Massport shuttle to connect riders to terminals, while express MBTA transit buses connect only at Terminal C, and local bus service to the Airport is limited). Transfers between the Silver Line and the Red Line at South Station are free. At South Station, passengers may also connect to the MBTA commuter rail, Amtrak, and regional intercity buses.

11 Based on automated fare gate entrance counts, approximately 50 percent of entrances occur via the Bremen Street Park fare gates at Airport Station. Based on Massport curbside observations, approximately 45 percent of Airport Station entrances are by airport users.

Figure 5-9 Logan Airport - Public Transportation Options

Projection: Lambert Conformal Conic Coordinate System: NAD 1983 State Plane Massachusetts Mainland FIPS 2001 (Meter)

Figure 5-10 Passenger Activity - Blue Line (Airport Station) and Silver Line (SL1), 2010-2016



Source: Massport,

Water Transportation: Water Taxis and MBTA Ferries

Three companies provide water transportation within the Boston area: Boston Harbor Cruises Water Taxi, Rowes Wharf Water Taxi, and MBTA Harbor Express. Collectively, these companies serve numerous destinations throughout Boston Inner Harbor. The water taxi landing locations include: Long, Rowes, and Central wharfs; the World Trade Center and the Moakley Courthouse in South Boston; and stops in the North End, Charlestown, Chelsea, and East Boston. A new stop is planned at Lovejoy Wharf near North Station. The MBTA Harbor Express provides services to Long Wharf and destinations outside of the Inner Harbor, including Hingham and Hull.[12] The water transportation services stop at the Logan Airport dock on Harborside Drive. Massport provides a courtesy shuttle bus service between the Logan Airport dock, the MBTA Airport Station, and all Airport terminals. Massport also provides an employee subsidy for water transportation modes.

Water transportation accounts for less than 1 percent of the mode share to Logan Airport, according to the *2016 Logan Airport Air Passenger Ground-Access Survey*. Annual ridership on privately-provided water

12 The MBTA ferry schedule from Hingham/Hull to the Logan Airport Ferry Dock is not as frequent as Blue Line and Silver Line services, and does not run on frequent and consistent headways throughout the day. Headways between ferries range from one hour to several hours. There are 14 MBTA ferries to Logan Airport on weekdays; however, there are no MBTA ferries direct to Logan Airport from the South Shore during morning commuting times. In 2016, the one-way fare to cross the Boston Harbor from Long Wharf to Logan Airport costs $12, and $18.50 from Hingham/Hull (twice the regular fare to Boston). The MBTA suspended ferry service from Quincy's Fore River stop in fall 2013, and has since added service to the Hingham service, which has incorporated the Hull stop.

transportation experienced an increase of 6 percent in 2016 compared to 2015, while ridership on the MBTA Harbor Express remained constant (**Table 5-8**).

Other HOV Modes: Scheduled Buses, Shared-Ride Vans, Courtesy Vehicles, and Limousines

Massport provides priority, designated curb areas at all Airport terminals to support the use of HOV/transit modes, including privately-operated scheduled buses and shared-ride vans and limousine services. The majority of scheduled shared-ride carriers use a combination of 15- to 40-passenger vehicles and 40+ passenger coach buses. Scheduled express bus service is offered by several privately-operated carriers from outlying areas of the Boston metropolitan area and neighboring states. Shared-ride van services include services between Logan Airport and many hotels in the Greater Boston area. Shared-ride vans also provide service from western Massachusetts and other regional points throughout New England.

As shown in **Table 5-10**, the estimated total number of seats provided by these HOV modes increased by about 24 percent in 2016 compared to 2015.

Massport offers a 50-percent discount on the ground access fees for alternative fuel vehicles (AFVs) that use compressed natural gas (CNG) or are powered by electricity.

Table 5-10 Estimated Total Seats for Other Scheduled and Unscheduled HOV Modes: Scheduled Buses, Shared-Ride Vans, Courtesy Vehicles, and Limousines, 2010 - 2016

	Scheduled and Unscheduled HOV Modes			
Year	**Scheduled Buses**	**Scheduled Vans & Limousines**	**Courtesy Vehicles**	**Limousines (unscheduled)**
2010	2,345,145	893,992	2,021,415	1,882,172
2011	2,251,480	996,208	1,885,575	1,991,672
2012	2,360,050	656,288	2,071,545	2,180,020
2013	2,342,450	437,344	2,043,870	2,125,044
2014	2,332,110	311,680	2,092,965	2,739,464
2015	2,324,080	499,344	2,118,810	3,277,000
2016	2,754,290	640,586	2,583,345	4,203,915
Percent Change (2015 - 2016)	**18.5%**	**28.3%**	**21.9%**	**28.3%**

Source: Massport

Non-HOV (Automobile) Modes

Logan Airport passengers can access the Airport by a number of automobile modes, including private automobiles, taxis, TNCs, and rental cars. These modes account for about 69.5 percent of the access modes used by air passengers, based on the *2016 Logan Airport Air Passenger Ground-Access Survey*, a reduction of 2.7 percent since 2013. Although these modes are categorized as non-HOV, they frequently carry more than one passenger per vehicle. Based on the 2016 survey results, the average vehicle occupancies for these automobile modes range from 1.4 to 1.9 passengers per vehicle.

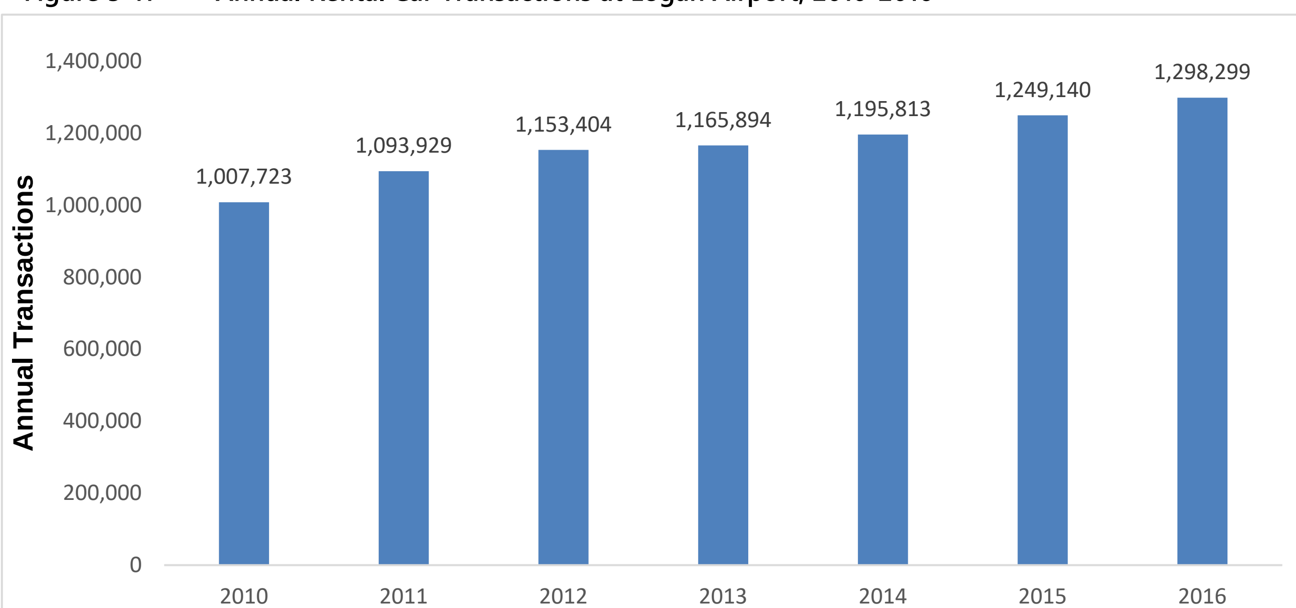
Automobile Access

Private automobile access to the Airport is classified as either curbside drop-off or parked-on-Airport (terminal area or remote/Economy). Traffic associated with these trips are described in this chapter's section on traffic conditions.

Rental Car

At the opening of the RCC in 2013, nine rental car brands were serving Logan Airport: Advantage, Alamo, Avis, Budget, Dollar, Enterprise, Hertz, National, and Thrifty. Payless and Firefly initiated operations in 2014 and Zipcar began operations at Logan Airport at the end of 2013. Rental car transactions (see **Figure 5-11**) have been increasing in recent years, following the trend of air passenger activity.

Figure 5-11 Annual Rental Car Transactions at Logan Airport, 2010-2016



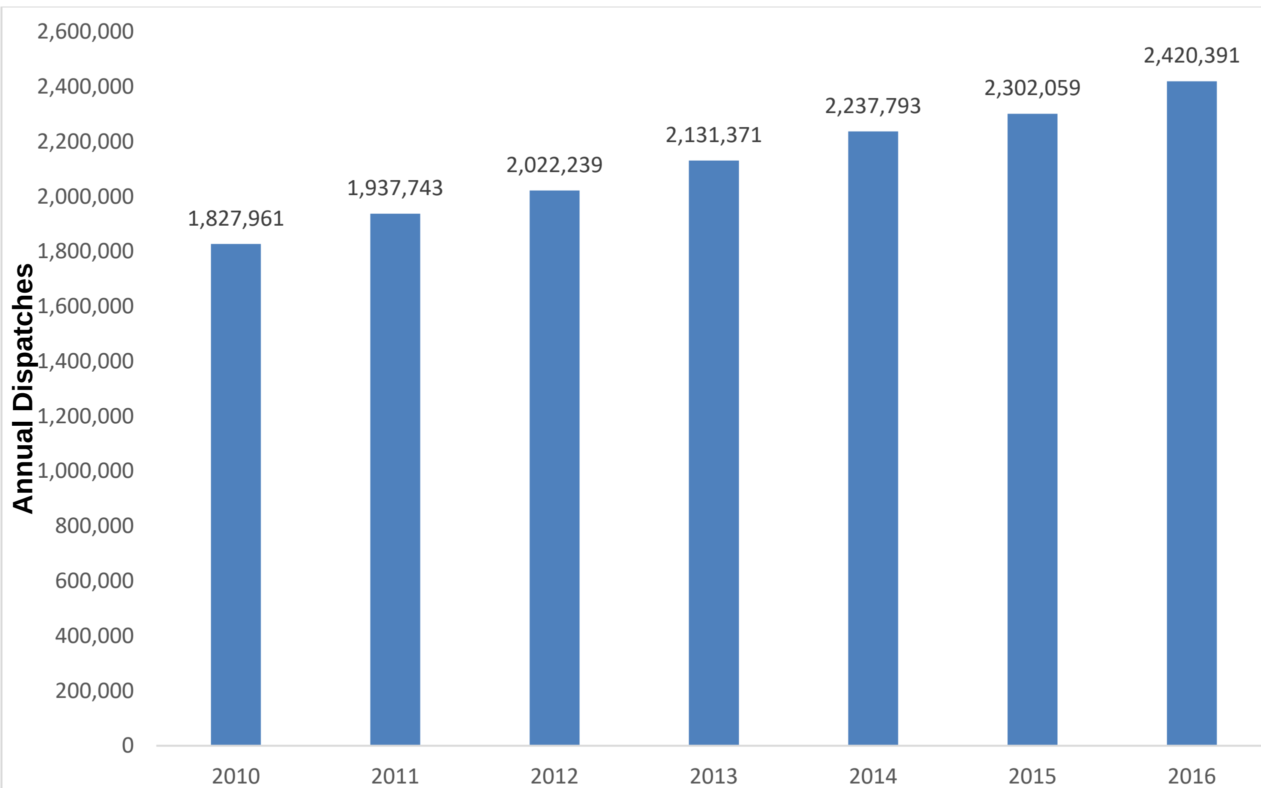
Source: Massport.

Taxis

Taxi ridership trends are reflected in the total number of taxis dispatched from Logan Airport (serving outbound passengers). The number of taxis dispatched rose in 2016 by 5.1 percent over the 2015 level (see **Figure 5-12**).

Taxi dispatches reflect the increase in air passenger levels. Taxi use in 2016 reached the highest recorded level at Logan Airport (2.4 million dispatches in 2016, when Logan Airport served 36.3 million annual air passengers).

Figure 5-12 Annual Taxi Dispatches at Logan Airport, 2010-2016



Source: Massport

Green Cab Program

Since 2007, Massport has sponsored a "Head-of-Line" hybrid vehicle taxi incentive program, in partnership with the City of Boston. Under this program, Boston taxis that qualify as clean-fuel vehicles may obtain permission to move up in the line at Logan Airport's taxi pool; this allows these "green cabs" to be dispatched to the terminals in a shorter amount of time.

TNC Program

Massport initiated TNC pick-up and drop-off operations in February 2017. Data and figures specific to the TNC program will be reported in the *2017 ESPR*.

Ground Access Planning Considerations

Surface transportation modes have environmental impacts, and are considered a standard component of airport GHG emissions inventories (see Chapter 7, *Air Quality/ Emissions Reduction*). Enhancing multimodal transportation options is one way an airport can reduce GHG emissions and improve its environmental footprint.

Potential emissions reductions are one reason why Massport is committed to a long-term goal to promote and support public and private HOV/shared-ride services aimed at serving air passengers, Airport users, and employees. Other benefits include:

- Reducing congestion on the terminal roadways and curbside drop-off/pick-up areas;
- Alleviating constraints on limited parking facilities; and
- Customer service (providing a range of transportation options for different traveler demographics).

Passenger HOV Mode Share Goal

Massport's current ground access goal is to attain a 35.2-percent passenger HOV mode share when annual air passenger levels reach 37.5 million. The 35.2-percent HOV mode share figure was developed by a planning process involving Massport staff and was first presented in the Logan Growth and Impact Control (LOGIC) planning studies that were completed in the early 1990s.[13] In subsequent environmental documents, the 35.2-percent HOV mode share became a declared goal related to ground access to Logan Airport.[14]

Beginning in 2017, Massport will introduce a new definition for HOV that takes into account vehicle occupancies of taxi, livery (black car limousine), and TNC modes. Under the current system, Massport counts all taxis as non-HOV and all black car limousines as HOV, regardless of the number of passengers transported. Massport is also classifying TNCs, which did not exist during LOGIC planning studies, as non-HOV, regardless of the number of passengers transported. Beginning in 2017, Massport will use a new HOV definition where vehicle occupancies of taxis, livery services, and TNCs that exceed one air passenger per vehicle, will be defined as HOV. With this new definition, Massport has committed to a goal of 35.5 percent HOV by 2022 and 40 percent by 2027.

Progress toward this goal is measured using the triennial air passenger ground-access survey. The latest survey, which was conducted in 2016, revealed an air passenger ground access mode share of 30.5 percent for HOV/shared-ride modes, which is a 2.7-percent increase since 2013 and roughly the same as the survey indicated in 2010. Historically, there has not been a significant shift in HOV mode share since 2004. This result demonstrates that Logan Airport has been able to maintain its HOV mode share in concert with improvements

13 Logan Growth & Impact Control Study (LOGIC) Phase I Report (1990) and Logan Growth & Impact Control Study (LOGIC), Phase II Final Report (June 1993).

14 West Garage Final EIR (January 31, 1995) and 1994 & 1995 Annual Update of the Final Generic Environmental Impact Report (GEIR), vol. 1 (July 1996), which presents for the first time "Massport's Ground Access Management Plan" and states that its goals are "to achieve a 35 percent high-occupancy vehicle (HOV) mode share by air passengers…" [p. I-7-4]

to roadway access to the Airport and despite significant increases in air passenger levels. Also, the result confirms Logan Airport's rank at the top of U.S. airports with respect to HOV/shared-ride mode share.[15]

Although generally useful, the calculation of overall HOV mode share is limited in that some modes can operate as both high-occupancy and low-occupancy vehicles (**Table 5-11**). Many automobile modes carry multiple passengers; for example, as seen in **Table 5-11.** The *2016 Logan Airport Air Passenger Ground-Access Survey* indicates an average occupancy of 1.66 air passengers per automobile used for airport ground access. The new Massport definition for HOV, beginning in 2017, aims to more closely align tracking metrics with Authority objectives for reducing on-Airport motor vehicle use, including accounting for emerging HOV alternatives for otherwise existing commercial drop-off/pick-up modes.

Table 5-11 Average Vehicle Occupancy by Vehicular Ground Access Mode (2016)

Mode	Est. Vehicle Occupancy	% SOV Trips
Private Vehicle	1.75	33.4%
Taxicab	1.54	41.8%
Rental Vehicle	1.91	27.1%
TNC	1.41	51.8%
Subtotal for Automobile Modes	**1.66**	**37.4%**
Car Service ("black car" limousine by reservation)	1.56	42.2%
Shared-Ride Van or Limousine (scheduled or reservation)	8.12	7.7%

Source: Massport, *2016 Logan Airport Air Passenger Ground-Access Survey*.
Notes: Based on air passengers departing on both weekdays and weekend days.
Average occupancy in this table was calculated as the average occupancy of arriving vehicles across survey respondents.
An SOV (single occupancy vehicle) passenger is defined as an air passenger that arrives at the Airport with no other air passengers in the vehicle. Air passengers can arrive as the only traveling air passenger in any of the above modes; thus, drivers and/or occupants who are not air passengers are excluded from the vehicle occupancy calculation.

Through a strategic planning process, Massport has concluded that its overarching ground access goal must be to minimize the number of motor vehicles used by both passengers and employees traveling to and from Logan Airport. Achieving this goal will require balancing the need to accomplish three objectives:

- Increasing the availability and use of transit, HOV, and shared-ride options for Logan Airport passengers and employees;
- Minimizing the number of drop-off/pick-up trips, particularly "dead head" trips in which a vehicle brings a passenger to Logan Airport and leaves with only the driver, effectively doubling the number of vehicle trips needed for that passenger to get to and from the Airport; and

15 It is useful to note that there is no standard aviation industry definition with respect to categorizing ground access modes as HOV versus single occupancy vehicle (SOV). While some modes (e.g., Logan Express and the Silver Line) clearly fall into the HOV mode category, the appropriate category for a limousine or taxi is less clear.

- Managing parking supply, pricing, and operations to promote use of transit/HOV/shared-ride options and reduce the amount of diversions/valeting, all without increasing the number of drop-off/pick-up trips due in part to a constrained parking supply.

The new HOV definition beginning in 2017 will describe the mode use and travel patterns of air passengers using Logan Airport to better reflect these considerations and track progress toward meeting all its ground access goals, including, but not limited to, maintaining its high HOV mode share.

Conditions Under Constrained Parking

According to research conducted for Massport, Logan Airport is the only airport in the country with a parking freeze.[16] As described earlier in this chapter, during many weeks in 2016, vehicles were diverted from Central Parking to Economy Parking or Terminal E lots, or valeted to other areas until lined spaces became available. Peak-day demand exhibited few signs of dampening, and overflow conditions persist. These conditions exist despite the supply of over 2,700 parking spaces off-Airport at nearby private lots, and despite the increases in Logan Express use since the lowering of parking rates at those locations.

With the Logan Airport Parking Freeze (and current capacity levels) in place, weekday demand is outpacing supply on a regular basis. Under such conditions, travelers arriving at the Airport to park on Tuesdays and Wednesdays would find themselves unable to park their cars on-Airport.

In 2015, Massport completed the West Garage Parking Consolidation Project. This project consolidated 2,050 temporary parking spaces as an addition to the West Garage and at the existing surface lot between the Logan Office Center and the Harborside Hyatt. Construction of these spaces constituted all the remaining spaces permitted under the Logan Airport Parking Freeze. As air traveler numbers have increased, the constrained parking supply at Logan Airport has periodically had the unintended consequence of causing an increase in environmentally harmful drop-off/pick-up vehicle trips (which generate up to four vehicle trips per air passenger, compared to two trips for those who drive and park, see **Figure 5-1**).

Another element of Massport's comprehensive transportation strategy was increasing the Logan Airport Parking Freeze Cap. Massport proposed to increase the Logan Airport Parking Freeze Cap by 5,000 on-Airport commercial parking spaces at Logan Airport. The goal of this change was to provide Massport with the ability to reduce the number of air passengers choosing more environmentally harmful drop-off/pick-up modes by allowing passengers to park on-Airport. MassDEP issued the amended regulation on June 30, 2017 approving the requested parking cap increase, and Massport initiated a parallel process with EEA by filing an ENF for new parking facilities on March 31, 2017. On May 5, 2017, EEA issued its Certificate on the ENF establishing the Scope for the required Draft EIR. On December 5, 2017, the EPA proposed a rule approving the revision of the Massachusetts SIP incorporating the amended Logan Airport Parking Freeze Cap. EPA finalized the rule on March 6, 2018, and became effective on April 5, 2018. Initiation of concept design for the parking facilities and preparation of a Draft EIR is expected to commence in the Spring of 2018.

16 LeighFisher, August 2011.

Planning for Passenger Ground Access

In the past, the ground access strategy has operated within the constraints of the Logan Airport Parking Freeze. Future efforts will need to address the growing use of drop-off/pick-up modes that include private vehicles, taxis, limousines, and TNCs. Drop-off/pick-up vehicle activity is growing at a time when commercial parking supply is at or beyond capacity.

Passenger surveys have shown that under constrained parking conditions, over 75 percent of "would be" parkers opt for drop-off/pick-up modes rather than HOV/shared-ride modes. Accordingly, an unintended effect of constrained parking supply has been an increase in the total number of vehicle trips generated by Logan Airport passengers.

Therefore, Massport's challenge is how to influence a mode shift so that the passengers generating the excess parking demand are encouraged to use sustainable transportation modes (including public transit, Logan Express, and other shared-ride services) rather than increase commercial and private vehicle drop-off and pick-up activity that would generate increased levels of traffic and curbside congestion (and associated emissions) at Logan Airport. As passenger levels have increased, the lack of commercial parking spaces has had the counterproductive effect of inducing more drop-off/pick-up travel, which entails more trips, VMTs, and air emissions than trips by people who park at the Airport. This is a key planning issue that Massport will address in future Airport-wide efforts. Massport's longer-range ground access strategy will balance the need to increase the HOV/transit/shared-ride mode share, manage on-Airport parking, and reduce drop-off/pick-up vehicle trips.

As part of the Terminal E Modernization Project, a connection between Terminal E and the MBTA Blue Line Airport Station will be constructed to improve the passenger convenience. This connection is currently being studied and various approaches are under consideration. Consideration is being given to constructing an Automated People Mover (APM) which ultimately would connect the MBTA Blue Line Airport Station to all the terminals. The APM concept is in the very early stages of feasibility assessment and will be more definitive as the Terminal E Modernization Project moves into Phase 2. Future EDRs and ESPRs will provide updates as final design and construction proceed (see Chapter 3, *Airport Planning,* for additional information on this project.)

Ground Access Initiatives

Massport promotes ridership on HOV/transit/shared-ride modes and maintains efficient transportation access and parking options in and around Logan Airport to reduce the reliance on automobile modes as a means to achieving the HOV mode share goal. Measures implemented by Massport include a blend of strategies related to pricing (incentives and disincentives), service availability, service quality, marketing, and traveler information. Because of the different demographics of Logan Airport air passenger travelers, no single measure alone will accomplish the goal.

HOV/Transit/Shared-Ride Initiatives

In April 2014, Massport initiated the Back Bay Logan Express pilot service. Using Massport's 42-foot CNG buses, this service provides travelers with three scheduled trips per hour between the Hynes Convention Center, Copley Square (at the MBTA Green Line Copley Station), and Logan Airport. In addition to serving an area that generates a significant number of trips to the Airport, the Back Bay Logan Express service served transit riders inconvenienced by the two-year closure of the MBTA Government Center Station, where the Green Line meets the Blue Line. Since the re-opening of Government Center in March 2016, Massport has chosen to continue this pilot program.

Massport has expanded its Logan Express bus service, including spending $30 million to build a 1,100-space parking garage in Framingham to meet growing air passenger and employee demand. The Framingham Logan Express carries the highest number of non-employee passengers of all the Logan Express services. The completion of this new parking facility increased capacity by 550 spaces as compared to the previous surface lot.

Parking Programs and Initiatives

Cell Phone Waiting Lot

The cell phone waiting lot in the vicinity of Terminal E provides 61 parking spaces where drivers waiting for passengers on arriving flights may park. Before the creation of the Cell Phone Waiting Lot, drivers who were waiting for arriving passengers either used short-term parking, circulated around the Airport, or dwelled at the curb until asked to move by State Police officers. This facility reduces vehicle emissions by minimizing idling and on-Airport VMT by such motorists. The maximum wait time permitted at this parking lot is 30 minutes and parking is free of charge.

Parking PASSport Gold and Parking PASSport

Parking PASSport Gold and Parking PASSport allow users to enter and exit Logan Airport's parking garages and lots with an access card that is linked to an established account for faster payment transactions. Parking fees are automatically charged to a registered credit card and the receipt is emailed to the account holder. Customers in the Parking PASSport programs account for approximately 3 to 4 percent of parking exits at Logan Airport.

Massport offers guaranteed parking through its Parking PASSport Gold program. Parking PASSport Gold eliminates the need for a motorist to circle the garage looking for available spaces. First implemented in 2006, the Parking PASSport Gold program had 10,723 customers as of December 31, 2016, compared to 10,761 at the end of 2015. About 8 percent of spaces in the Central/West Parking garage and 12 percent of spaces in the Terminal B garage are set aside for these customers.

Hybrid and Alternative Fuel Vehicle (AFV) Preferred Parking

In the State's first preferred parking program for hybrid and AFVs, Massport began offering preferred parking for customers driving hybrid and AFVs in the spring of 2007. Massport provides designated parking spaces at Logan Airport's Central Garage, Terminal B Garage, Terminal E surface lot, and Economy Parking. Massport also offers a 50-percent discount on the ground access fees for AFVs that use CNG or are powered by electricity.

Employee Ground Transportation Initiatives

Airport employee transportation has different ground access considerations than passenger transportation. Airport employees often have non-traditional (and often unpredictable) working hours that are difficult to match to typical transit service hours (MBTA service does not start until after 5:00 AM and ends by 1:00 AM). Due to the time-sensitive nature of airline operations, on-time reliability is important for employee transportation, as is flexibility during severe weather or other delays that may extend a typical employee workday or work shift.

Massport strives to reduce the number of Airport employees commuting by private automobile, to enhance commuter options, and to reduce traffic and parking demands at Logan Airport. To help accomplish these objectives Massport continues to:

- Provide off-Airport employee parking in Chelsea, which is served by frequent shuttle bus service to the terminals (Route 77) 24 hours a day, 7 days a week;
- Run free employee shuttle buses between Airport Station and employment areas in the SWSA and the South Cargo Area (SCA) locations (Routes 44, 66, and Logan Office Center);
- Operate early morning and late-night Logan Express bus trips for commuters;
- Support the Logan Transportation Management Association (TMA);
- Support the Sunrise Shuttle for early morning bus service from East Boston, Winthrop, and Revere prior to the start of MBTA service;
- Create and maintain a comprehensive sidewalk/walkway system on Logan Airport to facilitate pedestrian access;
- Provide bicycle racks; [17] and
- Comply with the state rideshare regulation.

Two of these initiatives that are exclusively targeted to employees are described below.

Logan Transportation Management Association (TMA)

The Logan TMA advises Airport employers on transit benefits and provides information on available commuting transportation alternatives, ride-matching services, and reduced-rate HOV/transit fare options. Massport continues to contribute $65,000 annually to the Logan TMA. Benefits and services provided by the Logan TMA in 2016 included:

- East Boston, Winthrop, and Revere early morning shuttle service (Sunrise Shuttle; further details are provided below);
- Computerized ride-matching services for participating in carpools and vanpools;

17 Bicycle racks are provided at Terminal A, Terminal E, Logan Office Center, MBTA's Airport Station, Economy Parking Garage (covered), Signature general aviation terminal, the Green Bus Depot (Bus Maintenance Facility), and the Rental Car Center (covered).

- Advocacy for improved service and reduced fares for its members from Massport, the MBTA, or other providers of mass transit and other alternative forms of transportation; and
- Outreach to Airport employees about commuting transportation alternatives.

Sunrise Shuttle

Originally launched in August 2007, this shuttle service provides low-cost transportation to Airport employees who live in nearby East Boston, Revere, and Winthrop. A second shuttle route was added in October 2011 that serves East Boston's Orient Heights neighborhood and Winthrop.

The Sunrise Shuttle services operate outside of MBTA service hours between 2:40 AM and 6:00 AM, with shuttles every half-hour transporting employees to the Airport terminals. Ridership levels have steadily increased since the shuttle's launch. The two-route service has reached over 1,500 riders per month.

Logan Airport Air Passenger Ground-Access Survey

Massport periodically[18] administers an extensive survey of air passengers to better understand the ground access characteristics of air passengers traveling to and from Logan Airport and to track historical trends of these attributes. Since the late 1970s, the *Logan Airport Air Passenger Ground-Access Survey* has been Massport's primary tool for understanding the changes in air passenger travel behavior, including ground access mode choices, travel patterns, and market characteristics. The survey is a tool that assists Massport in evaluating the effectiveness of its transportation policies and services, and the impacts on the regional transportation system. The survey also shapes the direction of Massport's planning efforts to encourage Logan Airport travelers to use HOV transit/shared-ride modes instead of SOV modes.

The survey is the principal means of measuring air passenger ground access HOV mode share. **Table 5-12** presents the air passenger ground access mode shares from the 2016 survey findings. Additional findings from the *2016 Logan Airport Air Passenger Ground-Access Survey* that relate to mode choice are presented in this section, as are comparisons of the results to past surveys.

Traveling in a private vehicle and being dropped off at the Terminal Area is still the predominant way that air passengers get to Logan Airport; this mode is used by 21.3 percent of departing air passengers. The use of TNCs[19] (such as Uber/Lyft/Fasten) to access the Airport is the second most common mode, at a 14.3-percent share. The combined mode shares for transit modes (including MBTA services, water taxis, Logan Express, and similar scheduled bus services) is approximately 16.3 percent of air passengers traveling to the Airport. Driving and parking at the Airport is the mode used by 11.4 percent of air passengers and taxis are now used by 9.8 percent. The *2016 Logan Airport Air Passenger Ground-Access Survey* is available online at www.massport.com/media/2593/2016-logan-air-passenger-ground-access-survey.pdf.

18 Since 2004, a survey has been administered every three years.

19 TNCs were not legally allowed to operate for arriving passengers in 2016.

Table 5-12 Air Passenger Ground-Access Mode Share, 2016

	Spring 2016 Air Passenger Survey		
Ground Access Mode	**Weekday**	**Weekend**	**All Trips**
Automobile Modes:			
Private Vehicle			
Dropped off	19.2%	26.5%	**21.3%**
Parked at Terminal	9.8%	5.7%	**8.6%**
Parked in Economy Lot or Overflow	3.1%	1.9%	**2.8%**
Parked Off-Airport	1.8%	1.7%	**1.8%**
Rental Vehicle	10.6%	11.6%	**10.9%**
Taxicab	10.0%	9.5%	**9.8%**
Uber/Lyft/Fasten	14.4%	14.2%	**14.3%**
Subtotal	**68.8%**	**71.1%**	**69.5%**
HOV/Shared Ride Modes:			
Public Transit			
Logan Express Bus	5.8%	3.8%	**5.2%**
Other Express Bus	4.6%	4.2%	**4.5%**
MBTA Blue Line Subway	2.2%	5.6%	**3.1%**
MBTA Silver Line Bus	3.8%	2.3%	**3.3%**
Water Shuttle/Water Taxi	0.2%	0.1%	**0.2%**
Other Shared-Ride Vehicles			
Car Service (black car, private limousine, etc.)	5.9%	4.4%	**5.5%**
Shared ride van or limousine	2.6%	2.9%	**2.7%**
Free Hotel/Courtesy Shuttle	3.4%	3.2%	**3.3%**
Charter Bus	1.7%	1.2%	**1.5%**
Other	1.0%	1.3%	**1.1%**
Subtotal	**31.2%**	**28.9%**	**30.5%**
Total	**100%**	**100%**	**100%**

Source: Massport, *2016 Logan Airport Air Passenger Ground-Access Survey*

Table 5-13 presents these aggregated air passenger ground access mode shares for survey years 2004 through 2016. As the data indicate, the overall HOV mode share for air passengers has fluctuated between 28 and 31 percent in each of the survey years during this time period. Thus, even with air passenger growth, the mode share split between HOV and automobile modes has remained relatively stable.

Table 5-13 Ground-Access Mode Share (All Passengers) by Survey Year

Ground Access Mode	2004	2007	2010	2013	2016
Non-HOV/Automobile					
Private Automobile	36.0%	40.2%	40.4%	43.2%	**34.5%**
Taxi	22.8%	19.7%	18.8%	18.6%	**9.8%**
Rental car	10.9%	12.4%	10.9%	10.4%	**10.9%**
TNCs	NA	NA	NA	NA	**14.3%**
Total Non-HOV Share	**69.7%**	**72.3%**	**70.1%**	**72.2%**	**69.5%**
HOV/Shared-Ride					
Unscheduled HOV	8.1%	7.3%	7.6%	8.3%	**8.1%**
Scheduled HOV	10.6%	6.9%	8.2%	6.9%	**9.7%**
Transit	6.5%	6.7%	7.6%	7.6%	**6.6%**
Courtesy Shuttle	3.1%	3.5%	4.6%	3.3%	**3.3%**
Other	2.0%	3.4%	1.8%	1.7%	**2.6%**
Total HOV Share	**30.3%**	**27.8%**	**29.9%**	**27.8%**	**30.5%**

Source: Massport, *2004, 2007, 2010, 2013, 2016 Air Passenger Ground-Access Surveys*

Notes: For this table, air passenger ground access modes are grouped into the following categories:

- Private Automobile: Includes all passengers that are dropped off by a privately-owned automobile, and all passengers who drive and park their vehicles at the Airport or at an off-airport parking facility.
- Taxi: A passenger driven to Logan Airport in a licensed, commercial taxi.
- Rental Car: A passenger who rents a car from an on-Airport or nearby off-Airport rental car agency.
- TNCs include services such as Uber, Lyft, and Fasten and are captured in the 2016 survey data for the first time.
- Scheduled HOV Service: A passenger who arrives at Logan Airport via scheduled bus, limousine, or van service, including privately-operated services and Massport's Logan Express.
- Unscheduled HOV Service: Includes passengers who travel to Logan Airport via unscheduled limousine or van providers.
- Transit: A passenger who takes an MBTA public transit service (including the Blue Line subway, Silver Line bus rapid transit) or one of the water transportation services (operated in conjunction with a dedicated Massport shuttle bus to/from Logan Airport terminals).
- Courtesy Shuttle: A passenger who arrives at the Airport in a courtesy shuttle, such as those offered by nearby hotels.
- Other: Includes passengers that access the Airport by walking, riding a bicycle, taking a charter bus, or riding an MBTA bus (excluding the Silver Line).

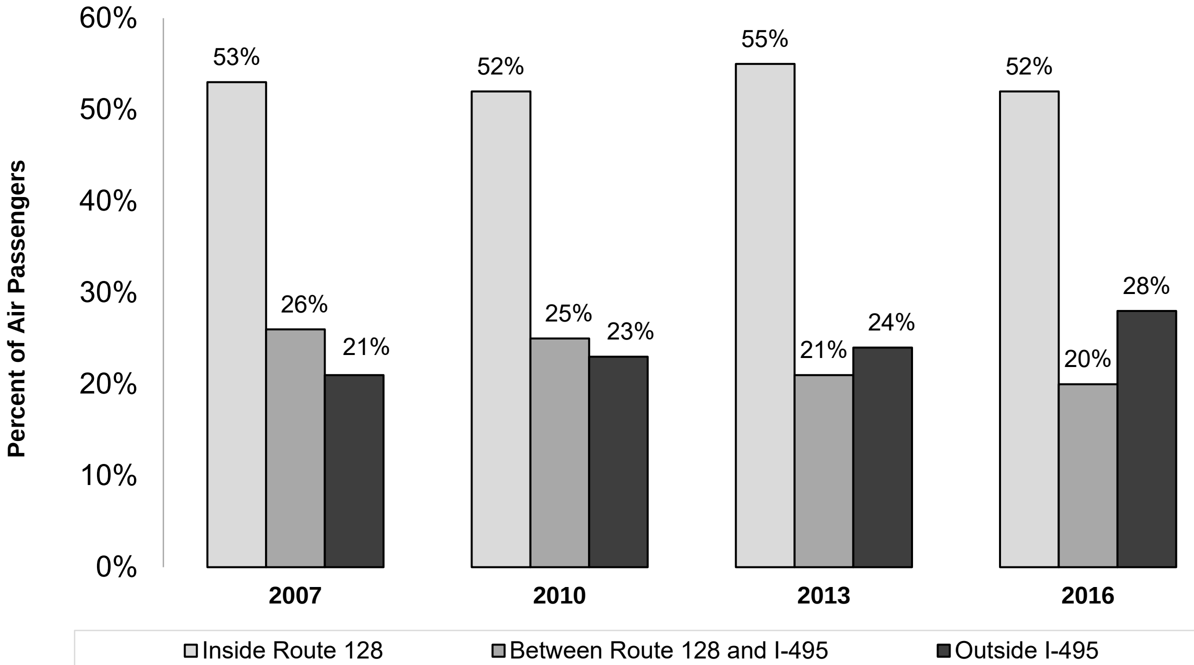
Average Vehicle Occupancy (Air Passengers) by Ground-Access Vehicle Modes

Table 5-11 presented estimates of average vehicle occupancy and the share of ground access trips made by air passengers in single-occupant vehicles by various ground access modes (transit modes and charter and express buses and vans are excluded). These estimates are based on the responses provided in the *2016 Logan Airport Air Passenger Ground-Access Survey*. In 2016, the average occupancy for non-HOV automobile vehicle modes was 1.66 passengers per vehicle, down from 1.85 in 2013. Some of this change can be explained by the introduction of TNCs, which on average have lower vehicle occupancies. Most trips made by air passengers in private automobiles carry more than one passenger per vehicle; only 33 percent of air passengers arriving by private vehicle were traveling alone.

Ground-Access Origins of Air Passengers

Figure 5-13 indicates how the distribution of air passenger trips by geographic area has changed since 2004. The majority of trips still originate in Boston and other communities within Route 128. Nevertheless, Logan Airport now draws over a quarter of its passengers from areas outside of I-495.

Figure 5-13 **Logan Airport Air Passenger Ground Access Trip Origins**



Source: Massport, *2004, 2007, 2010, 2013, 2016 Logan Airport Air Passenger Ground-Access Surveys*.
Note: Based on air passengers departing on both weekdays and weekend days.

The origin of an air passenger ground access trip has an important influence on mode choice. Simply stated, transportation systems and services vary by geographic area, and thus affect the travel behavior of a passenger traveling to Logan Airport. This is apparent from the results shown in **Table 5-14,** in which the distribution of ground access modes among passengers within four geographic areas is provided.

As expected, transit use is highest in the Urban Core (defined as Boston, Brookline, Cambridge, and Somerville) as this area is served by the MBTA's rapid transit system. TNC and taxi use is also highest in this area (approximately half of all trips), due in part to the proximity to the Airport. The area outside of the Urban Core but within the Route 128 highway belt is the area with fewest HOV/transit options, and its mode share reflects this, including the highest share of private vehicle drop-off. Outside of Route 128, scheduled express bus services provide the bulk of the HOV/shared-ride services; correspondingly, these modes carry the highest HOV mode share in these areas. In fact, ridership growth in Logan Express and private buses have helped increase transit shares outside of Route 128 (but within the Commonwealth of Massachusetts) to near parity with the Urban Core. Otherwise, private vehicles are the dominant mode of access for passengers originating in areas outside of the Boston metropolitan area urban core.

Table 5-14 Ground-Access Mode Share by Air Passenger Ground Trip Origin, 2016

	Ground Trip Origin				
Ground Access Mode	**Urban Core**	**Between Urban Core and Route 128**	**Between Route 128 and I-495**	**Outside I-495**	**Outside of MA**
Automobile Modes					
Private Vehicle					
Dropped off	14%	32%	26%	27%	18%
Parked On-Airport	4%	13%	20%	16%	18%
Parked Off-Airport	0%	1%	2%	3%	5%
Subtotal Private Vehicle	**18%**	**47%**	**48%**	**46%**	**41%**
Rental Vehicle	5%	12%	13%	15%	14%
Taxicab	19%	10%	3%	2%	1%
TNC	30%	12%	4%	2%	2%
Subtotal – Automobile Modes	**71%**	**80%**	**69%**	**65%**	**57%**
HOV/Shared Ride Modes					
Public Transit					
Logan Express Bus	3%	2%	13%	7%	4%
Other Express Bus	<1%	0%	1%	8%	21%
MBTA Silver Line Bus	7%	2%	1%	2%	1%
MBTA Blue Line Subway	8%	1%	1%	0%	<1%
Water Shuttle/Water Taxi	<1%	0%	<1%	0%	<1%
Subtotal Public Transit	18%	5%	17%	17%	27%
Other Shared-Ride Vehicles					
Car service (black car, private limousine, etc.)	3%	7%	9%	6%	7%

Table 5-14 Ground-Access Mode Share by Air Passenger Ground Trip Origin, 2016 (Continued)

	Ground Trip Origin				
Ground Access Mode	**Urban Core**	**Between Urban Core and Route 128**	**Between Route 128 and I-495**	**Outside I-495**	**Outside of MA**
Shared ride van or limousine	2%	2%	2%	5%	4%
Free Hotel/Courtesy Shuttle	4%	6%	1%	1%	2%
Charter Bus	1%	0%	0%	5%	2%
Subtotal Other Shared-Ride Vehicles	**10%**	**14%**	**12%**	**18%**	**16%**
Other	1%	1%	2%	1%	1%
Subtotal – HOV/Shared Ride/Other Modes	**29%**	**20%**	**31%**	**35%**	**43%**

Source: Massport, *2004, 2007, 2010, 2013, 2016 Logan Airport Air Passenger Ground-Access Surveys*

Market Segment: Trip Purpose and Residency

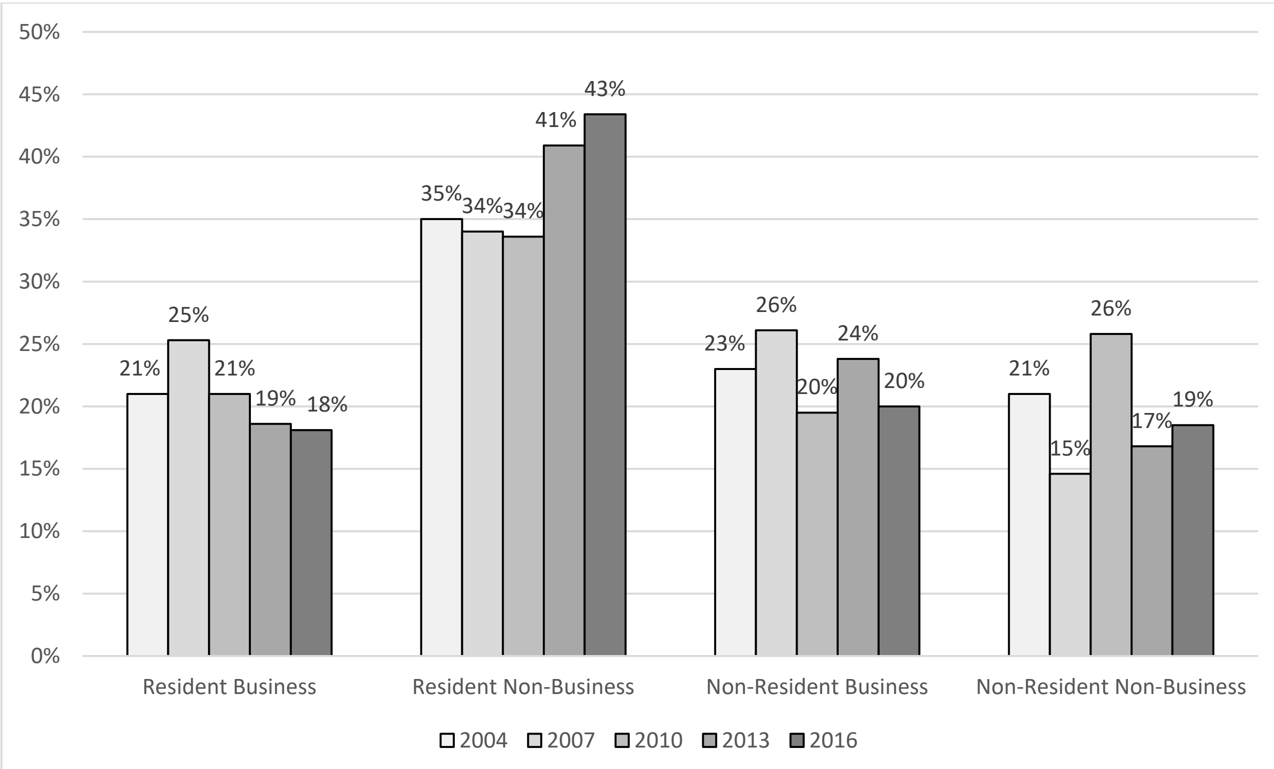
Massport characterizes air passengers into four distinct market segments:

- **Resident Business:** passengers living within the region served by Logan Airport and traveling for business reasons;
- **Resident Non-Business:** passengers living within the region served by Logan Airport and conducting personal travel (e.g., leisure trip);
- **Non-Resident Business:** passengers living outside the region served by Logan Airport and traveling to conduct business; and
- **Non-Resident Non-Business:** passengers living outside the region served by Logan Airport and traveling for personal reasons (e.g., leisure or vacation travelers).

Residents are defined as passengers who use Logan Airport as their "home" airport, regardless of their proximity to other airports. It is important to study the passenger market in this manner because sensitivity to key factors that influence travel behavior such as convenience, time reliability, and pricing varies substantially among these passenger market segments. This information assists Massport in developing appropriate ground access services for passengers.

Figure 5-14 compares the share of weekday trips by market segment across the five most recent surveys. The resident non-business market is the largest market segment, contributing over one-third of all air passengers at Logan Airport. In general, the market share of leisure segments increased in 2016 compared to 2013.

Figure 5-14 Weekday Market Segments (Combined Trip Purpose and Residency)[1]



Source: Massport, *2004, 2007, 2010, 2013, 2016 Logan Airport Air Passenger Ground-Access Surveys*.
Note:
1 Based on air passengers departing on weekdays only. Figures rounded.

There are numerous implications for ground access due to the changing mix of Logan Airport air passengers. **Tables 5-15** and **5-16** present ground access mode shares by market segment. HOV mode share is overall typically lower in the business market segments; business travelers typically have a high sensitivity to time, require flexibility and schedule reliability, and often make decisions related more to convenience than to cost (which is often covered by their employer not by the air passenger). Public transit and scheduled HOV services (including Logan Express) have a higher share among the non-business market segments, particularly for residents that have greater familiarities with the systems. Non-business market segments are more sensitive to ground transportation costs, travel less frequently but for longer time periods, and tend to travel at off-peak fly times/days. These factors help account for the increase in HOV and the relatively flat year-over-year changes observed in parking exits.

Table 5-15 Ground-Access Mode Share by Market Segment, 2016

	Resident Business	Resident Non-business	Non-resident Business	Non-resident Non-business
Private Automobile	48%	44%	6%	29%
Taxi	9%	5%	21%	10%
Rental Car	2%	2%	29%	21%
TNCs	14%	14%	15%	15%
Subtotal Non-HOV	**74%**	**65%**	**72%**	**75%**
Unscheduled HOV/limousine	12%	7%	10%	5%
Public and Water Transit	3%	9%	4%	7%
Scheduled Bus	8%	14%	3%	7%
Courtesy shuttle	<1%	2%	7%	5%
Other	2%	2%	4%	1%
Subtotal HOV	**26%**	**35%**	**28%**	**25%**

Source: Massport, *2016 Logan Airport Air Passenger Ground-Access Survey*
Notes: Based on air passengers departing on both weekdays and weekend days. Rounded figures.

Table 5-16 Ground-Access Mode Share by Market Segment (Recent Surveys)

	Resident Business					Non-Resident Business				
Ground- Access Mode	**2004**	**2007**	**2010**	**2013**	**2016**	**2004**	**2007**	**2010**	**2013**	**2016**
Automobile Modes										
Private Automobile	54%	54%	59%	62%	48%	18%	12%	12%	14%	6%
Taxi	19%	18%	16%	17%	9%	30%	35%	36%	30%	21%
Rental Car	1%	2%	<1%	<1%	2%	24%	29%	27%	25%	29%
TNCs	-	-	-	-	14%	-	-	-	-	15%
Subtotal Automobile Modes	**74%**	**74%**	**76%**	**80%**	**74%**	**72%**	**76%**	**75%**	**69%**	**72%**
HOV Modes										
Unscheduled HOV	11%	13%	10%	9%	12%	7%	8%	10%	12%	10%
Scheduled HOV	8%	6%	6%	6%	8%	7%	3%	3%	2%	3%
Transit	5%	6%	4%	5%	3%	6%	6%	5%	9%	4%
Courtesy shuttle	1%	<1%	2%	<1%	<1%	7%	5%	5%	6%	7%

Source: Massport, *2016 Logan Airport Air Passenger Ground-Access Survey*
Notes: Based on air passengers departing on both weekdays and weekend days. Rounded figures.
1 Previously reported as Schedule HOV
2 Previously reported as Transit

Table 5-16 Ground-Access Mode Share by Market Segment (Recent Surveys) (Continued)

	Resident Business					Non-Resident Business				
Other	1%	1%	1%	<1%	2%	1%	2%	2%	2%	4%
Subtotal HOV Modes	**26%**	**26%**	**24%**	**20%**	**26%**	**28%**	**24%**	**25%**	**31%**	**28%**
	Resident Non-Business					**Non-Resident Non-Business**				
Ground Access Mode	**2004**	**2007**	**2010**	**2013**	**2016**	**2004**	**2007**	**2010**	**2013**	**2016**
Automobile Modes										
Private Automobile	49%	51%	49%	55%	44%	38%	36%	36%	33%	29%
Taxi	16%	14%	13%	13%	5%	15%	19%	17%	18%	10%
Rental Car	3%	2%	2%	1%	2%	17%	19%	18%	20%	21%
TNCs	-	-	-	-	14%	-	-	-	-	15%
Subtotal Automobile Modes	**68%**	**67%**	**63%**	**69%**	**65%**	**70%**	**73%**	**71%**	**71%**	**75%**
HOV Modes										
Unscheduled HOV	9%	7%	8%	9%	7%	5%	3%	4%	4%	5%
Scheduled HOV	13%	12%	12%	11%	14%	11%	6%	8%	6%	7%
Transit	8%	11%	11%	7%	9%	8%	9%	9%	11%	7%
Courtesy shuttle	1%	3%	4%	2%	2%	5%	5%	6%	6%	5%
Other	1%	1%	2%	1%	2%	1%	4%	2%	2%	1%
Subtotal HOV Modes	**32%**	**33%**	**37%**	**30%**	**35%**	**30%**	**27%**	**29%**	**29%**	**25%**

Source: Massport, *2004, 2007, 2010, 2013, 2016 Logan Airport Air Passenger Ground-Access Surveys*

Ground Access Goals

Table 5-17 lists each ground access goal and updates Massport's initiatives associated with each goal. Initiatives are planned, designed, implemented, and continuously refined to account for the changing national, regional, and local conditions that affect Logan Airport and its users.

Table 5-17 Ground Access Planning Goals and Progress (2016)

Goal	2016 Update
Increase air passenger ground-access (high-occupancy vehicle) HOV mode share to 35.2 percent by the time Logan Airport accommodates 37.5 million annual air passengers.[20]	The *2016 Logan Airport Air Passenger Ground-Access Survey* revealed that 30.5 percent of air passengers use high-occupancy vehicles (HOV)/shared-ride modes to access the Airport. Massport continues to provide and actively promote numerous HOV/shared-ride options to air passengers, including Logan Express bus service, the Silver Line, water shuttle services, and frequent, free shuttle bus service to and from the Massachusetts Bay Transportation Authority (MBTA) Blue Line Airport Station. Massport is investigating ways to increase HOV mode share by implementing new HOV initiatives and pricing strategies. Logan Airport continues to rank at the top of U.S. airports in terms of HOV/transit mode share. Massport continues its partnership with the MBTA to offer free boardings of the Silver Line bus at the Airport. The promising results of reduced dwell times and faster travel times through the terminal area led Massport to extend the free-fare program indefinitely. Next-bus arrival digital dynamic signs have been added to the Terminal curb bus stops to now include Airport Shuttle, Blue Line/Rental Car, and Logan Express (in addition to Silver Line signs previously installed). Massport continues to improve wayfinding for ground transportation (with an emphasis on public transportation) within the terminals, resulting in enhanced directional signs in the terminals for arriving air passengers. In April 2014, the Boston Back Bay Logan Express service was implemented. In April 2015, 1,100-space garage was opened at the Framingham Logan Express to encourage passenger use of HOV modes.
Reduce employee reliance on commuting alone by private automobile	Massport continues to support the Logan Transportation Management Association (TMA) with $65,000 annually (no dues are collected from Airport employers). Massport uses funds from the Logan TMA to operate the two early morning Sunrise Shuttle services that serve East Boston, Winthrop, and Revere. Massport continues to provide outreach to employees about commute options. For employees who reside in neighborhoods and communities closer to the Airport, bicycle parking options have increased with bicycle racks offered at Terminal A, Terminal E, the Economy Garage, the Green Bus Depot, the Rental Car Center, the Logan Office Center, and the Signature general aviation terminal. Massport is also investigating ways to improve bicycle access to/around Logan Airport facilities. For example, the East Boston Greenway Connector construction was completed in July 2014.
Increase the overall efficiency of the metropolitan transportation system through interagency coordination	Massport participates in the Boston Metropolitan Planning Organization (MPO) to promote planning and funding of transportation system options that enhance access to the Airport. Massport and the MBTA have worked together on several initiatives including the renovated Blue Line Airport Station and the Silver Line SL1 service to Logan Airport. Massport has also partnered with the MBTA, the Massachusetts Department of Transportation (MassDOT), the City of Boston, and the Convention Center Authority in implementing transportation improvement plans recommended in the South Boston Waterfront, including sustainable transportation plans, as a means to improve the MBTA Silver Line access between South Station, the South Boston Waterfront, and the Airport.

20 Beginning in 2017, Massport will use a new HOV definition where vehicle occupancies of taxis, limo services and TNCs exceed one air passenger per vehicle, while the same modes with one air passenger will count as non-HOV. With this new definition, Massport has committed to a goal of 35.5 percent HOV by 2022 and 40 percent by 2027.

Table 5-17 Ground Access Planning Goals and Progress (2016) (Continued)

Goal	2016 Update
Improve management of on-Airport ground access and infrastructure through technology	Massport disseminates ground access and parking information through the Internet (www.massport.com), social media (Twitter and Facebook), a toll-free telephone number (1-800-23-LOGAN), Smartraveler, and in-Airport kiosks. Massport's redesigned website has an interactive tool that helps users access Logan Airport, while providing multimodal options. In 2016, Logan Airport continued to experience peak levels of parking demand for the terminal area parking garages. In an effort to reduce the operational impacts of peak parking, Massport completed the West Garage Parking Consolidation Project in 2015. As one element of its comprehensive ground transportation strategy, Massport proposes to build 5,000 new on-Airport commercial parking spaces at Logan Airport in two locations. The goal of the Logan Airport Parking Project is to reduce the number of air passengers choosing more environmentally harmful drop-off/pick-up modes, which generate up to four vehicle trips instead of two (see below for a detailed description). The construction of additional commercial parking spaces at Logan Airport was predicated on a regulatory change, by the Massachusetts Department of Environmental Protection (MassDEP), whereby MassDEP would need to amend the existing Logan Airport Parking Freeze to allow for some additional commercial parking spaces at Logan Airport. In response to Massport's 2016 request to consider an amendment to the Logan Airport Parking Freeze (to increase the commercial parking freeze limit by 5,000 spaces), MassDEP conducted a stakeholder process, which was followed by a public process to amend the Parking Freeze regulation. MassDEP issued the amended regulation on June 30, 2017 approving the requested parking increase. Massport initiated a parallel process with the Executive Office of Energy and Environmental Affairs (EEA) by filing an Environmental Notification Form (ENF) for new parking facilities on March 31, 2017. On May 5, 2017, EEA issued its Certificate on the ENF establishing the Scope for the required Draft Environmental Impact Report (EIR). Initiation of concept design for the parking facilities and preparation of a Draft EIR is expected to commence in the Spring of 2018. MassDEP issued the amended regulation on June 30, 2017, approving the requested parking increase. On December 5, 2017, the U.S. Environmental Protection Agency (EPA) proposed a rule approving the revision of the Massachusetts State Implementation Plan (SIP) incorporating the amended Logan Airport Parking Freeze Cap. EPA approved the proposed rule on March 6, 2018, and the rule went into effect April 5, 2018.The Draft EIR will provide additional details on the number of spaces per location and planned construction phasing.

This Page Intentionally Left Blank.

6

Noise Abatement

Introduction

The Massachusetts Port Authority (Massport) strives to minimize the noise effects of Boston-Logan International Airport (Logan Airport or the Airport) operations on its neighbors through a variety of noise abatement programs, procedures, and other tools. At Logan Airport, Massport implements one of the oldest and most extensive noise abatement program of any airport in the nation. Massport's comprehensive noise abatement program includes a dedicated Noise Abatement Office; a state-of-the-art Noise and Operations Monitoring System (NOMS); extensive residential and school sound insulation programs; time and runway restrictions for noisier aircraft; ground run-up procedures; and flight tracks designed to optimize over-water operations (especially during nighttime hours). The public can register noise complaints by phone or online through Massport's website.[1]

The foundation of Massport's noise program is the *Logan Airport Noise Abatement Rules and Regulations*[2] (the Noise Rules), which have been in effect since 1986. Massport's Noise Abatement Office is responsible for implementing noise abatement measures and generally monitoring community complaints and other aspects of the noise effects from Logan Airport operations. This chapter describes runway use, fleet mix, level of operations, noise levels, and modeled noise conditions at Logan Airport related to aircraft operations during 2016 and compares the findings to those for 2015. Historical comparisons to the years 1990, 2000, and 2010 are also provided.

Noise conditions for 2016 were assessed primarily through computer modeling, supplemented by the analysis of measured noise levels from Logan Airport's noise monitoring system. This *2016 Environmental Data Report (EDR)* marks the transition from the Federal Aviation Administration's (FAA) legacy analysis software, the Integrated Noise Model (INM), to its next-generation software, the Aviation Environmental Design Tool (AEDT). Massport developed a suite of customized adjustments for use with INM necessary for accurate modeling of the unique Logan Airport environment, and has been working with FAA since 2015 to implement equivalent methods in AEDT. FAA has responded to Massport's request and did not approve two adjustments: over-water noise propagation and hill effects. However, FAA did concur[3] with the use of 2016 weather data and Logan Airport-specific aircraft stage length adjustments. The adjustments resulted in smaller differences

1 Massport. Noise Complaints. http://www.massport.com/logan-airport/about-logan/noise-abatement/complaints/.

2 The Logan International Airport Noise Abatement Rules and Regulations, effective July 1, 1986, are codified as 740 Code of Massachusetts Regulations (CMR) 24.00 et seq (also known as the Noise Rules).

3 FAA approves non-standard modeling requests only for projects requiring FAA review; such as an EA or Part 150 Study.

between the INM and AEDT contours under the defined flight paths but larger differences along the sides of the runways especially close to the Logan Airport.

Consistent with previous practice, Massport presents AEDT modeling results as the primary model in this *2016 EDR*. INM results are provided for comparison only for 2016 and future filings will present only AEDT results. Research efforts that address potential improvements in AEDT modeling are underway for terrain adjustments and recently concluded for acoustically reflective surfaces. The results of these studies, if and when they are implemented in AEDT, will add capabilities previously addressed by Logan Airport's over-water and hill effect adjustments. Further details regarding the implementation of AEDT are provided in the section *Noise Modeling Process* later in this chapter.

This chapter presents summaries of the 2016 operational data used in the noise modeling, as well as the resultant annual Day-Night Average Sound Level (DNL) noise contours, a comparison of the modeled results with measured levels from the noise monitoring system, and estimates of the population residing within various increments of noise exposure in 2016. Both FAA and the U.S. Department of Housing and Urban Development consider DNL exposure levels above 65 decibels (dB) to be incompatible with residential land use.[4,5] To better understand the noise environment, analyses also include several supplemental noise metrics including Logan Airport's Cumulative Noise Index (CNI), Time Above (TA) various threshold sound levels, and periods of dwell and persistence of noise levels. Massport's progress on implementing noise abatement measures, the aRea NAVigation (RNAV)[6] Pilot study being jointly undertaken by FAA and Massport, and a summary of the recently-concluded Boston Logan Airport Noise Study (BLANS) are also provided.

Appendix H, *Noise Abatement*, provides historical details on aircraft operations, runway use, noise exposed population, and the status of the sound insulation program since 1990. Total runway use from all operations, usage by runway end, and DNL levels at U.S. Census Block group locations are included. Appendix H also contains the *Flight Track Monitoring Report* for 2016 and a *Fundamentals of Acoustics and Environmental Noise* section, which gives an overview of key noise issues, noise metric definition, and terminology for the general reader.

Noise Metrics

The common metrics used in this chapter to describe and evaluate aircraft noise are:

- **Decibel (dB)** – The decibel is the unit of sound pressure level (SPL), the standard measure for sound. It is a logarithmic quantity reflecting the ratio of the pressure of the sound source of interest and a reference pressure. The range of SPL extends from about 0 dB for the quietest sounds that one can detect to about 120 dB for the loudest sounds we can hear without pain. Many sounds in our daily environment have SPL on the order of 30 to 100 dB.

4 14 CFR Part 150, Appendix A to Part 150 Noise Exposure Maps, Sec. A150.101(d)

5 24 CFR Part 51, Subpart B Noise Abatement and Control, Sec. 51.103(c)

6 RNAV – aRea NAVigation, RNAV enables aircraft to fly on any desired flight path within the coverage of ground- or space- based navigation aids, within the limits of the capability of aircraft self-contained systems, or a combination of both capabilities.

- **"A"-weighted decibel (dBA)** – This metric applies frequency weighting (A-weighting) to the SPL to approximate the sensitivity of the human auditory system. Human hearing is less sensitive to both low and high frequency components of sound, while being most sensitive to mid-frequency sounds.
- **Day-Night Average Sound Level (DNL)** – The Day-Night Average Sound Level is a measure of the cumulative noise exposure over a 24-hour day. It is the 24-hour, logarithmic (or energy) average. DNL treats nighttime noise differently than daytime noise; for the A-weighted sound pressure levels occurring at night (between 10:00 PM and 7:00 AM) a 10-dB penalty is applied to the nighttime event. DNL is the FAA-defined metric for evaluating noise and land use compatibility.[7]
- **Time Above (TA)** – The Time Above metric describes the total number of minutes that instantaneous sound levels (usually from aircraft) are above a given threshold. For example, if 65 dB is the specified threshold, the metric would be referred to as "TA65." The TA metric is typically associated with a 24-hour annual average day but can be used to represent any time period. Any threshold may be chosen for the TA calculation. For this study, TA65, TA75, and TA85 were computed at each of the monitoring sites.
- **Effective Perceived Noise Level (EPNL)** – A time series of "tone corrected" perceived noise levels are used to compute EPNL, which is expressed in units of EPNdB. The tone corrected perceived noise level is determined by measuring the perceived noise level and adding to that value a "pure-tone" correction of up to 6 dB. The EPNdB is an international standard for the noise certification of aircraft and is used in this report in the calculation of the CNI.

For a more in-depth description of noise metrics, refer to Appendix H, *Noise Abatement*.

Regulatory Framework

The noise regulatory framework that this *2016 EDR* follows is described in Appendix H, *Noise Abatement*. Regulations discussed include:

- Logan Airport Noise Abatement Rules and Regulations;
- Federal Aviation Regulation (FAR) Part 36;
- FAR Part 150; and
- FAR Parts 91 and 161.

Noise Modeling Process

The sections below provide an overview of the noise modeling included in this *2016 EDR*. For this *2016 EDR*, Massport used the required AEDT model for the noise assessment.

Aviation Environmental Design Tool

For this *2016 EDR*, Massport has transitioned from using FAA's legacy modeling software, INM, to FAA's next-generation software, AEDT. AEDT is the required model for noise studies seeking FAA approval. While the

7 14 CFR Part 150, Appendix A to Part 150 Noise Exposure Maps, Sec. A150.101(b).

Massachusetts Environmental Policy Act (MEPA) EDR/ESPR process does not require FAA approval, Massport wishes to perform analysis to FAA standards.

For past studies using INM, Massport has developed customized adjustments to address specific terrain conditions at Logan Airport:

- **Over-water adjustment** – Logan Airport is surrounded by water, which is an acoustically reflective surface. Consequently, noise levels near the Airport are higher than they would be for an airport surrounded by soft ground, which is acoustically absorptive. A correction is applied in INM for aircraft at low altitudes to account for this.
- **Hill effects** – Elevated locations near the Airport experience line-of-sight exposure to ground operations at the Airport. A corresponding adjustment has been applied in these areas in INM.

Massport has sought FAA approval for implementation of these adjustments in AEDT, but after Massport's request and FAA review, FAA has not approved these adjustments. Further information on these issues is provided in the section *AEDT Analysis* in Appendix H, *Noise Abatement*.

Noise Modeling Overview

The DNL, CNI, and TA noise metrics reported annually by Massport provide varied means of understanding and comparing Logan Airport's complex noise environment from one year to the next. The noise context is influenced by numbers of operations, types of aircraft operating during the day and at night, use of various runway configurations, and the location and frequency of use of flight paths to and from the runways. Changes in any one of these operational parameters from one year to the next can cause changes in the values of the noise metrics and alter the shapes of the noise exposure contours that represent the accumulation of noise events during an average day.

Massport continues to make use of state-of-the-art improvements in the noise modeling process, which has been updated each year. These developments in noise modeling technologies and techniques, which were first employed in the preparation of the *2005 EDR*, and have continued through this *2016 EDR,* are discussed below.

- As with prior reports, the *2016 EDR* continues to use data from Massport's Noise and Operations Management System (NOMS), including all radar data and noise measurement data.[8]
- The flight operations data from the NOMS includes detailed information with each flight record, such as aircraft registration numbers, wherever possible, which provides better AEDT aircraft type selection. This allows for the assignment of the modeled AEDT aircraft type based on the specific aircraft and engine combination used on each flight at Logan Airport during 2016.
- The modeling process includes continued use of U.S. Geological Survey digital terrain data. AEDT uses the detailed terrain data to evaluate each receptor location at its proper elevation, which enhances the accuracy of the results.

8 The noise measurement data are only used for reporting and are not used to calibrate the model.

- Massport uses the proprietary software RC for AEDT™, an AEDT pre-processor that prepares high-fidelity data for processing by AEDT.
  - RC for AEDT™ automates the production of noise contours directly from each individual radar trace. In 2016, approximately 396,615 traces were collected and 388,857 retained enough information to be modeled in the RC for AEDT™ system. Each radar trace was converted to a model track, ensuring that the lateral dispersion of radar tracks was retained in the modeling. The operations on these radar traces were then scaled to account for all the 391,222 operations in 2016. This method also helps to develop more accurate noise contours by retaining the actual runway used and time of each operation.
  - RC for AEDT™ provides greater detail than standard AEDT analyses through the use of individual flight tracks taken directly from radar systems rather than relying on consolidated, representative flight tracks data.

RC for AEDT™ improves the precision of modeling by:

- Directly converting the radar flight track for every identified aircraft operation to an AEDT track, rather than assigning all operations to a limited number of prototypical or representative tracks;
- Modeling each operation for the actual time of day and on the specific runway that it actually used, rather than applying a generalized distribution to broad ranges of aircraft types;
- Selecting the specific airframe and engine combination to model, on an operation by operation basis, based on the aircraft registration or a published composition of the fleets of the specific airlines operating at Logan Airport;
- Using each flight's city-pair information to select the proper stage length; and
- Using each aircraft's actual altitude profile to select from the available flight profiles in the AEDT database.

These enhancements are examples of Massport's continued commitment to improving the monitoring, reporting, and understanding of the noise environment at Logan Airport. The following section of this chapter summarizes the basic operational data used to compute the DNL, CNI, and TA noise metrics reported for 2016.

Noise Model Inputs

For this *2016 EDR*, noise was modeled using the most recently available version of FAA's AEDT version 2c, Service Pack 2 (AEDT 2c SP2). The model requires detailed operational data as inputs for noise calculations, including numbers of operations per day by aircraft type and by time of day, which runway for each arrival and for each departure, and flight track geometry for each track. These data are summarized in tables that follow or are included in Appendix H, *Noise Abatement*. The following section summarizes the average-day operations for each year as used in the noise modeling and compares 2016 inputs to the previous year's data (2015).

Radar Data

Operations data for noise modeling is obtained from the Massport NOMS system, which incorporates the Harris NextGen data feed. This data feed integrates information from ground-based radar and other sensors with transponder data from aircraft. Further detail about this system is provided in the section *2016 Radar Data* in Appendix H, *Noise Abatement*.

Fleet Mix

Since 2004, Massport has relied primarily on radar data as the main source of input for noise calculations, because radar data typically are more accurate than the information reported by airlines. The radar data result in a list of approximately 500 different aircraft types that use Logan Airport during a year, including the wide variety of small corporate jets and propeller aircraft flown by general aviation (GA) users, as well as the large passenger and cargo jets operated by air carriers.

For 2016, the aircraft types identified by the radar data were matched to the AEDT database, which contains individual noise and performance profiles for 279 different fixed-wing aircraft types, 164 of which represent civilian aircraft, the balance being military aircraft.[9] For those aircraft recorded in radar data that are not in the AEDT database, the radar type is paired with the best available alternative using an aircraft substitution list included in the AEDT model. The final list of modeled aircraft, used as an input to AEDT, is presented in detail in Appendix H, *Noise Abatement*.

Operations by aircraft type are summarized into several key categories: commercial (passenger and cargo) or GA operations; Stages 2 to 4 jet aircraft; and turboprop and propeller (non-jet) aircraft. Stage 3 and 4 categories include any aircraft that are certificated in the Stage 3 or Stage 4 FAA noise categories. Note that many aircraft originally certificated as Stage 3 would in fact satisfy the newer Stage 4 and 5 criteria if recertificated. FAA does not require aircraft to be recertificated and FAA has no plans at this time to restrict Stage 3 operations.[10] To better understand noise conditions, aircraft operations are split into daytime and nighttime periods, where nighttime hours are defined as 10:00 PM to 7:00 AM. Operations occurring during nighttime hours incur a 10 dB penalty when included in the DNL modeling calculation.

Table 6-1 summarizes the numbers of operations by categories of aircraft operating at Logan Airport in 2016 and provides comparison data for the previous two years (2014 and 2015) as well as reference years 1990, 2000, 2010, and 1998, the year of peak operations at Logan Airport. Available data for each year prior to 2014 are included in Appendix H, *Noise Abatement*.

The number of operations by regional jet (RJ) aircraft decreased between 2015 and 2016 by an average of five operations per day. Night operations by commercial operators increased in 2016 compared to 2015 by approximately eight operations per night. Most of the increase in operations is due to an increase in passenger and cargo flights at night as airlines expand destinations and the number of flights per day. Commercial non-

9 Some of these are military types as well as older Stage 1 and 2 airplanes that no longer operate in the U.S. or do not operate at Logan Airport. There are ordinarily no military aircraft operations at Logan Airport.

10 Massport does not have the regulatory authority to restrict aircraft using Logan Airport.

jet operations (such as Cape Air and Porter Airlines) were nearly unchanged from 2015 and 2016, increasing by one daily operation to 129 operations per day.

Table 6-1 Modeled Average Daily Operations by Commercial and General Aviation (GA) Aircraft[1]

		1990[2,3]	1998	2000[4]	2010[5]	2014[5]	2015[5]	2016[5]
		Commercial Aircraft (Passenger and Cargo)						
Stage 2 Jets[6]	Day	312.40	84.93	5.13	0.01	0.00	0.00	0.00
	Night[7]	19.99	5.92	0.26	0.01	0.00	0.00	0.00
	Total	**332.39**	**90.85**	**5.39**	**0.02**	**0.00**	**0.00**	**0.00**
Stage 3 and 4 Jets (All)	Day	288.89	541.43	727.09	674.25	670.00	685.92	713.65
	Night[7]	57.25	95.54	103.66	107.92	123.60	130.96	142.16
	Total	**346.14**	**636.97**	**830.75**	**782.17**	**793.61**	**816.88**	**855.81**
Air Carrier Jets	Day	N/A[2]	N/A	648.95	521.64	556.59	585.55	620.45
	Night[7]	N/A[2]	N/A	99.79	93.98	115.84	126.36	134.93
	Total	**N/A[2]**	**N/A**	**748.74**	**615.62**	**672.43**	**711.92**	**755.38**
Regional Jets	Day	N/A[2]	N/A	78.14	152.61	113.41	100.36	93.20
	Night[7]	N/A[2]	N/A	3.87	13.94	7.77	4.60	7.23
	Total	**N/A[2]**	**N/A**	**82.01**	**166.55**	**121.18**	**104.96**	**100.43**
Non-Jet Aircraft	Day	444.41	552.56	409.62	138.53	128.45	125.27	125.88
	Night[7]	11.72	21.86	21.58	5.21	2.28	2.41	3.01
	Total	**456.13**	**574.42**	**431.20**	**143.74**	**130.73**	**127.68**	**128.89**
Total Commercial Operations	Day	1,045.70	1,178.92	1,141.84	812.78	798.45	811.19	839.53
	Night[7]	88.96	123.32	125.51	113.13	125.88	133.37	145.17
	Total	**1,134.60**	**1,302.24**	**1,267.35**	**925.91**	**924.33**	**944.56**	**984.70**
		GA Aircraft						
Stage 2 Jets[6]	Day	N/A[7]	5.25	7.29	0.27	0.00	0.28	0.00
	Night[7]	N/A[7]	0.40	0.64	0.04	0.00	0.02	0.00
	Total	**N/A[7]**	**5.65**	**7.93**	**0.30**	**0.00**	**0.30**	**0.00**
Stage 3 and 4 Jets	Day	N/A[3]	30.54	40.08	27.80	52.64	51.82	53.98
	Night[7]	N/A[3]	4.21	3.21	3.21	4.65	4.28	4.85
	Total	**N/A[3]**	**34.75**	**43.29**	**31.01**	**57.29**	**56.10**	**58.83**

Table 6-1 Modeled Average Daily Operations by Commercial and General Aviation (GA) Aircraft[1] (Continued)

		1990[2,3]	1998	2000[4]	2010[5]	2014[5]	2015[5]	2016[5]
Stage 3&4 Jets	Day	N/A[3]	30.54	40.08	27.80	52.64	51.82	53.98
	Night[7]	N/A[3]	4.21	3.21	3.21	4.65	4.28	4.85
	Total	**N/A[3]**	**34.75**	**43.29**	**31.01**	**57.29**	**56.10**	**58.83**
Non-Jets	Day	N/A[3]	37.29	34.57	8.19	13.95	19.31	23.77
	Night[7]	N/A[3]	16.28	1.83	0.72	1.13	1.46	1.62
	Total	**N/A[3]**	**53.57**	**36.40**	**8.92**	**15.08**	**20.77**	**25.38**
Total GA Operations	Day	N/A[3]	73.08	81.94	36.26	66.59	71.40	77.75
	Night[7]	N/A[3]	20.89	5.68	3.97	5.78	5.77	6.47
	Total	**N/A[3]**	**93.97**	**87.62**	**40.22**	**72.37**	**77.17**	**84.21**
Total (Commercial and GA)	Day	1,045.70	1,252.00	1,223.78	849.03	865.05	882.59	917.28
	Night[7]	88.96	144.21	131.19	117.10	131.66	139.14	151.64
	Total[3]	**1,134.60**	**1,396.21**	**1,354.97**	**966.13**	**996.70**	**1,021.73**	**1,068.91**

Source: Massport's Noise Monitoring System, Revenue Office and HMMH, 2017.

1 Operations include scheduled and unscheduled operations. Data for all years prior to 2014 are available in Appendix H, *Noise Abatement*.

2 RJs were not tracked separately prior to 1999.

3 Totals prior to 1998 do not include GA operations.

4 Prior to 2010, the split between air carrier jets and RJs is 100 seats with RJs having less than 100 seats.

5 After 2009, the split between air carrier jets and regional jets (RJs) is 90 seats with RJs having less than 90 seats.

6 Stage 2 aircraft above 75,000 pounds were banned on December 31, 1999 and all Stage 2 aircraft were banned on December 31, 2015.

7 Nighttime operations occur between 10:00 PM and 7:00 AM.

Commercial Operations

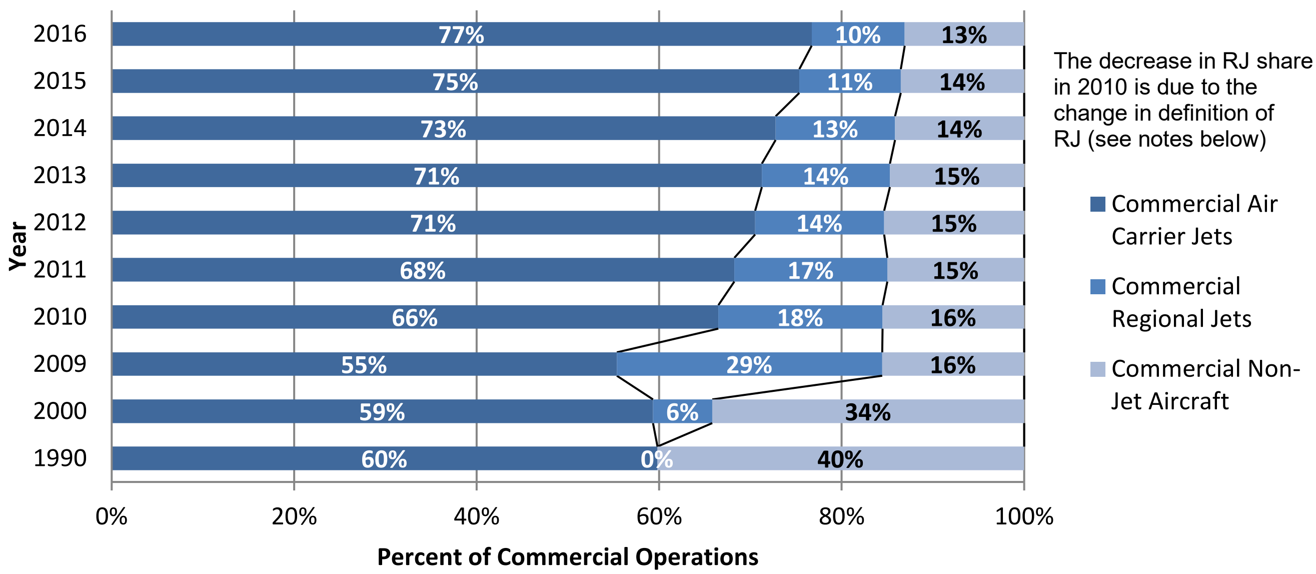
Regional jets (RJ) are defined as those aircraft with 90 or fewer seats, consistent with the categorization in Chapter 2, *Activity Levels*.[11] For years prior to 2010, the RJs in EDRs and ESPRs were classified as aircraft with fewer than 100 seats. When RJs first started gaining popularity, the aircraft types available were typically 50 seats or fewer with the traditional air carrier jet being 100 seats and higher. As newer aircraft types have become available, the smaller 35- to 50-seat types have been replaced by 70- to 99-seat types, with the 90 and above seat types flying many of the traditional air carrier routes. Most of the newer aircraft types fall into two categories: the 70- to 75-seat category, which remain categorized as RJs, and the 91- to 99-seat category, which are categorized as air carrier jets.

The percent of RJs in the overall commercial fleet fell 4 percent between 2015 and 2016 from 38,310 to 36,758 operations, while non-jets' share of the commercial fleet fell from 14 percent to 13 percent (**Figure 6-1**). In contrast, commercial air carrier operations increased their share by 2 percent, accounting for 77 percent of commercial operations in 2016 compared to 75 percent in 2015 (from 259,843 operations in 2015 to 276,469 in 2016).

Figure 6-1 presents the commercial operations groups in terms of percent of the total for each year from 2009 through 2016 and including 1990 and 2000 for historical context. **Figure 6-1** also shows the decrease in commercial non-jet operations after 2000 (34 percent of the fleet) and the rise of RJs, which were just 6 percent of the fleet in 2000 and increased to almost 30 percent of the fleet by 2009. The RJ share decreased in 2010 mainly due to a change in the definition of RJ (from 90 seats to 100 seats), but it has gradually decreased since then as there has been a trend among carriers of operating larger aircraft.

11 United States Code, 2006 Edition, Supplement 3, Title 49 – Transportation Subtitle VII – Aviation Programs Part A – Air Commerce and Safety, Subpart II, Economic Regulation, Chapter 417 - Operations or Carriers, Subchapter III - Regional Air Service Incentive Program, Sec. 41762 – Definitions – defines regional jet air carrier service to be aircraft with a maximum of 75 seats. Therefore, this report categorizes aircraft with 70 to 75 seats and below as regional jets and aircraft with 90 seats and higher aircraft as air carriers (note that there are no aircraft types with 75 to 90 seats).

Figure 6-1 Fleet Mix of Commercial Operations (Passenger and Cargo) at Logan Airport



Source: HMMH, 2017.
Notes: Includes both passenger and cargo operations.
After 2009, the split between air carrier jets and RJs is 90 seats with RJs having fewer than 90 seats.
Prior to 2010, the split between air carrier jets and RJs is 100 seats with RJs having fewer than 100 seats.

General Aviation Operations

Modeled GA activity in 2016 rose slightly compared to 2015, from 77 operations per day in 2015 to 84 operations per day in 2016 (**Table 6-1**). There were no Stage 2 GA jet operations for 2016.

Stage 3, Stage 4, and Stage 5 Jet Aircraft

Jet aircraft currently operating at Logan Airport are categorized by FAA as Stage 3 or Stage 4. Stage 5 aircraft certification will begin in 2018; however, 18 percent of the current jet fleet already meets this standard. As described previously, the designation refers to a noise classification specified in FAR Part 36 that sets noise emission standards based on an aircraft's maximum certificated weight. Generally, the heavier the aircraft, the more noise it is permitted to make within the limits established by FAR Part 36.

FAA has banned Stage 2 aircraft operations in the contiguous United States as of December 31, 2015, and just recently adopted a higher standard of noise classification called Stage 5. Stage 5 aircraft are certificated as a cumulative 17 dB below Stage 3 standards and will be effective for new aircraft type certification after December 31, 2017 and December 31, 2020, depending on the weight of the aircraft.[12]

12 The Stage 5 Final Rule was published on October 5, 2017. https://www.federalregister.gov/documents/2017/10/04/2017-21092/stage-5-airplane-noise-standards.

Because of the noise differences among aircraft certificated as Stage 2, recertificated Stage 3, Stage 3, and Stage 4, Massport tracks operations by these categories to follow their trends. **Table 6-2** provides the percentage of commercial jet operations by stage since 2010 with 2000 and 1990 reported for historical context. As noted in **Table 6-2**, 97 percent of the commercial jet fleet at Logan Airport met Stage 4 requirements in both 2015 and in 2016. FAA's newest noise category, Stage 5, is satisfied by 18 percent of Logan Airport's commercial jet fleet for 2016.

Table 6-2 Percentage of Commercial Jet Operations by Part 36 Stage Category[1]

Year	Stage 5 Requirements[5]	Stage 4 Requirements[2]	Certificated Stage 3	Recertificated Stage 3[3]	Stage 2 Greater than 75,000 lbs.	Total
1990	N/A	N/A	51.1%	0.0%	48.9%	100%
2000	N/A	N/A	70.0%	21.0%	9.0%	100%
2010	N/A	93.2%	4.7%	1.1%[4]	0.0%	100%
2011	N/A	95.5%	4.0%	0.5%[4]	0.0%	100%
2012	N/A	95.8%	4.1%	0.1%[4]	0.0%	100%
2013	N/A	97.4%	2.6%	0.0%	0.0%	100%
2014	N/A	97.4%	2.6%	0.0%	0.0%	100%
2015	N/A	96.7%	3.3%	0.0%	0.0%	100%
2016	17.8%[6]	79.2%	3.0%	0.0%	0.0%	100%

Source: Massport's Noise Monitoring System, Revenue Office and HMMH, 2017.

Notes:

1 Data for all years beginning in 1999 are available in Appendix H, *Noise Abatement*.

2 Aircraft that meet Stage 4 requirements are aircraft that are certificated Stage 4 or would qualify if recertificated. Certificated Stage 4 aircraft were not available until 2006 and the level of aircraft that meet Stage 4 requirements has not been determined prior to 2008.

3 Recertificated Stage 3 aircraft are aircraft originally manufactured as a certificated Stage 1 or 2 aircraft under FAR Part 36 that either have been retrofitted with hushkits or have been re-engined to meet Stage 3 requirements.

4 Prior to 2013, only one commercial carrier, with more than 100 annual operations, continued to use recertificated Stage 3 aircraft at Logan Airport (Federal Express). A few charter operators also use these aircraft.

5 Aircraft that meet Stage 5 requirements are aircraft that are certificated Stage 5 or would qualify if recertificated. Certificated Stage 5 aircraft will not be available until 2018 and the level of aircraft that meet Stage 5 requirements has not been determined prior to 2016. All aircraft listed as meeting Stage 5 requirements are also listed as Stage 3 or 4 aircraft.

Nighttime Operations

Massport monitors flights that operate during the DNL nighttime period of 10:00 PM to 7:00 AM, when each modeled flight is penalized 10 dB in calculations of noise exposure. **Table 6-3** shows this nighttime activity by different groups of aircraft. Commercial jet nighttime operations increased from 131.0 in 2015 to 142.2 in 2016 and commercial non-jet nighttime operations increased from 2.4 in 2015 to 3.0 in 2016. GA nighttime operations increased from 5.8 in 2015 to 6.5 in 2016. These changes resulted in 12.9 additional flights per night. Nighttime operations represent 14 percent of total operations for 2016 at Logan Airport. The majority (85 percent) of nighttime operations occurred either before midnight or after 5:00 AM.

Table 6-3 Modeled Nighttime Operations (10:00 PM to 7:00 AM) at Logan Airport Per Night[1]

	Commercial Jets	Commercial Non-Jets	General Aviation	Total
1990	77.2	11.7	N/A[2]	89.0
1998	101.4	21.9	20.9[3]	144.2
2000	103.9	21.6	5.7	131.2
2010	107.9	5.2	4.0	117.1
2011	109.4	4.7	6.7	120.8
2012	106.6	3.1	8.5	118.1
2013	115.9	3.2	6.3	125.4
2014	123.6	2.3	5.8	131.7
2015	131.0	2.4	5.8	139.1
2016	142.6	3.0	6.5	152.1
Change (2015 to 2016)	**11.6**	**0.6**	**0.7**	**12.9**
Percent Change	**8.9%**	**25.1%**	**12.4%**	**9.3%**

Source: Massport and Harris radar data; and HMMH, 2017.
Notes:
1 Data for all years beginning in 1990 are available in Appendix H, *Noise Abatement*.
2 Totals prior to 1998 do not include GA operations.
3 Previously reported as N/A. 1998 was the first year GA operations were reported and included in the total nighttime operations.

Nighttime cargo operations increased slightly, accounting for 5.8 percent of all commercial nighttime operations in both 2015 and 2016.

Similar to conditions reported in 2015, flights by cargo operators using recertificated Stage 3 aircraft made up almost no commercial nighttime activity in 2016. For comparison, in 2000, flights by cargo operators using recertificated Stage 3 aircraft accounted for 8 percent of the commercial nighttime activity. Though the International Civil Aviation Organization (ICAO) and FAA are not expected to require the phase-out of the remaining recertificated operations prevalent among cargo operators, the use of these aircraft will continue to decrease as these aircraft age and are taken out of service.

Increases to nighttime commercial activity were due to passenger aircraft operations primarily resulting from the overall growth in domestic air carrier flights. In addition to this, nighttime operations on new routes to international destinations were introduced in 2016 (similar to 2015) and contributed to the overall increase in 2016 nighttime activity.

Runway Use

Logan Airport's runways are shown in **Figure 6-2**. Runway use refers to the frequency with which aircraft use each of these runways during the year, as dictated or permitted by availability, wind, weather, aircraft performance, demand, and air traffic control conditions. Runway 15R-33L and Runway 4R-22L are Logan Airport's longest runways; each runway is just over 10,000 feet in length.

In 2016, Runway 15R-33L was the preferred runway to use at night to reduce nearby community noise, with arrivals to Runway 33L and departures from Runway 15R (known as head-to-head procedures), thus keeping flights over Boston Harbor (although these flights do eventually fly over South Shore communities).

During other periods of the day, Runway 9 and 22R are used primarily for departures, and Runway 4R is used primarily for arrivals. Runways 15R, 27, 22L, and 33L are used for both arrivals and departures.

Operations on Runway 27 and Runway 22R are known as Converging Runway Operations (CRO) since the extended centerlines of these runways cross within a short distance. During periods of high demand, and when Runway 22R is in use for departing aircraft, arrivals that would typically be directed to Runway 27 are sent by FAA Air Traffic Control to arrive on Runway 22L.

Runway 14-32 is unidirectional; there are no arrivals to Runway 14 and no departures from Runway 32. Additionally, Runway 14-32 can be used only during northwest or southeast wind conditions when winds are 10 knots or greater. Under certain northwest wind conditions, Runway 32 provides FAA with a second arrival runway, thereby reducing delays at the Airport. Runway 14 is available for departures but is rarely used in that manner. Runway 15L-33R is Logan Airport's shortest runway at under 3,000 feet long. This runway is primarily used for small non-jet aircraft arrivals.

Jet runway use conditions in 2016 are summarized in **Table 6-4** and were as follows:

- Runway 4L-22R was closed for a period of one month in 2016 for a resurfacing project. This resulted in a decrease in the share of departures from Runway 22R from 32 percent in 2015 to 27 percent in 2016.
- These departures were accommodated by other runways. Runway 33L experienced an increased departure share from 15 percent in 2015 to 18 percent in 2016. Departure shares of Runways 9, 15R, and 27 each increased by 1 percent from 2015.
- Runway 4L is not a preferred runway for arrivals, but the closure did cause its share of arrivals to decrease from 5 percent in 2015 to 4 percent in 2016.

- There were negligible numbers of departures from Runway 4L or arrivals to Runway 22R, so these were not affected by the closure.
- Arrival shares experienced little change from 2015 to 2016. Runway 4R increased from 29 percent in 2015 to 31 percent in 2016. All other runways experienced changes of 1 percent or less.

Runway use for all aircraft types (Jet and Non-Jet) for 2015 and 2016 is provided in Appendix H, *Noise Abatement*.

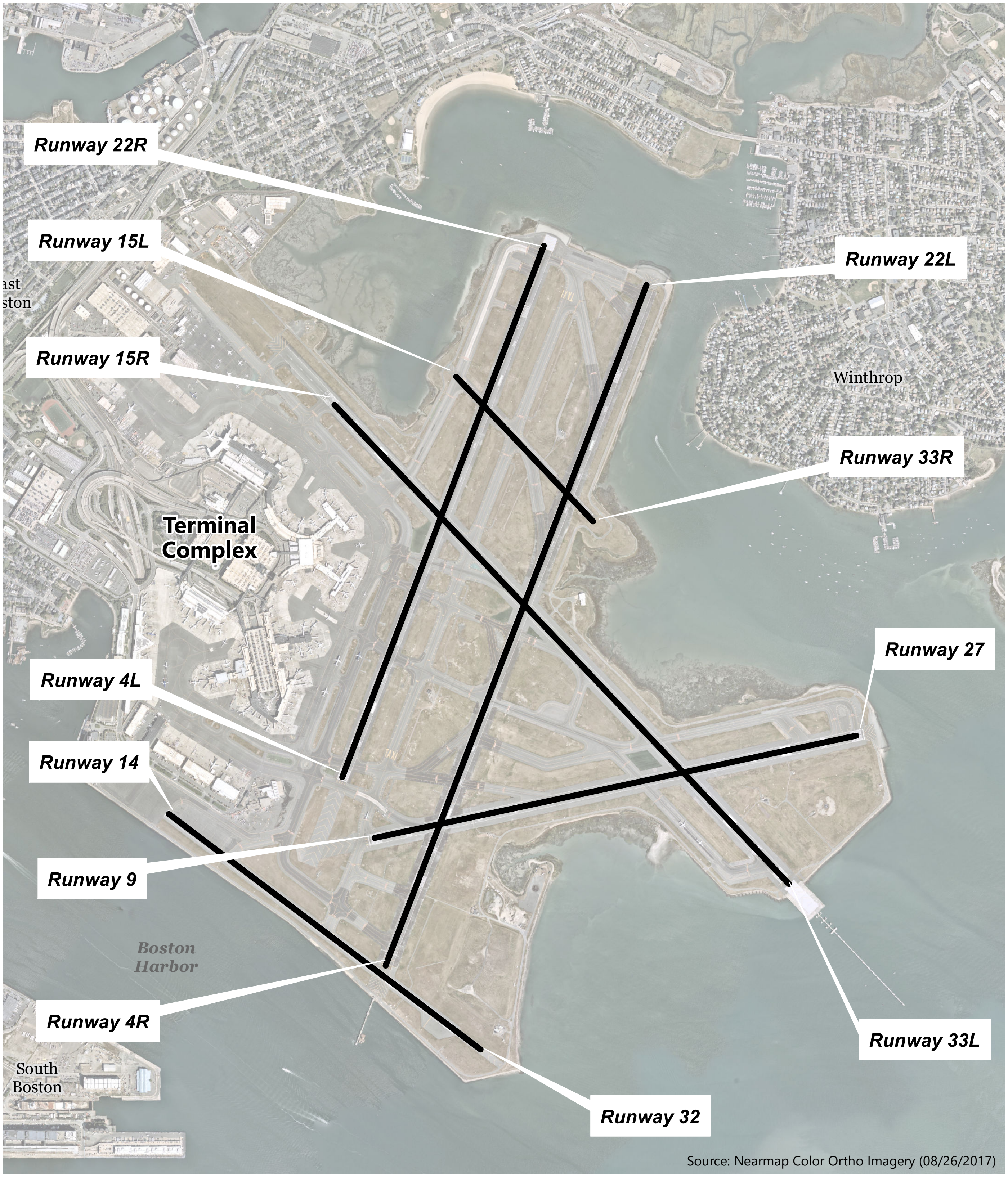


FIGURE 6-2 Logan Airport Runways

2016 Environmental Data Report

0 500 1000 2000 Feet

Table 6-4 Summary of Annual Jet Aircraft Runway Use[1]

	Runway									
	4L	**4R**	**9**	**14[2]**	**15R**	**22L**	**22R**	**27**	**32[2]**	**33L**
1990										
Departures	0%	3%	21%	N/A	10%	2%	36%	20%	N/A	7%
Arrivals	1%	25%	0%	N/A	2%	14%	0%	28%	N/A	29%
2000										
Departures	0%	8%	35%	N/A	4%	3%	30%	15%	N/A	6%
Arrivals	4%	40%	0%	N/A	1%	7%	0%	28%	N/A	20%
2010										
Departures	0%	4%	28%	<1%	8%	2%	31%	10%	-	17%
Arrivals	5%	28%	0%	-	1%	15%	0%	32%	1%	16%
2014										
Departures	0%	5%	31%	<1%	5%	2%	28%	13%	-	17%
Arrivals	5%	30%	0%	-	2%	25%	<1%	21%	1%	16%
2015										
Departures	0%	4%	29%	<1%	5%	2%	32%	12%	-	15%
Arrivals	5%	29%	0%	-	2%	25%	<1%	23%	1%	16%
2016										
Departures	0%	4%	30%	-	6%	2%	27%	13%	-	18%
Arrivals	4%	31%	-	-	1%	24%	<1%	23%	1%	16%

Source: Massport Noise Office and HMMH, 2017.

Notes: These data reflect actual percentages of jet aircraft operations on each runway end. They should not be confused with effective runway use.
Jet aircraft are not able to use Runway 15L or 33R due to its length of only 2,557 feet.
Values may not add to 100 percent due to rounding.

N/A Not Available.

1 Data for all years beginning in 1990 are available in Appendix H, *Noise Abatement*.

2 Runway 14-32 opened in late November 2006. (Runway 14-32 is unidirectional with no arrivals to Runway 14 and no departures from Runway 32.)

Preferential Runway Advisory System (PRAS)

To provide an equitable distribution of Logan Airport's noise impacts on surrounding communities, in 1982 Massport developed the Preferential Runway Advisory System (PRAS). The system was enhanced in 1990 and in subsequent years. The two primary objectives of PRAS are to distribute noise on an annual basis and to provide short-term relief from continuous operations over the same neighborhoods at the ends of the runways.

PRAS consisted of two parts: (1) a set of specific runway use goals to address the PRAS objectives, and (2) a computer program that would provide runway configuration recommendations to air traffic controllers based on weather, traffic, and PRAS goals. In February 2004, the PRAS system was suspended due to an upgrade of FAA radar system during the consolidation of the Boston Terminal Control Center at the new facility in Merrimack, New Hampshire and has not since restarted.

During Phase 2 of the recently concluded BLANS, the Logan Airport Community Advisory Committee (CAC) voted to abandon PRAS because it had not achieved the intended noise abatement.[13] Phase 3 of the BLANS focused on the development of an updated Runway Use Program. Operational tests of a new program began in November 2014 and continued through September 2016. The BLANS project ended in 2016 without the Logan Airport CAC agreeing on a new Runway Use Program. A final BLANS project report was issued in April 2017.[14]

Although the PRAS system was discontinued, the PRAS goals remain a benchmark to assess the equity of noise impacts, and Massport continues to present an assessment of runway use data relevant to the PRAS goals. Under the PRAS, each runway end has a specific annual utilization goal, defined separately for departures and arrivals. The goals are defined in terms of effective usage, which applies a factor of 10 to nighttime (10:00 PM to 7:00 AM) operations, equivalent to increasing nighttime exposure by 10 dB so that a change in effective utilization is roughly proportional to the change in DNL.

Table 6-5 provides a comparison of effective runway use[15] in 2016 to that of 2015 and 2014, and to the PRAS goals. The 2016 utilizations shown in bold indicate improvements toward the goals for each runway compared to 2015. Two of the arrival percentages moved closer to the PRAS goals in 2016 compared to 2015 and two of the departure percentages moved toward the PRAS goals.

13 BLANS Level 3 Screening Analysis, FAA, December 2012, Page E-2.
14 The final report is available online at: http://www.bostonoverflight.com/.
15 Effective Runway use refers to runway use which applies a factor of 10 to the night operations similar to DNL.

Table 6-5 Effective Jet Aircraft Runway Use in Comparison to PRAS Goals

	PRAS Effective Usage Goals		2014 Effective Usage		2015 Effective Usage		2016 Effective Usage	
Runway End	**Arrivals**	**Departures**	**Arrivals**	**Departures**	**Arrivals**	**Departures**	**Arrivals**	**Departures**
4R/L	21.1%	5.6%	28.1%	4.9%	25.1%	4.1%	26.4%	3.8%
9	0.0%	13.3%	0.0%	24.2%	0.0%	22.3%	0.0%	23.9%
15R	8.4%	23.3%	2.1%	11.6%	1.9%	13.1%	0.7%	12.6%
22L/R	6.5%	28.0%	30.4%	29.2%	31.3%	30.8%	**28.0%**	**26.4%**
27	21.7%	17.9%	15.4%	15.0%	16.6%	14.6%	**20.4%**	**16.2%**
33L	42.3%	11.9%	23.4%	15.1%	24.5%	15.1%	24.0%	17.0%
14[1]	NA	NA	0.0%	<0.1%	0.0%	<0.1%	0.0%	0.0%
32[1]	NA	NA	0.6%	0.0%	0.5%	0.0%	0.6%	0.0%

Source: Massport Noise Office and HMMH, 2017.
Notes: PRAS goals are stated in terms of effective jet operations which exclude non-jet flights, but which multiply each nighttime (10:00 PM to 7:00 AM) operation by a factor of 10.
Bold text indicates runway use that is closer to PRAS goals from the prior year.
1 Runway 14-32 opened in late November 2006. (Runway 14-32 is unidirectional with no arrivals to Runway 14 and no departures from Runway 32.) PRAS goals have not yet been established for Runways 14 and 32.

Flight Tracks

As described in the *Noise Modeling Process* section, Massport used a data pre-processor RC for AEDT™. Appendix H, *Noise Abatement* provides a summary discussion of this software package. RC for AEDT™ is used to develop the AEDT inputs based on available radar tracks. Instead of using representative model tracks, RC for AEDT™ converts each radar track to an AEDT model track and then models the scaled operation on that track.[16] This allows Massport to account for runway closures and/or temporary or permanent airspace changes which occur during the year.

For this *2016 EDR*, 388,857 flight tracks were modeled to calculate the noise levels surrounding Logan Airport for calendar year 2016. **Figures 6-3** through **6-9** provide examples of flight tracks used with RC for AEDT™ to develop the 2016 contours.[17] The figures show arrivals and departures from a representative sample throughout the year separately for each of three aircraft categories: air carrier jets, RJs, and non-jets. Additional figures and associated text at the end of this chapter describe the RNAV[18] standard instrument departure procedure and any changes that were in effect during 2016. In addition to the RNAV procedures recommended from the BLANS study, other RNAV procedures implemented at Logan Airport (such as the RNAV arrivals into

16 This method provides a one to-one correspondence of radar tracks to model tracks and ensures that the lateral and vertical dispersion of aircraft types are consistent with the radar data.

17 The flight tracks shown in these figures are a representative sample, selected uniformly from the complete track set to match the overall annual runway use.

18 RNAV enables aircraft to fly on any desired flight path within the coverage of ground- or space-based navigation aids, or within the limits of the capability of aircraft self-contained systems, or a combination of both capabilities.

the terminal airspace) are part of a national FAA initiative which is being implemented to improve safety and efficiency in the airspace system. These procedures result in consolidated flight paths and greater predictability along the flight route. Similar procedures have been implemented at Denver, Minneapolis, Baltimore-Washington, Houston, Dallas, Chicago Midway, and Seattle Airports.

- **Figure 6-3** displays air carrier jet departures following the recommended departure routes. The departure procedures reflect FAA RNAV routes that have been implemented since 2010. The Runway 33L RNAV procedure was first implemented by FAA in June 2013.
- **Figure 6-4** displays air carrier jet arrivals. The RNAV arrival procedures are very evident in the 2016-modeled data with a narrowing of the flight tracks into concentrated areas.
- **Figure 6-5** displays the RJ departures following the RNAV departure routes with flights remaining north of the Hull peninsula and passing over the Nahant Causeway.
- **Figure 6-6** displays the RJ arrivals that utilize both east and west sides of the Airport for arrivals. Arrivals to Runway 32 are also displayed on this graphic.
- **Figure 6-7** displays the non-jet departures that tend to turn early off the runways and do not follow the jet departure routes. Non-jet departures from Runways 4L, 22R, 33L, and 27 are allowed to turn over populated areas whereas the jet aircraft are not. This also keeps the non-jet aircraft out of the jet departure paths allowing for efficient jet departures.
- **Figure 6-8** displays the non-jet arrivals and includes the Boston Harbor route for non-jet aircraft arriving to Runway 4L. The graphic also displays the non-jet arrivals to Runways 22R and 33R in addition to the other runways, which also accommodate jets.
- **Figure 6-9** displays the night jet arrivals using the Light Visual Approach[19] to Runway 33L. This is a procedure developed from the BLANS project, which is available only during visual conditions in which pilots can follow a route offshore to reduce noise impacts. These flights remain offshore and avoid overflying Cohasset and Hull at night. Flights arriving to Runway 33L from the west pass over Saugus and Nahant at a higher altitude and then head south over Boston Harbor to intersect with the visual approach procedure. Of 8,885 nighttime arrivals to Runway 33L in 2016, approximately 700 used this procedure. In the fall of 2013, JetBlue Airways conducted a test of an RNAV visual approach procedure[20] which coincides with the route of the standard visual approach. This procedure gives aircraft with advanced navigational capabilities a more stabilized approach to the visual Runway 33L. This procedure is now available to authorized airlines only and is seen in the concentrated approach path in **Figure 6-9**.

Meteorological Data

AEDT has several settings that reflect aircraft performance profiles and sound propagation based on meteorological data. Meteorological settings include average temperature, barometric pressure, and relative humidity at the Airport. Massport obtained weather data for 2016 from the National Climatic Data Center, and an annual average was used in modeling all 2016 operations.

19 A Visual Approach procedure can only be used when weather conditions permit and the pilots follow visual landmarks to follow the procedure.

20 Boston-Logan Runway 33 Left Area Navigation (RNAV) Visual Flight Procedure Test CATEX, approved June 26, 2013.

FIGURE 6-3 Air Carrier Departure Flight Tracks

2016 Environmental Data Report

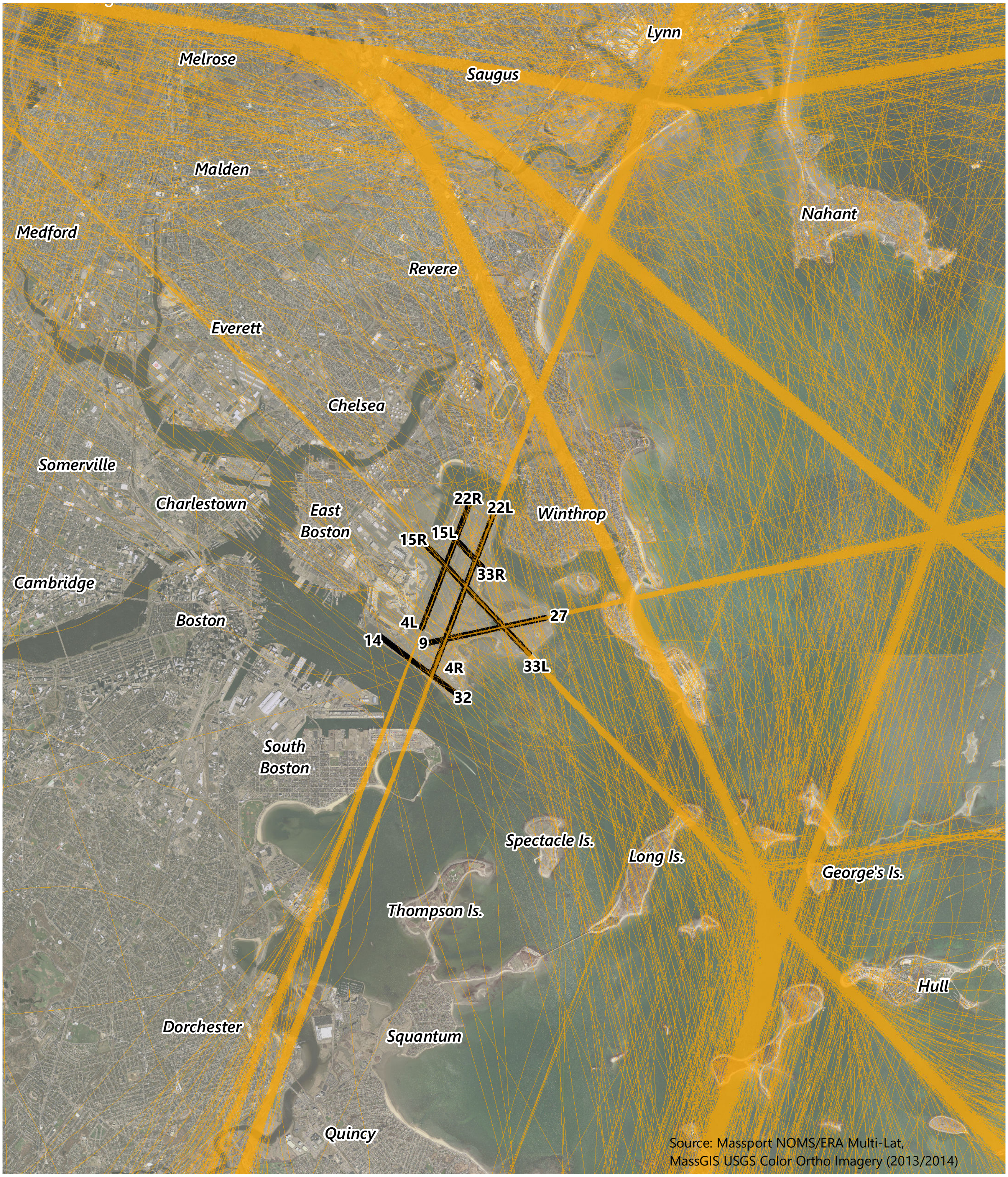


FIGURE 6-4 Air Carrier Arrival Flight Tracks

2016 Environmental Data Report

0 0.5 1 2 Miles

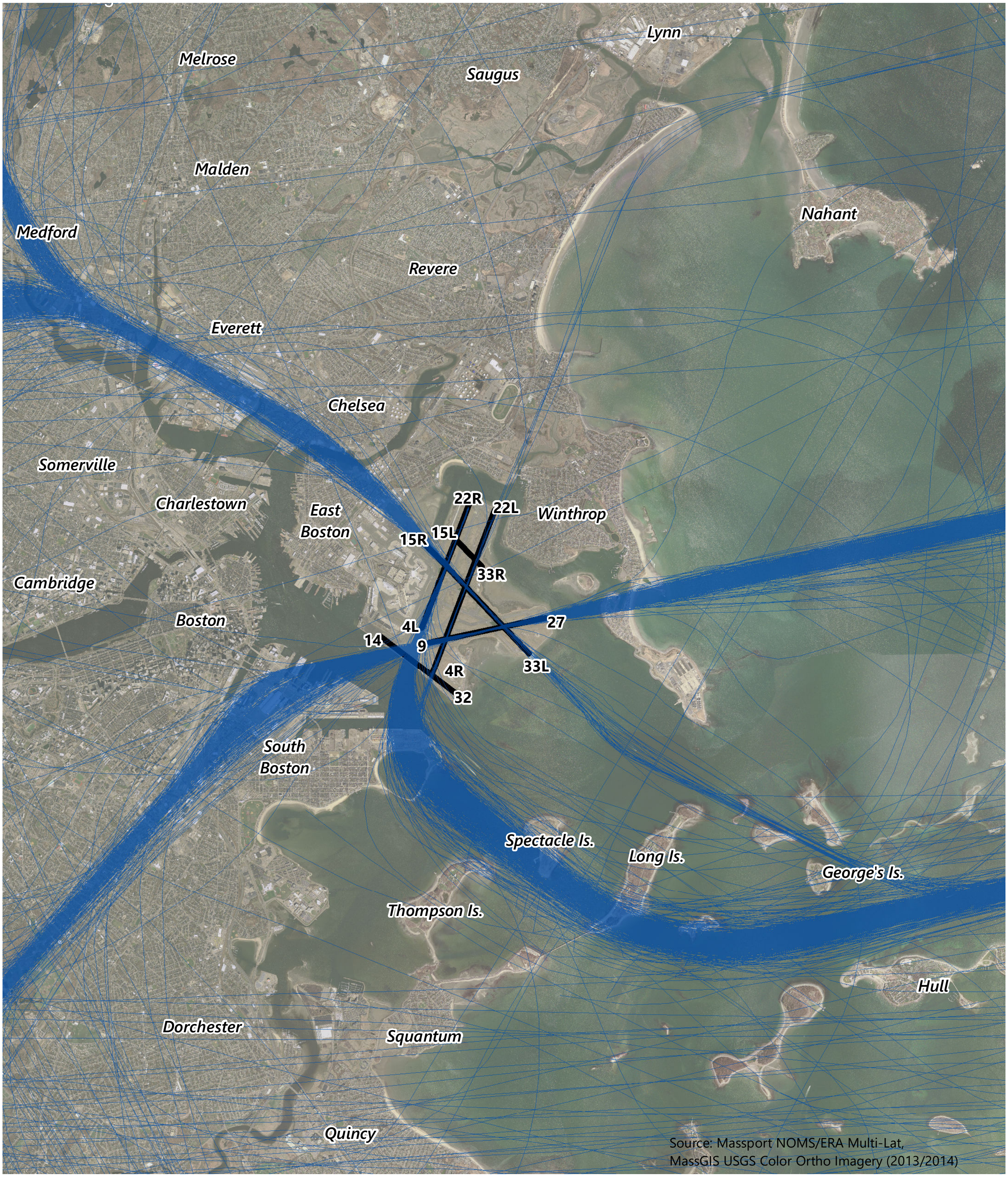


FIGURE 6-5 Regional Jet Departure Flight Tracks

2016 Environmental Data Report

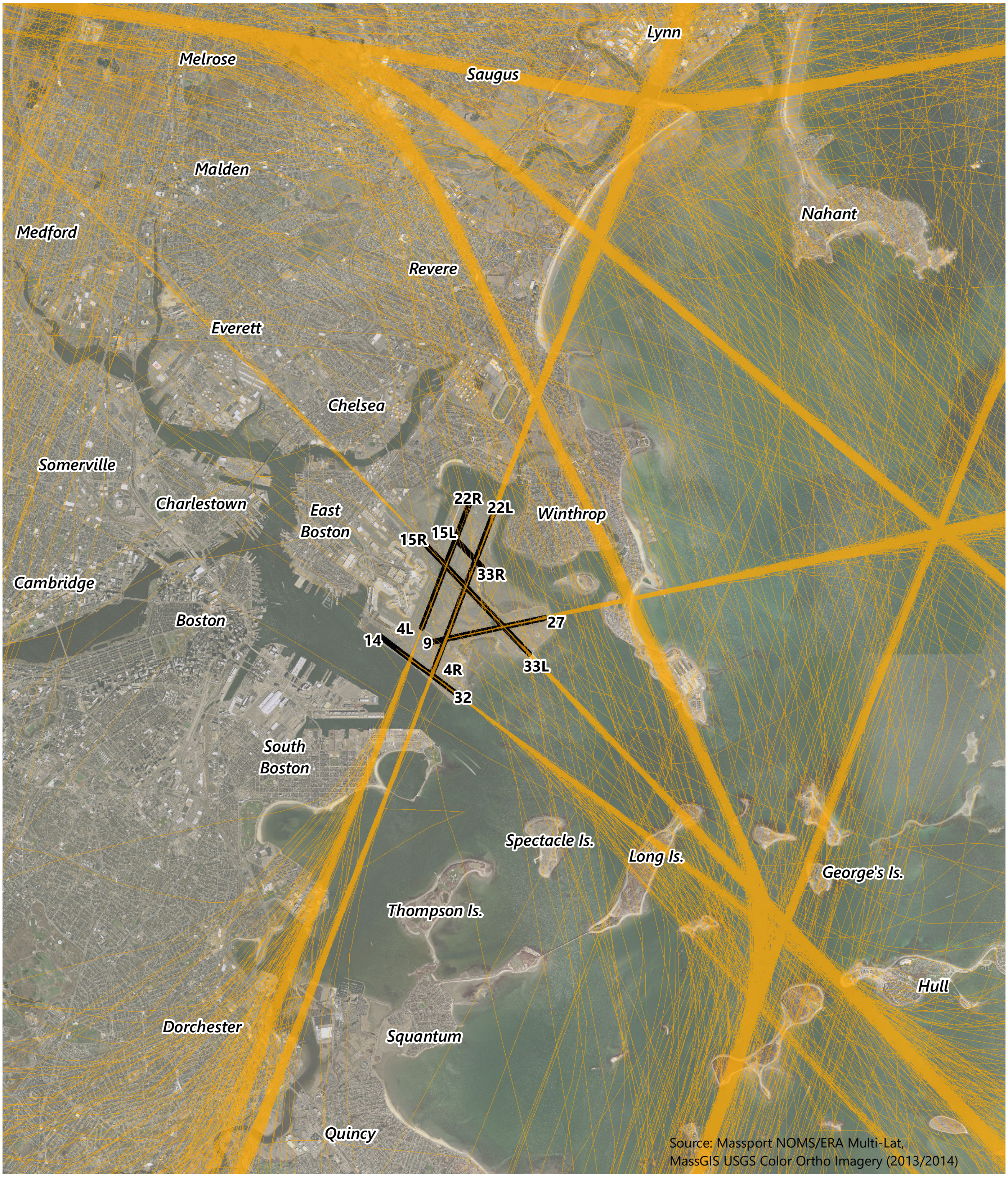
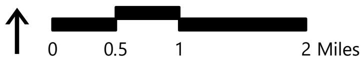


FIGURE 6-6 Regional Jet Arrival Flight Tracks | **2016 Environmental Data Report**



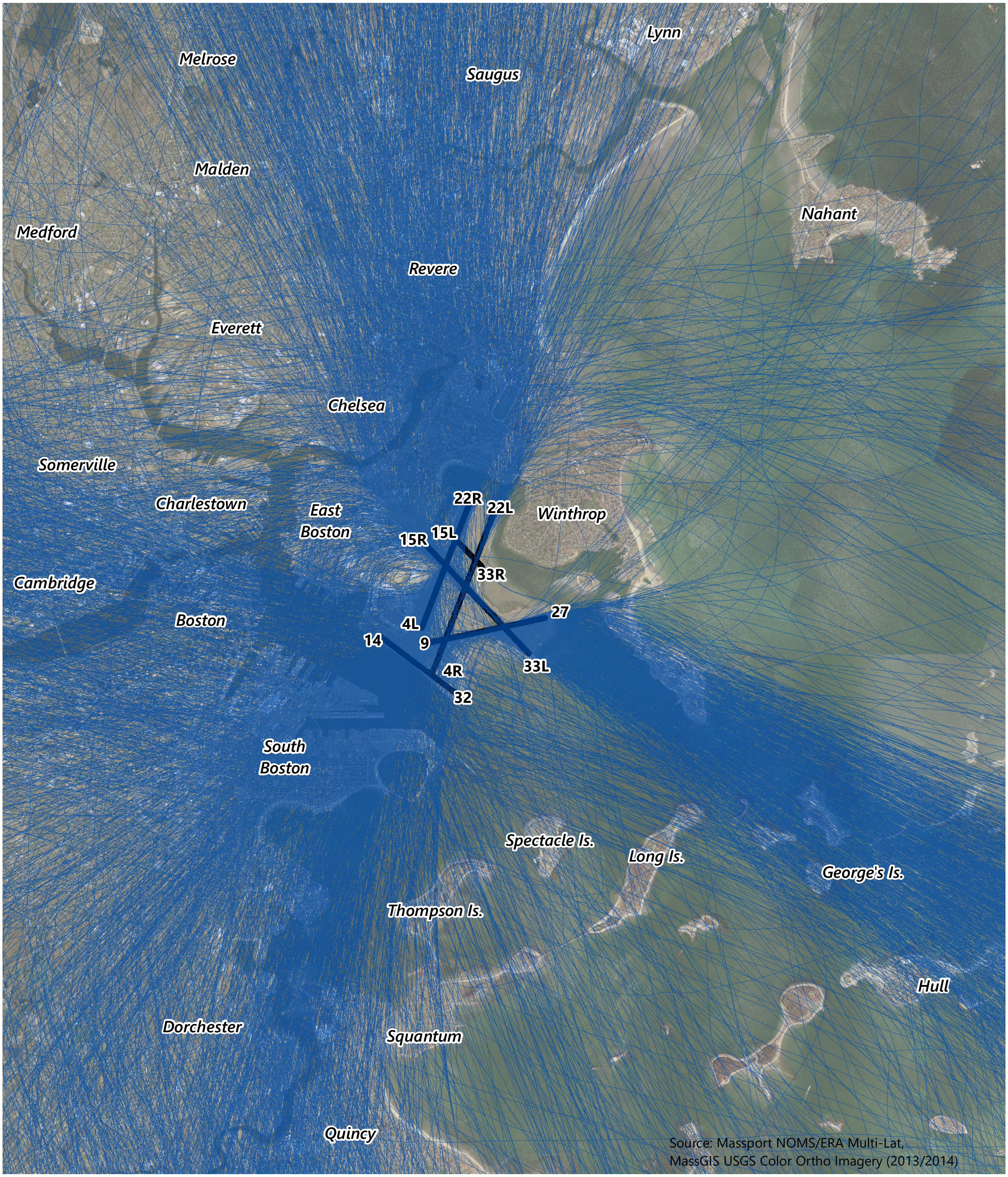


FIGURE 6-7 Non-Jet Departure Flight Tracks | **2016 Environmental Data Report**

Note: Non-jet tracks are non-RNAV.

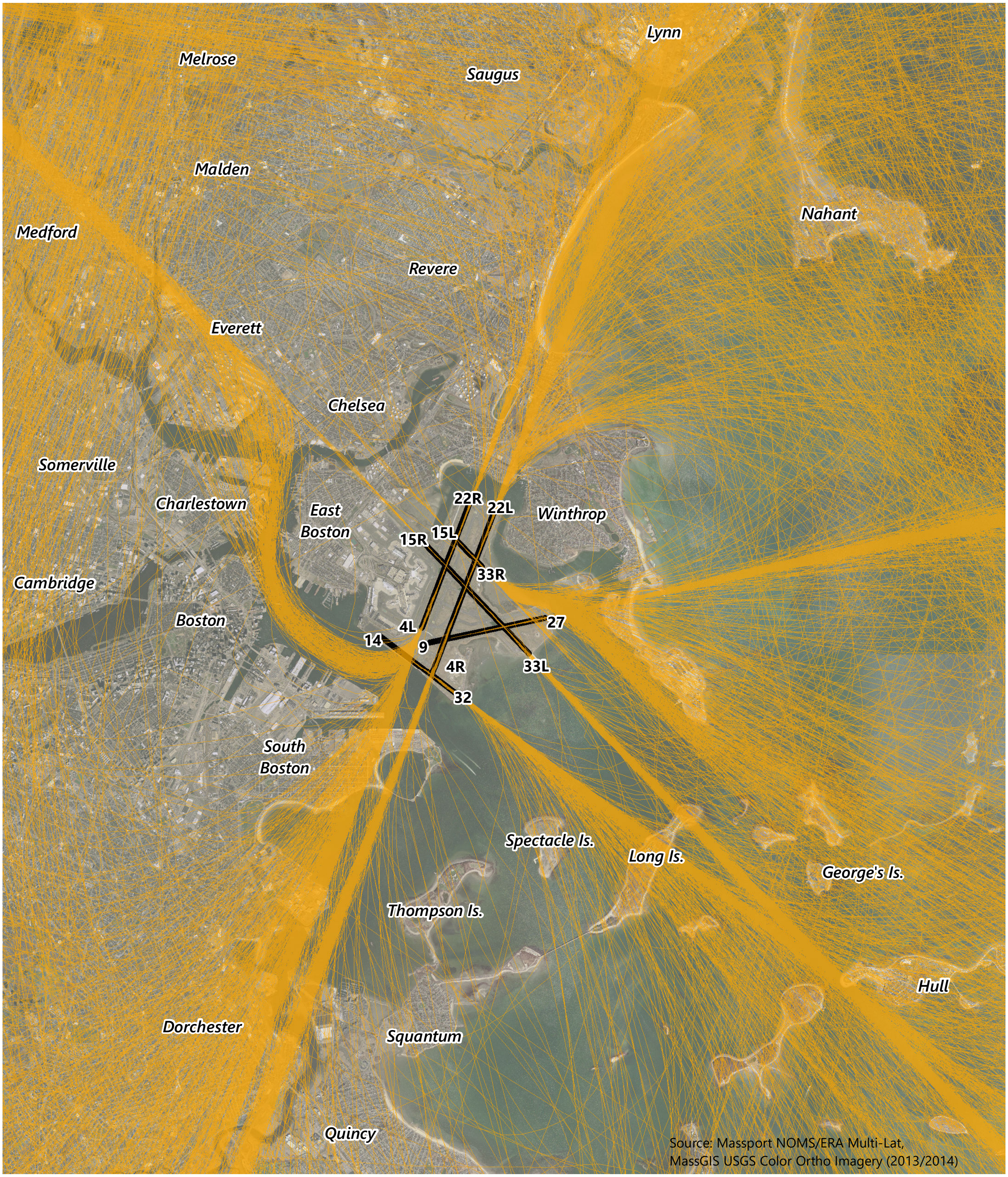


FIGURE 6-8 Non-Jet Arrival Flight Tracks | **2016 Environmental Data Report**

Note: Non-jet tracks are non-RNAV.

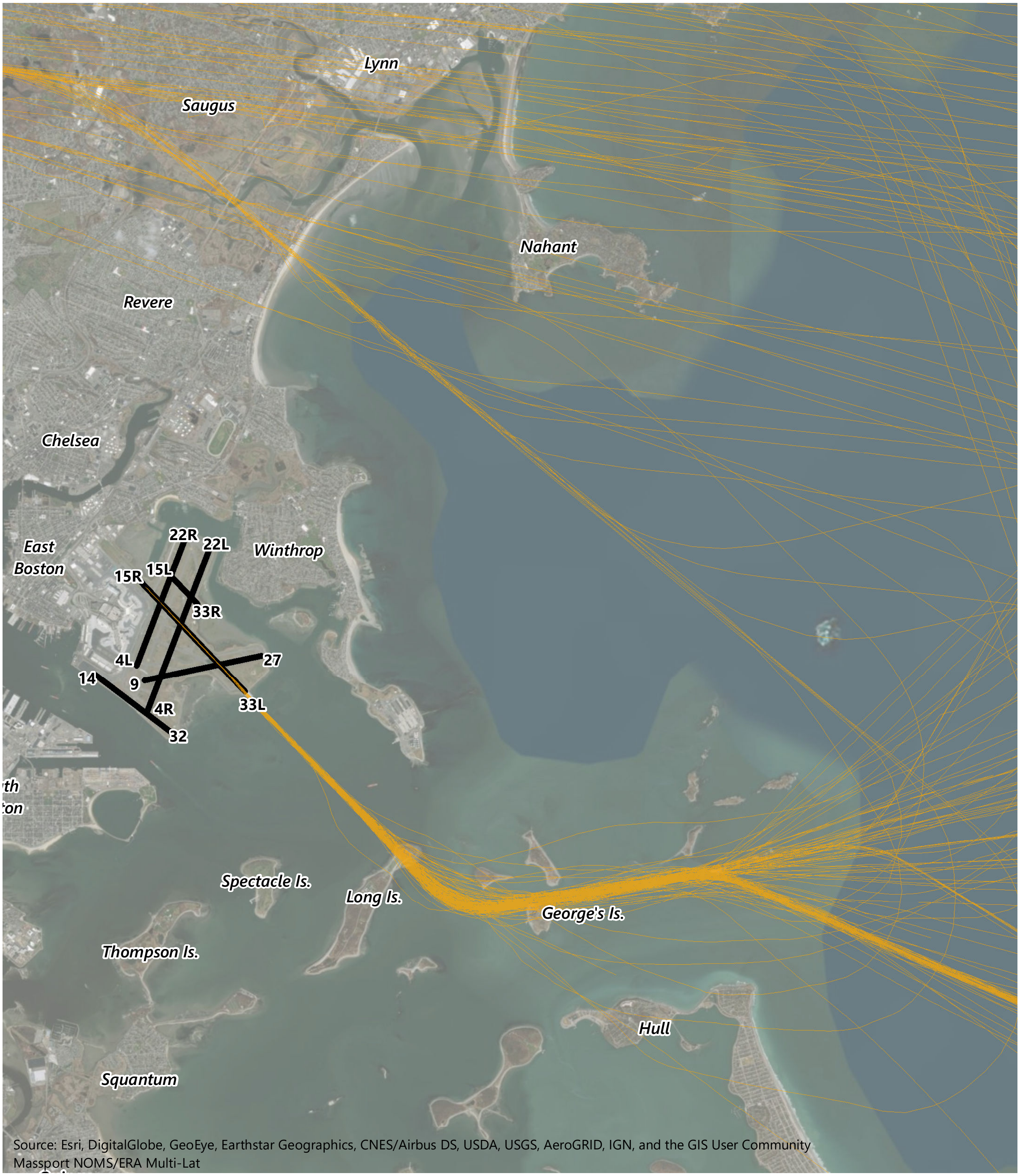


FIGURE 6-9 **Runway 33L Night (10PM - 7AM) Light Visual Approach Arrival Flight Tracks**

2016 Environmental Data Report

0 0.5 1 2 Miles

Noise Levels in 2016

The following section describes the results of noise modeling in AEDT for 2016. Population impacts are discussed and historical data are provided for context.

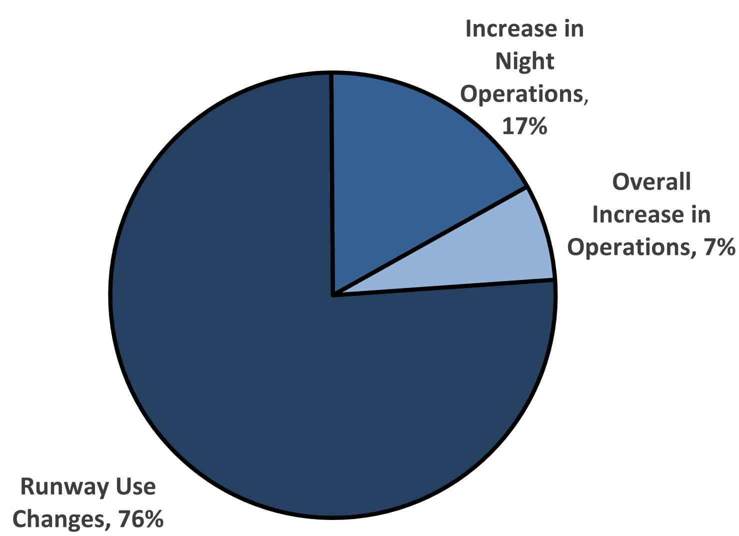
Day-Night Noise Contours for 2016

The 2016 DNL contours were prepared using the most recent version of FAA's INM model and the new AEDT model to demonstrate the effects of the difference between the two models. The differences between the AEDT noise contours for 2016 and the INM noise contours for 2015 can be attributed to a combination of changes in aircraft operations and differences in the noise model from 2015 to 2016. These are explained separately below.

Aircraft operation effects

Compared to 2015, aircraft operations at Logan Airport in 2016 were different in overall volume, proportion of nighttime operations, and runway use. **Figure 6-10** shows the relative influence of these factors on changes in the noise contour.

Figure 6-10 Reason for Changes in Number of People Exposed to DNL Values Greater than or Equal to 65 dB (2015 INM to 2016 INM)



Note: When comparing the 2015 INM contour to the 2016 INM contour, there is an increase in noise exposed population. However, when comparing 2015 INM (the official 2015 model) and 2016 AEDT (the official 2016 model) there is a decrease in the noise exposed population.

Figure 6-11 shows DNL 65 dB contours for 2015 and 2016, both modeled with the legacy INM software. The Logan Airport-specific adjustments to INM have been applied for both years, so any differences shown in this figure are due to changes in aircraft operations.

The FAA-required RNAV was in place for the third full year in 2016. With the RNAV procedures fully in use between 2015 and 2016, the contour lobes remain concentrated and elongated, and the overall shape of the 2016 contours is very similar to 2015 conditions.

The overall increase in the size of the contour reflects the increase in operations from 2015 to 2016. Two other factors influencing the noise contours were (1) the month-long closure of Runway 4L-22R, which shifted operations to Runway 9-27 and Runway 15R-33L, and (2) an increase in nighttime operations (9.3 percent increase from 2015 to 2016 versus 4.9 percent increase for overall operations). The combination of runway use and nighttime operations closely matches the increases in the contour:

Modeling effects

As noted in the section *Noise Modeling Process*, the AEDT model does not include the Logan-specific custom adjustments that were developed for INM modeling. The largest effect of these adjustments in the INM modeling is due to the over-water adjustment, which applies to departing aircraft at low altitudes. Therefore, its greatest effect on the noise contours is seen near runway ends where aircraft ramp up to maximum thrust for takeoff (start-of-takeoff roll, or SOTR). A second adjustment is the use of custom altitude profiles, which has the greatest effect where aircraft are ascending or descending. A third adjustment is the hill effect correction, which raises noise levels in the Orient Heights section of East Boston.

Figure 6-12 shows the DNL 65 dB contours for 2016, modeled with INM and AEDT.

Figure 6-13 displays the complete DNL contour set for 2016, modeled in AEDT.

Figure 6-14 provides a comparison of the DNL 65 dB contour for 2016 (AEDT) to historical 1990 and 1998 DNL 65 dB contours.

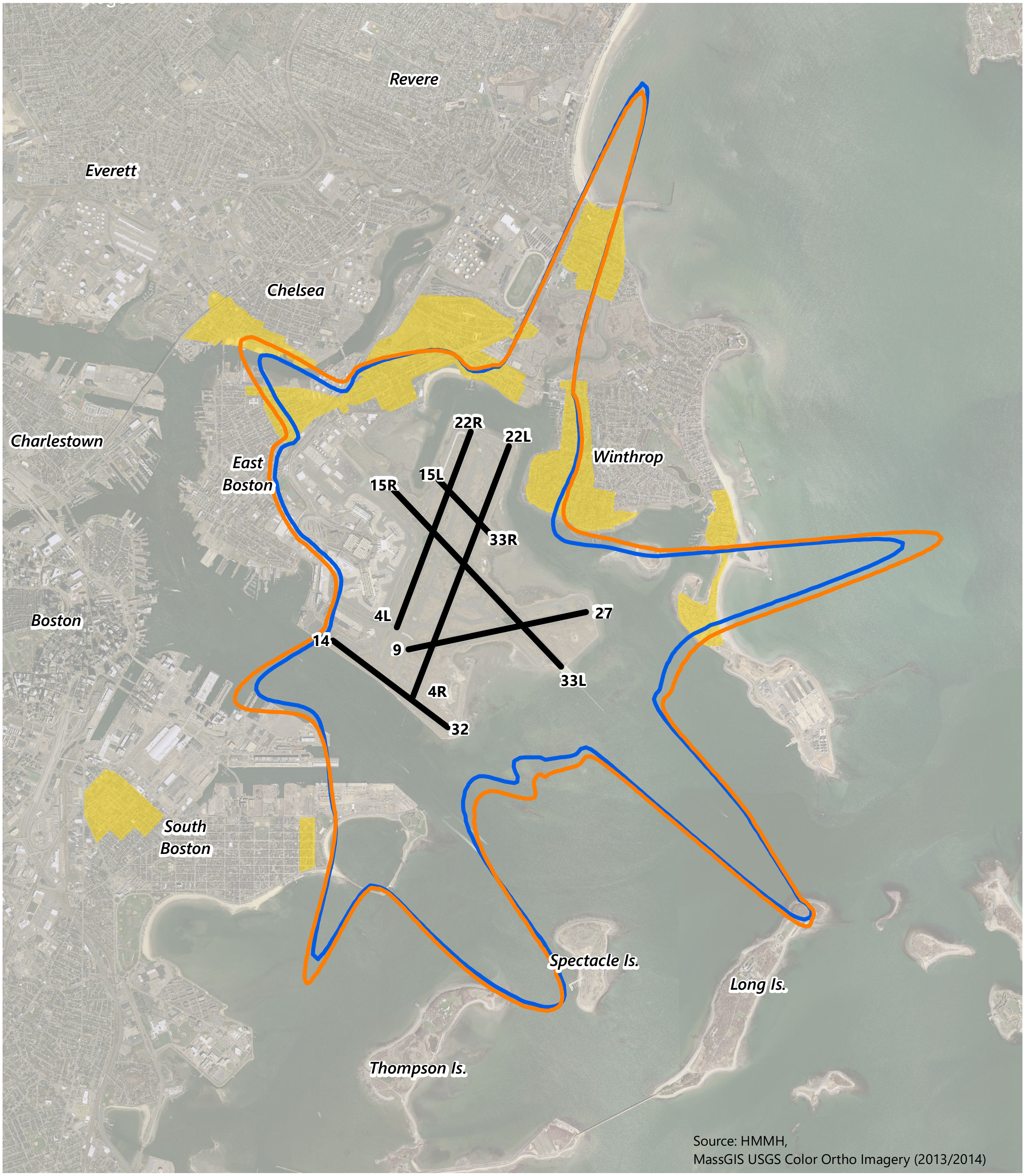


FIGURE 6-11 Comparison between 2015 (INM 7.0d) and 2016 (INM 7.0d) DNL 65 dB Contours

2016 Environmental Data Report

2016 DNL Contour (INM 7.0d)
2015 DNL Contour (INM 7.0d)
Sound Insulation Areas

0 1750 3500 7000 Feet

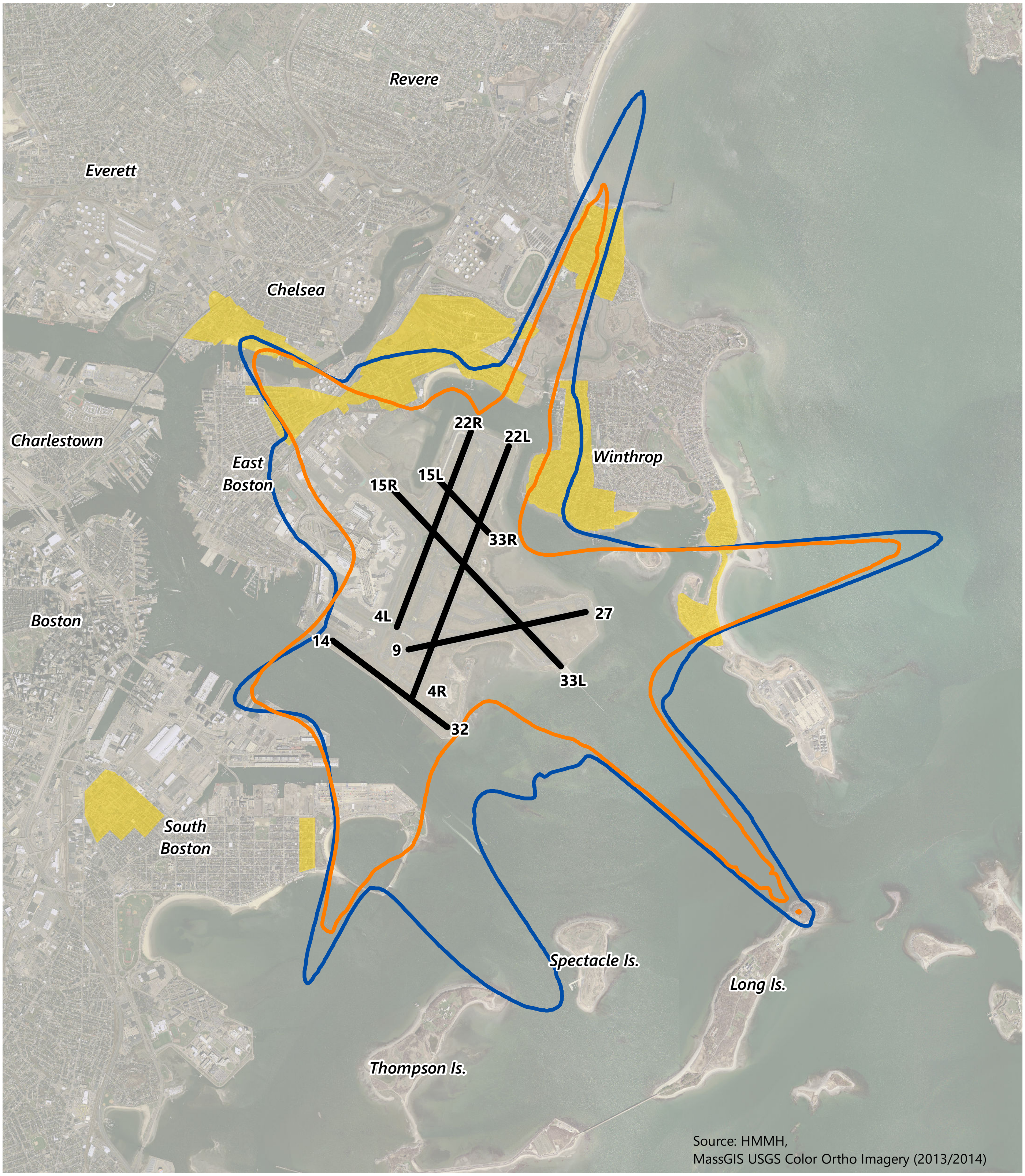


FIGURE 6-12 Comparison between 2016 (INM 7.0d) and 2016 (AEDT 2c) DNL 65 dB Contours

2016 Environmental Data Report

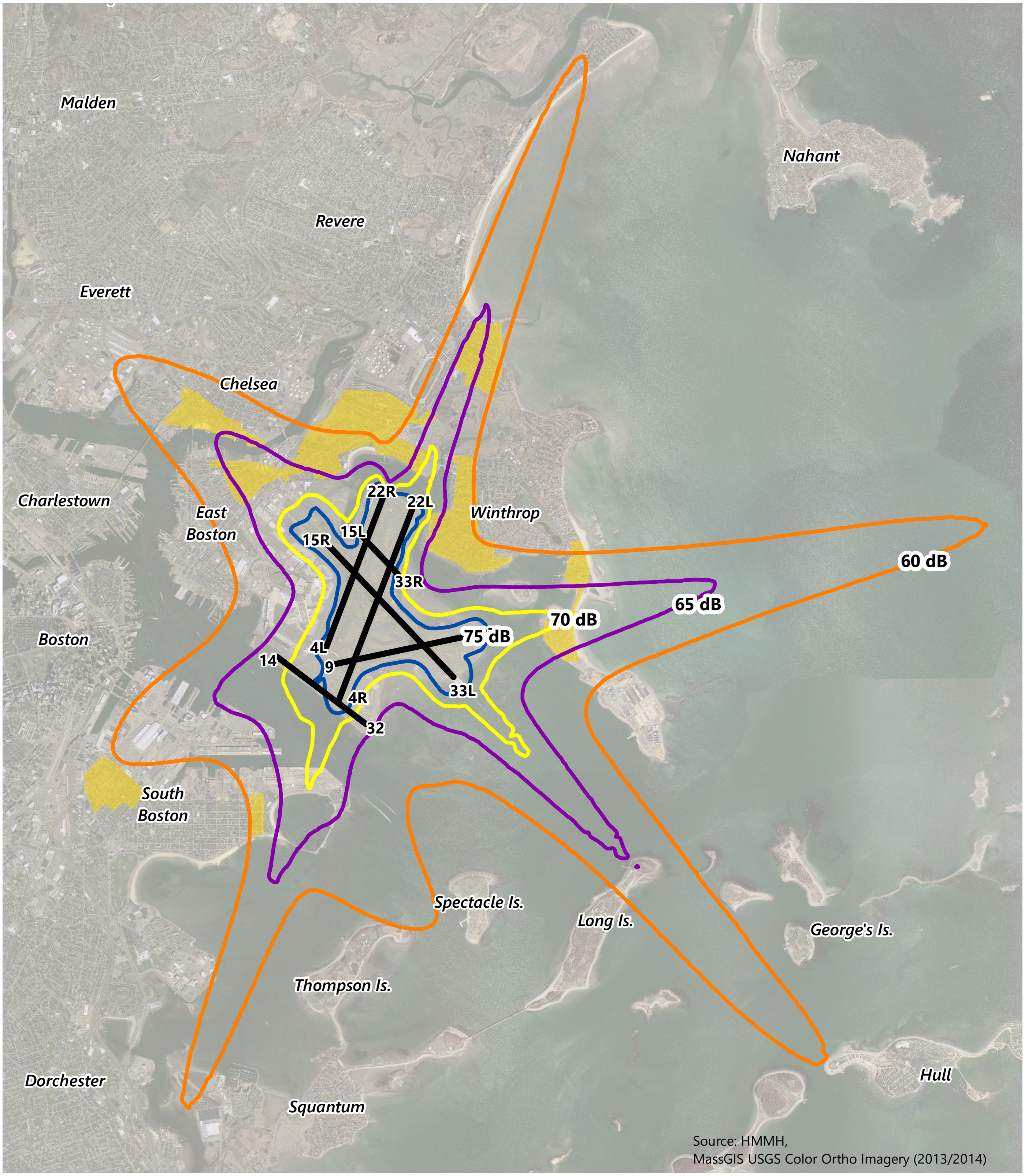


FIGURE 6-13 60-75 DNL Contours for 2016 Operations Using AEDT 2c

2016 Environmental Data Report

2016 DNL Contour (AEDT 2c)

- 60 dB
- 65 dB
- 70 dB
- 75 dB
- Sound Insulation Areas

0 1750 3500 7000 Feet

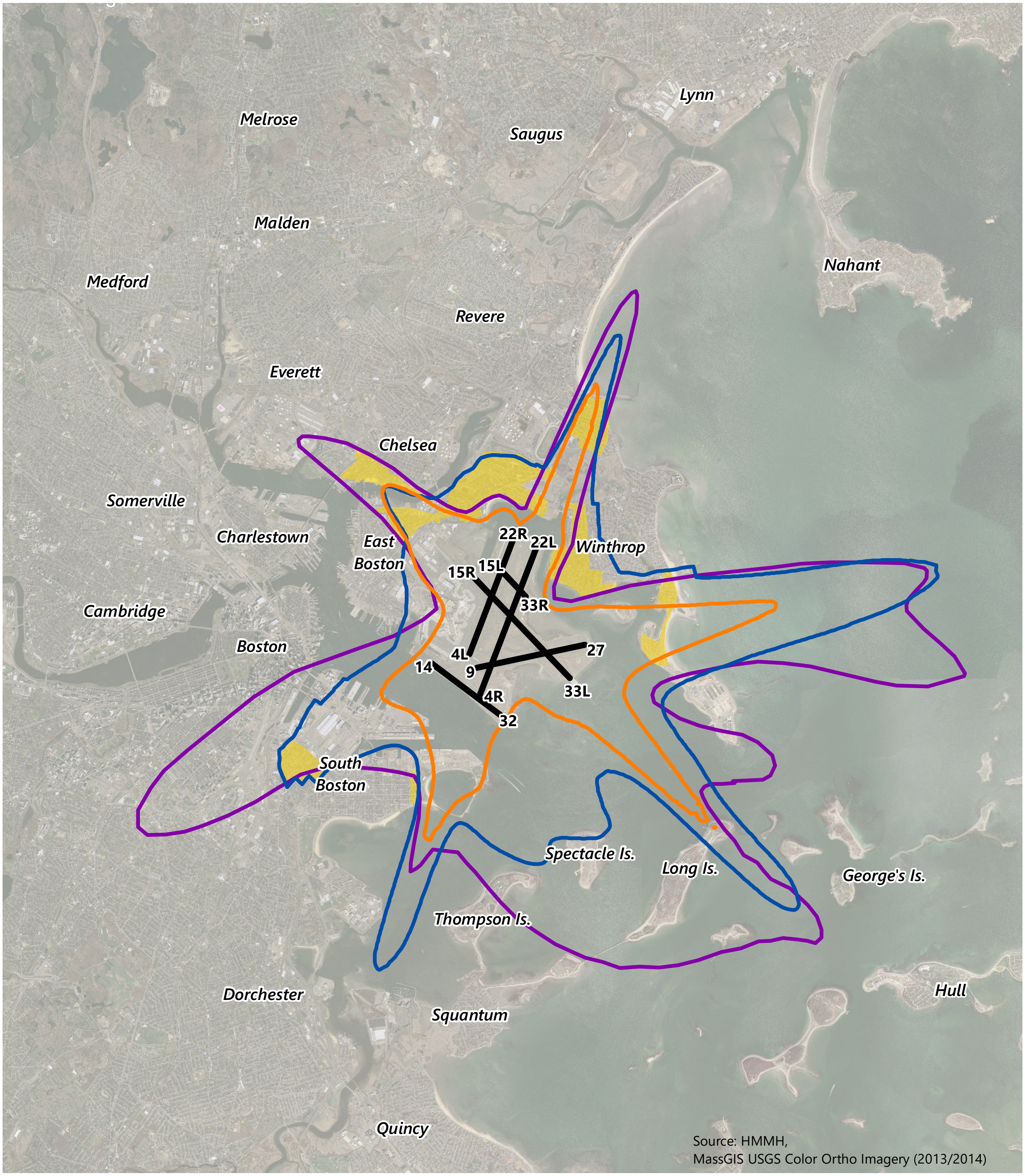


FIGURE 6-14 DNL 65 dB Contour Comparison with Historical Contour

2016 Environmental Data Report

Population Impact Assessment

Population counts within selected 5 dB increments of exposure are reported each year to indicate how Logan Airport's noise environment changes over time. Population counts for 2016 are shown in **Table 6-6** by community and are compared to previous years. The 2010 U.S. Census data, previously reported in the *2010 EDR,* were used to determine population counts. Population counts from 2000 through 2009 are based on U.S. Census data for 2000. Appendix H, *Noise Abatement* presents counts for calendar year 2010 from both sets of Census data. The noise analysis is based upon the most recently FAA-approved INM and AEDT models (INM 7.0d and AEDT 2cSP2).

Both FAA and the U.S. Department of Housing and Urban Development consider DNL exposure levels above 65 dB to be incompatible with residential land use. **Table 6-6** compares impacted populations for each year. **Table 6-7** provides an additional breakdown of the estimated population in East Boston and South Boston residing within the DNL 65 dB contour.

Table 6-6 Noise-exposed Population by Community[1]

Boston[2]						Revere					
Year	Census	> 75 DNL	70-75 DNL	65[3]-70 DNL	Total (65+)[3] DNL	Year	Census	> 75 DNL	70-75 DNL	65[3]-70 DNL	Total (65+)[3] DNL
1990	1990	0	1,778	28,970	30,748	1990	1990	0	0	4,274	4,274
2000	2000	0	234	9,014	9,248	2000	2000	0	0	2,496	2,496
2010 (7.0b)	2010	0	0	689	689	2010 (7.0b)	2010	0	0	2,413	2,413
2011 (7.0c)	2010	0	0	331	331	2011 (7.0c)	2010	0	0	2,547	2,547
2012 (7.0c)	2010	0	0	439	439	2012 (7.0c)	2010	0	0	2,772	2,772
2012 (7.0d)	2010	0	0	421	421	2012 (7.0d)	2010	0	0	2,762	2,762
2013 (7.0d)	2010	0	0	612	612	2013 (7.0d)	2010	0	0	2,505	2,505
2014 (7.0d)	2010	0	34	4,151	4,185	2014 (7.0d)	2010	0	0	2,832	2,832
2015 (7.0d)	2010	0	110	7,255	7,365	2015 (7.0d)	2010	0	0	3,789	3,789
2016 (7.0d)	2010	0	110	9,674	9,784	2016 (7.0d)	2010	0	0	3,789	3,789
2016 (AEDT)	2010	0	0	4,031	4,031	2016 (AEDT)	2010	0	0	2,376	2,376

Table 6-6 Noise-exposed Population by Community[1] (Continued)

Chelsea

Year	Census	> 75 DNL	70-75 DNL	65[3]-70 DNL	Total (65+)[3] DNL
1990	1990	0	0	4,813	4,813
2000	2000	0	0	0	0
2010(7.0b)	2010	0	0	0	0
2011 (7.0c)	2010	0	0	0	0
2012 (7.0c)	2010	0	0	0	0
2012 (7.0d)	2010	0	0	0	0
2013 (7.0d)	2010	0	0	0	0
2014 (7.0d)	2010	0	0	0	0
2015 (7.0d)	2010	0	0	0	0
2016 (7.0d)	2010	0	0	120	120
2016 (AEDT)	2010	0	0	0	0

Winthrop

Year	Census	> 75 DNL	70-75 DNL	65[3]-70 DNL	Total (65+)[3] DNL
1990	1990	676	1,211	2,420	4,307
2000	2000	247	1,070	4,684	6,001
2010 (7.0b)	2010	0	130	598	728
2011 (7.0c)	2010	0	130	939	1,069
2012 (7.0d)	2010	0	200	1,325	1,525
2012 (7.0d)	2010	0	200	1,186	1,386
2013 (7.0d)	2010	0	130	1,060	1,190
2014 (7.0d)	2010	0	130	1,775	1,905
2015 (7.0d)	2010	0	320	2,623	2,943
2016 (7.0d)	2010	0	431	2,861	3,292
2016 (AEDT)	2010	0	130	913	1,043

Everett

Year	Census	> 75 DNL	70-75 DNL	65[3]-70 DNL	Total (65+)[3] DNL
1990	1980	0	0	0	0
2000	2000	0	0	0	0
2010 (7.0b)	2010	0	0	0	0
2011 (7.0c)	2010	0	0	0	0
2012 (7.0c)	2010	0	0	0	0
2012 (7.0d)	2010	0	0	0	0
2013 (7.0d)	2010	0	0	0	0
2014 (7.0d)	2010	0	0	0	0
2015 (7.0d)	2010	0	0	0	0
2016 (7.0d)	2010	0	0	0	0
2016 (AEDT)	2010	0	0	0	0

All Communities

Year	Census	> 75 DNL	70-75 DNL	65[3]-70 DNL	Total (65+)[3] DNL
1990	1980	676	2,989	40,477	44,142
2000	2000	247	1,304	16,194	17,745
2010 (7.0b)	2010	0	130	3,700	3,830
2011 (7.0c)	2010	0	130	3,817	3,947
2012 (7.0c)	2010	0	200	4,536	4,736
2012 (7.0d)	2010	0	200	4,369	4,569
2013 (7.0d)	2010	0	130	4,177	4,307
2014 (7.0d)	2010	0	164	8,758	8,922
2015 (7.0d)	2010	0	430	13,667	14,097
2016 (7.0d)	2010	0	541	16,444	16,985
2016 (AEDT)	2010	0	130	7,320	7,450

Source: Massport and HMMH, 2017.

Notes: Population counts for 2010 through 2016 are provided for the 2010 U.S. Census block data (as indicated).

1 Data for years prior to 2010 are available in Appendix H, *Noise Abatement*. 7.0b, 7.0c, and 7.0d refer to INMv7.0b, INMv7.0c, and INMv7.0d respectively. AEDT version 2cSP2 was used for 2016.

2 These values reflect the effect of the FAA-approved terrain adjustment in Orient Heights.

3 DNL 65 dB is the federally-defined noise criterion used as a guideline to identify when residential land use is considered incompatible with aircraft noise.

Table 6-7 Estimated Population within 65 dB[1] DNL Contour[2]

		Boston							
		East Boston	**South Boston**	**Total**	**Chelsea**	**Revere**	**Winthrop**	**Everett**	**Total**
1990	1980	NA	NA	30,748	4,813	4,274	4,307	0	44,142
2000	2000	8,979[3]	269	9,248[3]	0	2,496	6,001	0	17,745
2010 (INMv7.0b)	2010	689	0	689	0	2,413	728	0	3,830
2011 (INMv7.0c)	2010	331	0	331	0	2,574	1,069	0	3,947
2012 (INMv7.0c)	2010	439	0	439	0	2,772	1,525	0	4,736
2012 (INMv7.0d)	2010	421	0	421	0	2,762	1,386	0	4,569
2013 (INMv7.0d)	2010	612	0	612	0	2,505	1,190	0	4,307
2014 (INMv7.0d)	2010	4,185	0	4,185	0	2,832	1,905	0	8,922
2015 (INMv70.d)	2010	7,365	0	7,365	0	3,789	2,943	0	14,097
2015 (AEDT)[4]	2010	386	0	386	0	2,376	152	0	3,564
2016 (INMv7.0d)	2010	9,784	0	9,784	120	3,789	3,292	0	16,985
2016 (AEDT)	2010	4,031	0	4,031	0	2,376	1,043	0	7,450
Change from 2015 (INM) to 2016 (AEDT)		**(3,334)**	**0**	**(3,334)**	**0**	**(1,413)**	**(1,900)**	**0**	**(6,647)**
Change from 2015 (AEDT) to 2016 (AEDT)		**3,645**	**0**	**3,645**	**0**	**0**	**241**	**0**	**3,886**

Source: Massport and HMMH, 2017.

Notes: Population counts for 2000 are based on the 2000 U.S. Census block data and for 1990 from the 1980 U.S. Census block data. Population counts for 2010 through 2016 are provided for the 2010 U.S. Census block data (as indicated). Changes in ( ) represent a decrease in estimated population.

1 DNL 65 dB is the federally-defined noise criterion used as a guideline to identify where residential land use is considered incompatible with aircraft noise.

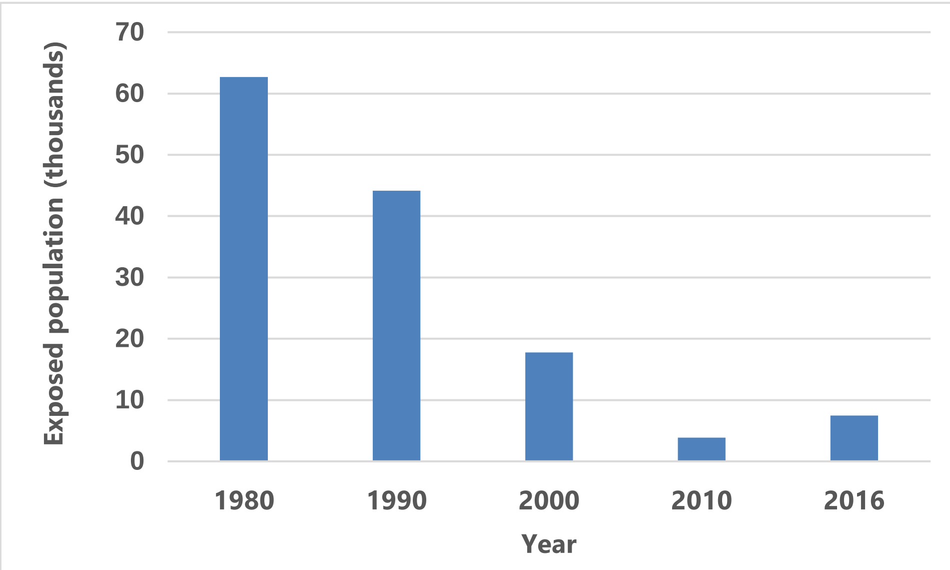
2 Data for years prior to 2010 are available in Appendix H, *Noise Abatement*.

3 These values reflect the effect of the FAA-approved terrain adjustment in Orient Heights.

4 Massport re-ran the *2015 EDR* contour in AEDT to use as a comparison in this table.

Figure 6-15 shows the long-term trend in population exposed to levels equal to or higher than DNL 65 dB since 1990.

Figure 6-15 DNL 65 dB Exposed Population Trend



Exposed populations vary depending on the model used. As discussed above in the previous section, *Day-Night Noise Contours for 2016*, adjustments implemented in INM are not yet available for AEDT, therefore the 2016 AEDT contours are smaller than the 2016 INM contours. Consequently, population calculations based on AEDT contours result in smaller exposed populations. The tables in this section provide population results for both models.

The discrepancies in population between the two models depend on two factors: (1) the size of the contours, and (2) the population in the areas where the contours differ. Referring to **Figure 6-12**, which shows the DNL 65 dB contours for the two models, there are two areas where the INM contour is significantly larger. One is offshore south of the Airport, where departures from Runway 22L turn to the southeast; however, this has no effect on population counts.

By contrast, the bulges in the INM contour near the Runway 15R and Runway 22L ends are largely over residential areas in East Boston and Winthrop. This results in a large discrepancy in impacted population between the two models.

2016 Affected Population (INM)

Comparing affected populations using INM for both 2015 and 2016 provides a clearer picture of how airport operations affected the community in 2016. The following discussion compares INM results for 2015 and 2016 (see **Tables 6-6 and 6-7**).

Due to the increase in operations in 2016 and changes in runway use, the total number of people exposed to DNL values equal to or greater than 65 dB increased to 16,985 people in 2016 from 14,097 people in 2015 (an increase of 2,888 people). The number of people residing within the DNL 70 dB contour increased from 430 people in 2015 to 541 people in 2016. The additional exposed population within the DNL 70 dB contour was exclusively in Winthrop. The 2016 INM levels remain below the number of people exposed in 2000 when 17,745 people were exposed to DNL noise levels equal to or greater than 65 dB and 1,551 people were exposed to DNL levels equal to or greater than 70 dB. All residences exposed to levels equal to or greater than the DNL 65 dB INM contour in 2016 have been eligible to participate in Massport's Residential Sound Insulation Program (RSIP) and to date residents that are qualified and have elected to participate in the program have been mitigated.

Due in part to the additional number of operations and an increase in departures from Runway 33L in 2016, East Boston had an increase in the number of people exposed to noise levels of DNL 65 dB or greater, from 7,365 in 2015 to 9,784 people in 2016. For historical context, 8,979 people were exposed to levels DNL 65 dB or greater in East Boston in 2000. Runway 33L operations also resulted in an exposed population of 120 in Chelsea for 2016, which in 2015 had no residents within the DNL 65 dB contour. The community with the second largest increase in exposed population is Winthrop, with 3,292 people within the DNL 65 dB contour for 2016, compared to 2,943 in 2015. This was primarily due to increased use of Runway 27 for departures and nighttime arrivals. Despite this increase, the exposed population in Winthrop is well below Year 2000's total of 6,001 people. In 2016, no people were exposed to DNL levels greater than 65 dB in South Boston. The number of people exposed in Revere was identical in 2015 and 2016, with 3,789 people within the DNL 65 dB contour (see **Table 6-6**).

As noted, the total population exposed to noise levels between DNL 70 to 75 dB increased in 2016 to 541 people compared to 430 people in 2015, which is less than levels from 2000. In 2016, there were no people exposed to levels higher than DNL 75 dB, unlike in 2000 when 247 people were exposed to levels higher than DNL 75 dB.

2016 Affected Population (AEDT)

As discussed in the previous section, *Day-night Contours for 2016*, the size of the 2016 AEDT contour is smaller than the 2016 INM contour due to adjustments used in the INM process for over-water effects, hill effects, and custom profiles for initial climb outs that were not approved by FAA for use in AEDT. The difference between INM and AEDT is particularly notable in the residential areas near the Runway 15R end, in East Boston, and the Runway 22R and 22L ends, affecting both East Boston and Winthrop. The extent of the contour peak in line with the Runway 22L end also shows a discrepancy between the two models, affecting the Revere neighborhood northeast of the Belle Isle Marsh Reservation.

As shown in **Table 6-7**, the population within the 2016 AEDT DNL 65 dB contour is 7,450, whereas the INM contour for 2016 surrounds a population of 16,985. Individual communities show a similar pattern, with exposed populations in East Boston of 4,031 (AEDT) versus 9,784 (INM), Revere with 2,376 (AEDT) versus 3,789 (INM), and Winthrop with 1,043 (AEDT) versus 3,292 (INM). Chelsea has no residents within the 2016 AEDT contour, whereas 120 are within the INM contour.

Comparing the population counts for 2016 (AEDT) with 2015 (INM), the 2016 numbers are lower, with 7,450 people within the DNL 65 dB contour for 2016, compared with 14,097 for 2015. The population within the DNL 70 dB contour fell from 430 in 2015 to 130 in 2016. For 2016, this population was exclusively in Winthrop, whereas in 2015 the 70-dB contour included residents of both Winthrop and East Boston.

Comparing Measured and Modeled Noise Levels

When changes in noise exposure are predicted through modeling, it is important to substantiate these modeled findings with actual noise measurements, such as those taken with Massport's permanent noise monitoring system. Massport's system continuously measures the noise levels at each of the 30 microphone locations around the Airport and environs, as shown in **Figure 6-16**. During normal operation, noise monitors at the microphone locations measure noise exposure levels as well as a variety of metrics associated with individual noise events that exceed preset threshold sound levels. Noise monitoring data are transmitted back to Massport's Noise Office, where daily DNL values and other noise metrics are computed for each location and summarized in various reports.

This *2016 EDR* compares the measured annual average DNL values from the monitors to AEDT-computed values of DNL at each of the specific noise monitor sites to check for reasonableness. Many sites produced small differences between measurements and predictions. However, results at more distant locations have often produced substantial differences of 10 dB or more, especially at measurement sites where DNL values were often less than 60 dB.

Differences between measured and modeled values have narrowed in recent years as both the noise monitoring and modeling processes have been refined. For 2016, these differences have increased moderately with the change to AEDT for modeling. As described in the section *Noise Modeling Overview* in this chapter, adjustments for over-water effects, hill effects, and custom altitude profiles, previously developed for modeling in INM, have not been implemented in the 2016 AEDT analysis. However, the overall difference between measured and modeled values remains small, with a difference in average values of DNL 3.1 dB, versus 2.6 dB for 2015 using the INM model.

FIGURE 6-16 Noise Monitor Locations

2016 Environmental Data Report

● Permanent Noise Monitor

▲ Airport Reference Point

0 17503500 7000 Feet

All sites have been verified by survey.
Locations not shown on map:
#19 Smith Lane, Swampscott
#20 Pond and Town Court, Lynn

Table 6-8 compares the measured 2015 DNL values to the measured 2016 DNL values at each location. In 2016, three locations had decreases of more than 2 dB while two had increases of more than 2 dB. The remaining 26 locations had changes in levels of less than 2 dB. The average measured value for 28 of the sites was 55.2 dB in 2016, unchanged from 2015. Sites 12 and 26 are excluded from the averages due to issues at each site. Site 12 was decommissioned in 2010 and will be relocated at a future date. Site 26 was damaged and unavailable for all of 2016, although it resumed operation in September 2017. To keep the sites used for the averages consistent between the two years, Sites 12 and 26 were excluded from the computations.

Several of the sites with the greatest variation from 2015 to 2016 were some of the most distant, for example Sites 18, 20, 27, and 28. Aircraft noise levels are lower at these sites, and therefore they can experience more variation due to local ambient noise from traffic, wind, etc. The large variation at Site 14 (decrease of 10 dB) is most likely due to external factors. This site was inactive for part of the year.

Noise level changes at various sites typically follow changes in runway use. With the one-month closure of Runway 4L-22R, traffic increased on Runway 9-27 and Runway 15R-33L. This can be seen in the Runway 33L departure RNAV route, which affects Sites 13, 15, 21, and 22, all of which experienced increases. Similarly, Site 5 in Winthrop experienced an increase due to increased arrivals and departures on Runway 27 and departures from Runway 9.

Distances reported in **Tables 6-8** and **6-9** are computed from the Airport Reference Point which is located along Runway 4L-22R near its intersection with Runway 15R-33L. This location is shown on **Figure 6-16**. The measured data are not used to calibrate the model but are shown here to compare to the modeled values and in general, they reveal similar trends.

Table 6-8 Measured Versus Measured - Comparison of Measured DNL Values From 2015 to 2016

Location	Site	Distance from Logan Airport (miles)	2015 Measured Aircraft (DNL)	2016 Measured Aircraft (DNL)	Difference 2016 minus 2015
South End – Andrews Street	1	3.7	56.0	57.5	1.5
South Boston – B and Bolton	2	2.9	57.9	59.3	1.4
South Boston – Day Blvd. near Farragut	3	2.5	59.2	58.5	(0.7)
Winthrop – Bayview and Grandview	4	1.6	71.0	67.1	(3.9)
Winthrop – Harborview and Faun Bar	5	1.9	63.4	64.1	0.7
Winthrop – Somerset near Johnson	6	0.8	64.0	64.6	0.6
Winthrop – Loring Road near Court	7	1.0	65.6	65.8	0.2
Winthrop – Morton and Amelia	8	1.6	59.2	59.6	0.4
East Boston – Bayswater near Annavoy	9	1.3	67.1	66.6	(0.5)
East Boston – Bayswater near Shawsheen	10	1.3	58.1	57.7	(0.4)
East Boston – Selma and Orient	11	1.8	55.1	55.7	0.6
East Boston Yacht Club	12	1.2	N/A	N/A	N/A
East Boston High School	13	1.9	61.7	63.3	1.6
East Boston – Jeffries Point Yacht Club	14	1.2	54.9	44.9	(10.0)
Chelsea – Admiral's Hill	15	2.8	61.3	61.5	0.2
Revere – Bradstreet and Sales	16	2.4	67.9	68.7	0.8
Revere – Carey Circle	17	5.3	60.4	60.4	0.0
Nahant – U.S.C.G. Recreational Facility	18	5.9	37.3	30.6	(6.7)
Swampscott – Smith Lane	19	8.7	40.4	39.5	(0.9)
Lynn – Pond and Towns Court	20	8.4	49.7	53.9	4.2
Everett – Tremont near Prescott	21	4.5	51.6	51.7	0.1
Medford – Magoun near Thatcher	22	6.0	52.0	53.5	1.5
Dorchester – Myrtlebank near Hilltop	23	6.3	55.4	56.2	0.8
Milton – Cunningham Park near Fullers	24	8.1	48.7	49.4	0.7
Quincy – Squaw Rock Park	25	4.2	42.0	41.1	(0.9)
Hull – Hull High School near Channel Street	26	6.0	59.8	N/A	N/A
Roxbury – Boston Latin Academy	27	5.3	54.3	56.2	1.9
Jamaica Plain – Southbourne Road	28	7.7	45.0	49.7	4.7
Mattapan – Lewenburg School	29	7.3	38.9	38.2	(0.7)
East Boston – Piers Park	30	1.5	47.9	49.8	1.9
Arithmetic Average			**55.2**	**55.2**	**0.0**

Source: HMMH, 2017.

Notes: Changes in ( ) represent a decrease in measured noise level.
Distance from Logan Airport calculated from the Airport Reference Point.
Sites 12 (East Boston Yacht Club) and 26 (Hull High School) are no longer operational. These sites are not included in the average values.

Table 6-9 compares the measured 2015 and 2016 DNL values at each measurement site to the modeled DNL values. The AEDT model was used to compute DNL noise levels at each noise monitoring site for 2016, and the 2015 values were computed using INM.

The average measured value for 28 of the sites is 55.2 dB in 2016 and the average modeled value is 58.2 dB in 2016 (Sites 12 and 26 are excluded from the averages due to issues at each site). The average of the difference between the measured versus modeled values for 2015 was 2.6 dB and 3.1 dB in 2016. In general, due to the modeled values being larger than the measured at most of the more distant monitors, the average difference will always be a positive value.

Using AEDT, Massport can compute the modeled DNL for the same periods for which the noise monitoring system was collecting data at each site. It is also able to capture runway use and airspace changes as they occur. The model, however, only computes noise from aircraft and while it includes terrain it does not include other factors such as local weather phenomena and the influence such as shielding from local buildings and trees.

As shown in **Table 6-9**, nine of the sites in 2016 have a difference between measured and modeled of 1 dB or less. In 2015 and 2016, for the majority of locations where modeled values exceed measured values, the measured levels are below DNL 60 dB. It is not unusual to experience differences between measured and modeled levels at the locations with lower measured DNL values. The monitor identification of aircraft noise events becomes more difficult, and long-distance effects can reduce levels that the model cannot duplicate. Differences at these sites farther from the Airport can easily increase the overall difference between measured and modeled results.

Table 6-9 Measured Versus Modeled - Comparison of Measured DNL Values to INM (2015) and AEDT (2016) modeled DNL Values

			2015		2016		2015	2016
Location	**Site**	**Distance from Logan Airport (miles)**	**Measured Aircraft – Only DNL**	**Modeled RC Results INMv7.0d (DNL)[1]**	**Measured Aircraft – Only DNL**	**Modeled RC Results AEDT (DNL)[1]**	**Difference Modeled minus Measured**	
South End – Andrews Street	1	3.7	56	54.2	57.5	55.9	(1.8)	(1.6)
South Boston – B and Bolton	2	2.9	57.9	59.1	59.3	59.7	1.2	0.4
South Boston – Day Blvd. near Farragut	3	2.5	59.2	60.5	58.5	60.7	1.3	2.2
Winthrop – Bayview and Grandview	4	1.6	71	72.1	67.1	71.8	1.1	4.7
Winthrop – Harborview and Faun Bar	5	1.9	63.4	63.5	64.1	64.6	0.1	0.5
Winthrop – Somerset near Johnson	6	0.8	64	64.1	64.6	61.9	0.1	(2.7)
Winthrop – Loring Road near Court	7	1.0	65.6	72.5	65.8	67.0	6.9	1.2
Winthrop – Morton and Amelia	8	1.6	59.2	63.9	59.6	61.3	4.7	1.7
East Boston – Bayswater near Annavoy	9	1.3	67.1	72.4	66.6	67.9	5.3	1.3
East Boston – Bayswater near Shawsheen	10	1.3	58.1	65.2	57.7	62.3	7.1	4.6
East Boston – Selma and Orient[2]	11[2]	1.8	55.1	57.8	55.7	57.3	2.7	1.6
East Boston Yacht Club	12	1.2		70.3		65.3		
East Boston High School	13	1.9	61.7	62.6	63.3	64.5	0.9	1.2
East Boston – Jeffries Point Yacht Club	14	1.2	54.9	57.2	44.9	61.0	2.3	16.1
Chelsea – Admiral's Hill	15	2.8	61.3	61.2	61.5	61.6	(0.1)	0.1
Revere – Bradstreet and Sales	16	2.4	67.9	68.7	68.7	67.7	0.8	(1.0)
Revere – Carey Circle	17	5.3	60.4	60.5	60.4	59.7	0.1	(0.7)
Nahant – U.S.C.G. Recreational Facility	18	5.9	37.3	44.9	30.6	46.1	7.6	15.5

Table 6-9 Measured Versus Modeled - Comparison of Measured DNL Values to INM (2015) and AEDT (2016) modeled DNL Values (Continued)

			2015		2016		2015	2016
Location	**Site**	**Distance from Logan Airport (miles)**	**Measured Aircraft – Only DNL**	**Modeled RC Results INMv7.0d (DNL)[1]**	**Measured Aircraft – Only DNL**	**Modeled RC Results AEDT (DNL)[1]**	**Difference Modeled minus Measured**	
Swampscott – Smith Lane	19	8.7	40.4	45.3	39.5	45.9	4.9	6.4
Lynn – Pond and Towns Court	20	8.4	49.7	55.1	53.9	54.8	5.4	0.9
Everett – Tremont near Prescott	21	4.5	51.6	53.9	51.7	54.5	2.3	2.8
Medford – Magoun near Thatcher	22	6.0	52.0	52.5	53.5	53.8	0.5	0.3
Dorchester – Myrtlebank near Hilltop	23	6.3	55.4	54.4	56.2	54.7	(1.0)	(1.5)
Milton – Cunningham Park near Fullers	24	8.1	48.7	54.0	49.4	54.2	5.3	4.8
Quincy – Squaw Rock Park	25	4.2	42.0	47.8	41.1	49.5	5.8	8.4
Hull – Hull High School near Channel Street	26	6.0	59.8	58.8		59.3	(1.0)	
Roxbury – Boston Latin Academy	27	5.3	54.3	53.4	56.2	54.5	(0.9)	(1.7)
Jamaica Plain – Southbourne Road	28	7.7	45.0	49.5	49.7	51.2	4.5	1.5
Mattapan – Lewenburg School	29	7.3	38.9	46.6	38.2	48.2	7.7	10.0
East Boston – Piers Park	30	1.5	47.9	54.8	49.8	58.3	6.9	8.5
Arithmetic Average [3]			**55.6**	**58.3**	**55.2**	**58.2**	**2.6**	**3.1**

Source: HMMH, 2017.
Note: 2015 and 2016 Modeled results were computed for the whole year.
Distance from Logan Airport calculated from the Airport Reference Point.
1 INMv7.0d with adjusted database. (Database modifications as described in the *Logan Airport 1994/1995 Generic Environmental Impact Report*.)
2 Includes FAA-approved terrain adjustment modifying normal INMv7.0d result for Site 11.
3 Sites 12 and 26 are not included in the average values.

Supplemental Metrics

To further describe the noise environment, this *2016 EDR* includes supplemental noise metrics: cumulative noise index (CNI), dwell and persistence, and times above a noise threshold.

Cumulative Noise Index

Massport reports total annual fleet noise at Logan Airport, as defined in the Logan Airport Noise Rules by a metric referred to as CNI. CNI is a single number representing the sum of the entire set of single-event noise energy from each operation experienced at Logan Airport over a full year of operation. CNI is weighted similarly to DNL so that activity occurring at night is penalized by adding an extra 10 dB to each modeled event. This penalty is equivalent to multiplying the number of nighttime events of each aircraft by a factor of 10.

The Logan Airport Noise Rules define CNI in units of EPNdB[21] and require that the index be computed for the fleet of commercial aircraft operating at Logan Airport throughout the year. In addition, in EDRs and ESPRs, Massport reports partial CNI values of noise at Logan Airport, so that various subsets of the fleet (cargo, night operations, passenger jets, etc.) are identified. Using the expanded data available from the NOMS, all available aircraft registration data were used to select the proper noise certification levels from the latest aircraft noise registration database.[22]

The Noise Rules, adopted by Massport following public hearings held in February 1986, established a CNI limit of 156.5 EPNdB. The CNI generally has decreased since 1990, remaining below that cap, and typical changes from one year to the next have been within a few tenths of a decibel. Since its 2010 minimum of 151.9 dB, the CNI has increased only moderately, and has decreased in each of the past two years. In 2016, the CNI decreased by 0.1 dB to 152.6 EPNdB, remaining well below the cap of 156.5 EPNdB. This decrease for 2016 occurred even though operational levels and night operations increased. This is the result of using quieter aircraft in 2016. The partial CNI was lower or unchanged across all categories for 2016 when compared to 2015, with the exception of a 0.1 dB increase in the category of Nighttime Passenger operations.

Partial Cumulative Noise Index Calculations

Partial CNI values were obtained by summing the noise from particular segments of Logan Airport's total operations. They are useful for identifying the greatest contributors to overall noise. As shown in **Table 6-10**, the sectors of the fleet with the highest numbers of partial CNI indicate a greater contribution to total noise. **Table 6-10** also indicates that for 2016:

- The passenger jets' contribution was unchanged in 2016 despite increased operations.
- While the daytime CNI contribution decreased, the nighttime CNI was unchanged. This is due to a combination of an increase in from passenger contribution offset by a decrease in cargo contribution.

21 EPNdB is the noise metric used to certify aircraft by FAA.

22 Type-certificate data sheet for noise database available from the European Aviation Safety Agency; http://www.easa.europa.eu/document-library/noise-type-certificates-approved-noise-levels.

Table 6-10 Cumulative Noise Index (EPNdB)[1]

Logan Airport CNI Cap – 156.5 EPNdB						
Full CNI (Entire Commercial Jet Fleet)	**1990**	**2000**	**2010**	**2015**	**2016**	**Change (2015-2016)**
	156.4	**154.7**	**151.9**	**152.7**	**152.6**	**(0.1)**
Total Passenger Jets	155.2	153.6	150.9	152.0	152.0	0.0
Total Cargo Jets	150.1	148.2	145.1	144.2	143.8	(0.4)
Total Daytime	152.5	149.5	146.8	147.2	147.0	(0.2)
Total Nighttime	154.4	153.1	150.3	151.2	151.2	0.0
Total Stage 2 Jets	N/A	124.7	113.6	N/A	N/A	N/A
Total Stage 3 Jets	N/A	154.7	151.9	152.7	152.6	(0.1)
Daytime Stage 2	N/A	122.6	103.6	N/A	N/A	N/A
Nighttime Stage 2	N/A	120.5	113.1	N/A	N/A	N/A
Daytime Stage 3	N/A	149.5	146.8	147.2	147.0	(0.2)
Nighttime Stage 3	N/A	153.1	150.3	151.2	151.2	0.0
Passenger Jet Stage 2	N/A	124.2	N/A	N/A	N/A	N/A
Passenger Jet Stage 3	N/A	153.6	150.9	152.0	152.0	0.0
Cargo Jet Stage 2	N/A	114.8	113.6	N/A	N/A	N/A
Cargo Jet Stage 3	N/A	148.2	145.1	144.2	143.8	(0.4)
Daytime Passenger	N/A	149.3	146.6	147.0	146.8	(0.2)
Nighttime Passenger	N/A	151.6	149.0	150.3	150.4	0.1
Daytime Cargo	137.1	137.5	134.5	134.4	133.8	(0.6)
Nighttime Cargo	149.9	147.8	144.7	143.7	143.4	(0.3)
Daytime Passenger Stage 2	N/A	122.3	N/A	N/A	N/A	N/A
Daytime Passenger Stage 3	N/A	149.2	146.6	147.0	146.8	(0.2)
Nighttime Passenger Stage 2	N/A	119.8	N/A	N/A	N/A	N/A
Nighttime Passenger Stage 3	N/A	151.6	149.0	150.3	150.4	0.1
Daytime Cargo Stage 2	N/A	111.1	103.6	N/A	N/A	N/A
Daytime Cargo Stage 3	N/A	137.5	134.4	134.4	133.8	(0.6)
Nighttime Cargo Stage 2	N/A	112.3	113.1	N/A	N/A	N/A
Nighttime Cargo Stage 3	N/A	147.8	144.7	143.7	143.4	(0.3)

Source: HMMH, 2017.
Notes: General aviation and non-jet aircraft are not included in the calculation.
N/A Not available.
1 Data for years prior to 2014 are available in Appendix H, *Noise Abatement*.

Table 6-11 provides the number of flight operations, the resulting CNI by airline for 2015 and 2016, and the partial CNI per operation for 2015 and 2016. The table shows the relative contribution of each airline to total CNI and reflects the contributions of individual aircraft noise levels and the frequency with which they occur. The table is sorted by the partial CNI per operation for 2016 and shows a mix of international carriers and cargo operators at the top of this list. This is due to the higher proportion of nighttime operations among these carriers, as well as the operation of larger and/or older aircraft. JetBlue Airways, with the largest number of operations, has the highest CNI per airline at 146.1 EPNdB in 2015 and 146.4 EPNdB in 2016, but its partial CNI by operation is well below the other major airlines in part due to its use of newer, quieter aircraft. FedEx has less than one twentieth of the operations of JetBlue Airways but its total CNI per airline is 142.9 EPNdB in 2015 and 142.3 EPNdB in 2016, only 4 dB below JetBlue Airways. The partial CNI by operation for FedEx is among the highest of all airlines due to its use of older DC10 and MD11 aircraft and operations at night. These are the primary aircraft in the FedEx fleet and account for half of its nighttime operations. The noisier signatures of these aircraft combined with the 10-dB nighttime DNL penalty results in the proportionally larger FedEx contribution to the CNI.

Regional carriers generally contribute the least to the partial CNI per operation whereas the international carriers, which operate larger aircraft and generally have more operations at night, are just below the cargo operators in rank. The relative positions for the domestic carriers are due mainly to their fleet characteristics and number of night operations. Southwest Airlines has over 10,000 fewer operations than Delta Air Lines and many fewer than JetBlue Airways; however, 21.0 percent of its operations are at night as compared to JetBlue Airways, which had only 15.5 percent at night. Delta Air Lines only has 14.8 percent of its operations at night but it flies an older and larger fleet consisting of MD-80s and Boeing 767s.

Table 6-11 Annual Operations by Partial CNI by Airline and per Operation, 2015 and 2016

Airlines with more than 100 flights in 2016	Operations	Total Airline CNI (EPNdB)	Operations	Total Airline CNI (EPNdB)	Partial CNI (EPNdB) per Operation		Airline Category
	2015	2015	2016	2016	2015	2016	
El Al Israel Airlines Ltd.	152	129.2	296	132.1	107.3	107.3	International
FedEx	3,523	142.9	3,896	142.3	107.4	106.4	Cargo
Cathay Pacific	279	130.0	454	132.1	105.6	105.5	International
United Parcel Service	1,538	137.5	1,834	138.0	105.7	105.3	Cargo
British Airways	2,575	138.7	2,702	139.0	104.6	104.6	International
Lufthansa	1,687	134.5	1,728	134.7	102.2	102.3	International
ATI	302	126.0	502	128.0	101.2	101.0	Cargo
Turkish Airlines	726	131.0	658	129.2	102.4	101.0	International
Emirates Airlines	914	131.1	1,382	132.0	101.4	100.6	International
Alitalia	562	127.9	558	128.0	100.4	100.5	International
Sun Country Airlines	1,414	130.7	1,374	131.1	99.2	99.7	Regional

Table 6-11 Annual Operations and Partial CNI by Airline and per Operation, 2015 and 2016 (Continued)

Airlines with more than 100 flights in 2016	Operations	Total Airline CNI (EPNdB)	Operations	Total Airline CNI (EPNdB)	Partial CNI (EPNdB) per Operation		Airline Category
	2015	2015	2016	2016	2015	2016	
Virgin Atlantic	702	130.5	715	128.0	102.0	99.5	International
SATA Int'l Airlines	542	127.4	630	127.1	100.0	99.1	International
Southwest Airlines	21,514	142.5	24,436	142.9	99.1	99.0	Domestic
United Airlines	24,644	142.7	25,052	143.0	98.7	99.0	Domestic
Qatar Airways	N/A	N/A	552	126.4	N/A	99.0	International
Air France	910	131.2	900	128.2	101.6	98.6	International
Alaska Airlines	3,027	133.4	3,256	133.7	98.6	98.5	Domestic
Swiss Air	711	127.8	1,020	128.5	99.3	98.4	International
Norwegian Air Shuttle	N/A	N/A	656	125.9	N/A	97.7	International
Virgin America	3,426	133.1	3,724	133.3	97.8	97.6	Domestic
Air Berlin	N/A	N/A	192	120.1	N/A	97.3	International
Japan Airlines	728	125.6	736	125.7	96.9	97.1	International
Delta Air Lines	33,909	142.1	33,935	142.4	96.8	97.0	Domestic
Iberia Air Lines	336	122.2	412	123.2	97.0	97.0	International
TAP - Air Portugal	N/A	N/A	378	122.7	N/A	96.9	International
JetBlue Airways	85,852	146.1	91,736	146.4	96.7	96.8	Domestic
Spirit Airlines	4,896	133.0	7,245	134.5	96.1	95.9	Domestic
Aer Lingus	1,973	129.9	2,066	129.0	97.0	95.8	International
Aeromexico	345	118.5	580	123.2	93.1	95.5	International
Sky Regional Airlines	3,784	128.8	2,738	129.8	93.0	95.4	International
American Airlines	48,355	144.1	55,782	142.6	97.2	95.1	Domestic
Icelandair	1,365	124.8	1,358	126.5	93.5	95.1	International
Shuttle America Corp	5,290	130.8	6,546	133.0	93.6	94.9	Regional
Air Canada	1,718	129.5	2,713	128.9	97.1	94.6	International
US Airways Express	4,669	129.0	1,458	125.8	92.3	94.2	Regional
GoJet Airlines	1,309	123.3	2,783	128.3	92.2	93.9	Domestic
Compañía Panameña	646	121.9	638	121.8	93.8	93.8	International
Hainan Airlines Co. Ltd.	744	125.7	961	123.2	97.0	93.4	International
Scandinavian Airlines	N/A	N/A	500	120.4	N/A	93.4	International

Table 6-11 Annual Operations and Partial CNI by Airline and per Operation, 2015 and 2016 (Continued)

Airlines with more than 100 flights in 2016	Operations	Total Airline CNI (EPNdB)	Operations	Total Airline CNI (EPNdB)	Partial CNI (EPNdB) per Operation		Airline Category
	2015	2015	2016	2016	2015	2016	
Endeavor Air	N/A	N/A	1,377	123.7	N/A	92.3	Domestic
Pinnacle Airlines	7,284	131.2	6,260	130.1	92.5	92.2	Regional
AWAC - US Air Express	4,998	128.7	5,010	128.1	91.7	91.1	Regional
Mesa Airlines	437	120.0	486	117.3	93.5	90.5	Regional
Delta Connection	4,923	127.1	4,032	126.3	90.1	90.3	Domestic
Air Canada Jazz	5,037	127.1	5,832	127.4	90.0	89.7	Regional
SkyWest Airlines	548	119.5	108	108.8	92.2	88.4	Domestic
WOW Air, LLC.	445	118.7	678	116.4	92.3	88.1	International

Source: Massport and HMMH, 2017.
Notes:
N/A Not available; Airline had no operations at Logan Airport.
1 Operations for some carriers differ to those in Chapter 2, *Activity Levels* and Chapter 7, *Air Quality/Emissions Reduction* because this table only includes jet aircraft and not turboprops, and because it includes both scheduled and unscheduled air carriers.

Dwell and Persistence Reduction Goals

Another supplemental measure of noise impact relates to the length of time noise impacts occur. To provide temporary relief to neighborhoods affected by regular overflights during single or multi-day periods, the PRAS Advisory Committee established two short-term goals for the system in addition to the annual goals:

- Provide relief from excessive dwell. Exceedance is defined as more than seven hours of operations over a given area during any day between the hours of 7:00 AM and midnight.
- Provide relief from excessive persistence. Exceedance is defined as more than 23 hours of operations over an area between 7:00 AM and midnight during a period of three consecutive days.

In contrast to the annual goals that count the number of equivalent operations on a runway, dwell and persistence are measured by the number of hours that a given location or area is subject to jet aircraft overflights. The PRAS Advisory Committee designated eight runway end combinations for computing the effects of dwell and persistence on the communities, as shown in **Table 6-12**.

Table 6-12 Representative Neighborhoods near Logan Airport Affected by Runway Use

Runway	Representative Affected Neighborhoods
4L and 4R Arrivals	South Boston (Farragut St.), Dorchester, Quincy, Milton, Weymouth, and Braintree
32 and 33L Arrivals	Boston Harbor, Hull, Cohasset, Hingham, Scituate, and other South Shore locations
14 and 15R Departures	Boston Harbor, Hull, Cohasset, Hingham, Scituate, and other South Shore locations
22L and 22R Departures	South Boston (Farragut Street), Boston Harbor, Hull, Cohasset, Hingham, Scituate, and other South Shore locations
27 Departures	South Boston (Fan Pier), Roxbury, Jamaica Plain, South End, West Roxbury, Roslindale, Brookline, Hyde Park, and other points South and West
4L and 4R Departures plus 22L and 22R Arrivals	East Boston (Bayswater, Orient Heights), Winthrop (Court Road), Revere, and Nahant
9 Departures plus 27 Arrivals	Winthrop (Point Shirley), Boston Harbor, and other points North
33 Departures plus 15 Arrivals	East Boston (Eagle Hill), Chelsea, Everett, Medford, Somerville, Arlington, Cambridge, and other points South and West

Source: Massport.

As required by Massport's commitments for the Logan Airside Improvements Planning Project,[23] this *2016 EDR* reports on noise dwell and persistence levels. Higher levels of dwell or persistence for over-water areas represent a benefit since this produces a corresponding decrease in total hours over populated areas. **Figures 6-17** and **6-18** illustrate the annual hours of dwell and persistence by runway end for 2010 through 2016. The Runway 33L Safety Area Improvement project construction, which altered annual runway use during 2011 and 2012, is evident in the figures as those two years are lower in the arrivals to Runway 15R and departures from Runway 33L runway end and higher in most of the remaining runway ends. Use of the runways returned to pre-construction levels in 2013.

The most marked difference in both metrics was the decrease in hours of Runway 27 arrivals and Runway 9 Departures, which no longer dominate the statistics as they have in most years. Another notable feature is the decrease in hours of Runway 22R/L arrivals and Runway 4R/L departures, returning to approximately their 2014 levels after a spike in 2015.

Increases are evident in operations involving Runways 14, 15R/L, and 33R/L, rising from very low levels to hours that are more in balance with other operations.

23 Federal Aviation Administration. 2002. *Logan Airside Improvements Planning Project Final EIS*. http://www.bostonoverflightnoisestudy.com/docs/2002_FAA_EIS_Executive%20Summary.pdf.

Figure 6-17 Comparison of Annual Hours of Dwell Exceedance by Runway End, 2010 to 2016

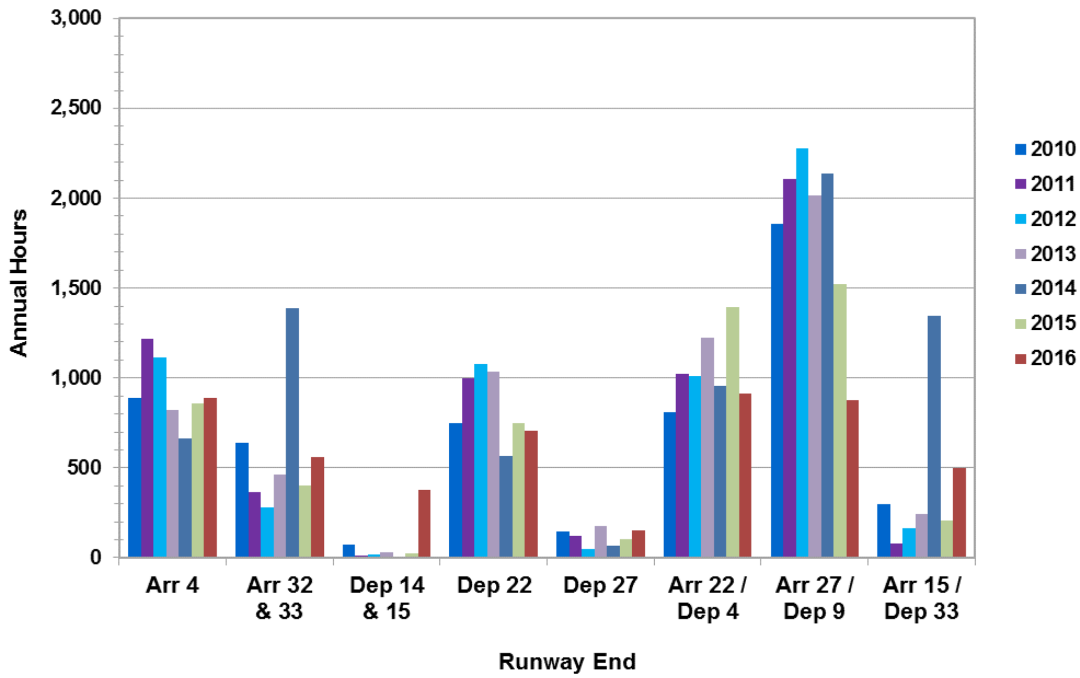
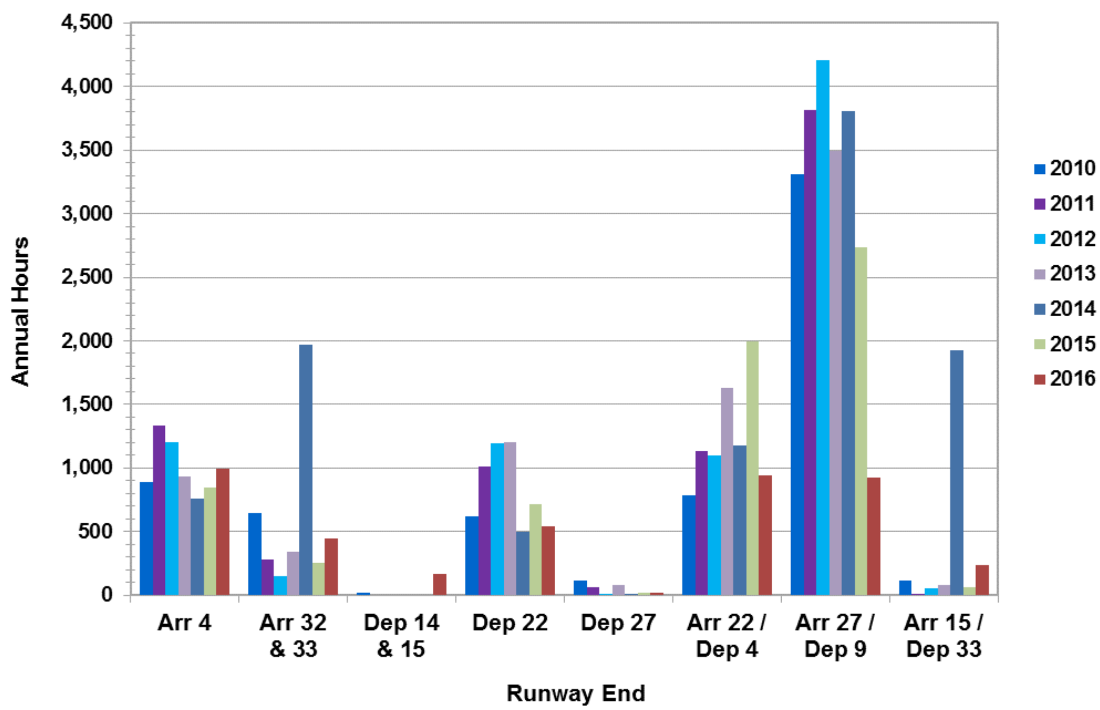


Figure 6-18 Comparison of Annual Hours of Persistence Exceedance by Runway End, 2010 to 2016



Time Above (TA)

The third supplemental noise metric reported in this *2016 EDR* is the amount of time that aircraft noise is above each of three predefined threshold sound levels. The measure is referred to generally as TA, and the threshold sound levels used in the analysis are 65, 75, and 85 dBA. Like DNL values, for 2016 these times are computed using the FAA-approved AEDT. The calculations are made at each of Massport's permanent noise monitoring locations and are based on an average 24-hour day during the year as well as for the average nine-hour nighttime period from 10:00 PM to 7:00 AM. The threshold sound levels of 65, 75, and 85 dBA reflect different degrees of speech interference depending on factors such as whether people are outdoors, indoors with their windows open, or indoors with windows closed.

Tables 6-13 and **6-14** present a summary of the calculated TA values for 2015 (INM) and 2016 (AEDT).

Table 6-13 Time Above (TA) dBA Thresholds in a 24-Hour Period for Average Day

			Minutes above Threshold						Modeled DNL[1]	
			2015			2016			2015	2016
Location	Site	Distance (mi)	85 dBA	75 dBA	65 dBA	85 dBA	75 dBA	65 dBA		
Winthrop – Bayview and Grandview	4	1.6	10.8	37.1	80.2	8.1	43.0	106.0	72.1	71.8
Winthrop – Harborview and Faun Bar	5	1.9	0.1	12.5	69.7	0.1	15.3	83.0	63.5	64.6
Winthrop – Somerset near Johnson	6	0.8	0.1	4.1	100.5	0.0	1.4	53.9	64.1	61.9
Winthrop – Loring Road near Court	7	1.0	2.5	25.5	156.4	1.0	10.8	84.2	72.5	67.0
Winthrop – Morton and Amelia	8	1.6	0.0	4.1	64.0	0.1	3.7	32.9	63.9	61.3
East Boston – Bayswater near Annavoy	9	1.3	2.4	30.1	85.6	1.2	20.3	72.1	72.4	67.9
East Boston – Bayswater near Shawsheen	10	1.3	0.2	6.6	52.5	0.1	5.2	45.7	65.2	62.3
East Boston – Selma and Orient	11	1.8	0.0	0.7	9.6	0.0	1.2	14.7	57.8	57.3
East Boston Yacht Club	12	1.2	1.3	35.1	164.3	0.0	8.2	124.6	70.3	65.3
East Boston High School	13	1.9	0.2	7.1	29.3	0.3	10.9	40.5	62.6	64.5

Table 6-13 Time Above (TA) dBA Thresholds in a 24-Hour Period for Average Day (Continued)

			Minutes above Threshold						Modeled DNL[1]	
			2015			2016			2015	2016
Location	**Site**	**Distance (mi)**	**85 dBA**	**75 dBA**	**65 dBA**	**85 dBA**	**75 dBA**	**65 dBA**		
East Boston – Jeffries Point Yacht Club	14	1.2	0.0	0.6	10.5	0.0	0.6	47.6	57.2	61.0
East Boston – Piers Park	30	1.5	0.0	0.3	4.7	0.0	0.2	16.0	54.8	58.3
Chelsea – Admiral's Hill	15	2.8	0.1	5.4	25.4	0.1	4.7	32.2	61.2	61.6
Revere – Bradstreet and Sales	16	2.4	1.8	20.3	51.0	1.1	19.4	50.8	68.7	67.7
Revere – Carey Circle	17	5.3	0.0	1.2	35.8	0.0	0.6	37.2	60.5	59.7
Nahant – U.S.C.G. Recreational Facility	18	5.9	0.0	0.0	0.3	0.0	0.0	0.6	44.9	46.1
Everett – Tremont near Prescott	21	4.5	0.0	0.2	9.2	0.0	0.1	12.4	53.9	54.5
Medford – Magoun near Thatcher	22	6.0	0.0	0.1	7.0	0.0	0.2	9.5	52.5	53.8
Swampscott – Smith Lane	19	8.7	0.0	0.0	0.8	0.0	0.0	0.9	45.3	45.9
Lynn - Pond and Towns Court	20	8.4	0.0	0.0	11.9	0.0	0.0	11.3	55.1	54.8
South End – Andrews Street	1	3.7	0.0	0.2	10.6	0.0	0.1	14.4	54.2	55.9
South Boston – B and Bolton	2	2.9	0.0	3.0	18.0	0.0	2.2	22.5	59.1	59.7
South Boston – Day Blvd. near Farragut	3	2.5	0.0	3.8	55.8	0.0	2.2	60.6	60.5	60.7
Roxbury – Boston Latin Academy	27	5.3	0.0	0.1	9.2	0.0	0.1	11.9	53.4	54.5
Jamaica Plain - Southbourne Road	28	7.7	0.0	0.0	2.8	0.0	0.0	3.3	49.5	51.2
Mattapan – Lewenburg School	29	7.3	0.0	0.0	0.5	0.0	0.0	0.3	46.6	48.2
Dorchester – Myrtlebank near Hilltop	23	6.3	0.0	0.0	14.5	0.0	0.0	12.0	54.4	

Table 6-13 Time Above (TA) dBA Thresholds in a 24-Hour Period for Average Day (Continued)

			Minutes above Threshold						Modeled DNL[1]	
			2015			2016			2015	2016
Location	**Site**	**Distance (mi)**	**85 dBA**	**75 dBA**	**65 dBA**	**85 dBA**	**75 dBA**	**65 dBA**		
Milton – Cunningham Park near Fullers	24	8.1	0.0	0.0	12.9	0.0	0.0	10.5	54.0	54.2
Quincy – Squaw Rock Park	25	4.2	0.0	0.0	0.4	0.0	0.0	0.4	47.8	49.5
Hull – Hull High School near Channel Street	26	6.0	0.0	0.2	25.9	0.0	0.2	26.9	58.8	59.3
Average TA Value			**0.7**	**6.7**	**37.2**	**0.4**	**5.0**	**34.6**	**58.6[2]**	**58.5[2]**

Source: HMMH, 2017.
Notes: Distance from Logan Airport calculated from the Airport Reference Point.
dBA = A-weighted decibel
1 2015 modeled with INM 7.0d, 2016 modeled with AEDT 2c SP2.
2 Arithmetic average includes all noise monitoring sites.

Table 6-14 Time Above (TA) dBA Thresholds in a Nine Hour Night Period for Average Day[1]

			Minutes above Threshold						Modeled DNL[2]	
			2015			2016			2015	2016
Location	**Site**	**Distance (mi)**	**85 dBA**	**75 dBA**	**65 dBA**	**85 dBA**	**75 dBA**	**65 dBA**		
Winthrop – Bayview and Grandview	4	1.6	1.1	3.5	8.0	1.1	5.0	13.9	72.1	71.8
Winthrop – Harborview and Faun Bar	5	1.9	0.0	1.2	6.7	0.0	1.6	9.6	63.5	64.6
Winthrop – Somerset near Johnson	6	0.8	0.1	1.4	18.0	0.0	0.3	9.5	64.1	61.9
Winthrop – Loring Road near Court	7	1.0	0.6	4.6	27.4	0.2	1.6	14.1	72.5	67.0
Winthrop – Morton and Amelia	8	1.6	0.1	0.9	12.9	0.0	0.5	6.3	63.9	61.3
East Boston – Bayswater near Annavoy	9	1.3	0.5	6.3	17.9	0.2	3.9	12.4	72.4	67.9

Table 6-14 Time Above (TA) dBA Thresholds in a Nine Hour Night Period for Average Day[1] (Continued)

			Minutes above Threshold						Modeled DNL[2]	
			2015			2016			2015	2016
Location	Site	Distance (mi)	85 dBA	75 dBA	65 dBA	85 dBA	75 dBA	65 dBA		
East Boston – Bayswater near Shawsheen	10	1.3	0.1	1.3	12.1	0.0	0.6	8.2	65.2	62.3
East Boston – Selma and Orient	11	1.8	0.0	0.0	1.2	0.0	0.1	2.0	57.8	57.3
East Boston Yacht Club	12	1.2	0.6	7.2	30.3	0.0	1.9	19.3	70.3	65.3
East Boston High School	13	1.9	0.1	1.3	4.7	0.1	1.9	6.2	62.6	64.5
East Boston – Jeffries Point Yacht Club	14	1.2	0.0	0.0	2.4	0.0	0.1	9.3	57.2	61.0
East Boston – Piers Park	30	1.5	0.0	0.0	1.0	0.0	0.0	3.9	54.8	58.3
Chelsea – Admiral's Hill	15	2.8	0.0	1.0	4.1	0.0	1.0	4.8	61.2	61.6
Revere – Bradstreet and Sales	16	2.4	0.4	4.7	11.3	0.3	4.0	9.7	68.7	67.7
Revere – Carey Circle	17	5.3	0.0	0.2	8.5	0.0	0.1	7.8	60.5	59.7
Nahant – U.S.C.G. Recreational Facility	18	5.9	0.0	0.0	0.0	0.0	0.0	0.1	44.9	46.1
Everett – Tremont near Prescott	21	4.5	0.0	0.0	1.9	0.0	0.0	2.2	53.9	54.5
Medford – Magoun near Thatcher	22	6.0	0.0	0.0	1.3	0.0	0.1	1.8	52.5	53.8
Swampscott – Smith Lane	19	8.7	0.0	0.0	0.1	0.0	0.0	0.1	45.3	45.9
Lynn - Pond and Towns Court	20	8.4	0.0	0.0	3.2	0.0	0.0	2.7	55.1	54.8
South End – Andrews Street	1	3.7	0.0	0.0	2.1	0.0	0.0	3.4	54.2	55.9
South Boston – B and Bolton	2	2.9	0.0	0.7	3.3	0.0	0.6	5.0	59.1	59.7
South Boston – Day Blvd. near Farragut	3	2.5	0.0	0.2	6.0	0.0	0.1	7.0	60.5	60.7

Table 6-14 Time Above (TA) dBA Thresholds in a Nine Hour Night Period for Average Day[1] (Continued)

			Minutes above Threshold						Modeled DNL[2]	
			2015			2016			2015	2016
Location	Site	Distance (mi)	85 dBA	75 dBA	65 dBA	85 dBA	75 dBA	65 dBA		
Roxbury – Boston Latin Academy	27	5.3	0.0	0.0	1.8	0.0	0.0	2.8	53.4	54.5
Jamaica Plain - Southbourne Road	28	7.7	0.0	0.0	0.6	0.0	0.0	0.9	49.5	51.2
Mattapan – Lewenburg School	29	7.3	0.0	0.0	0.0	0.0	0.0	0.1	46.6	48.2
Dorchester – Myrtlebank near Hilltop	23	6.3	0.0	0.0	1.5	0.0	0.0	1.5	54.4	54.7
Milton – Cunningham Park near Fullers	24	8.1	0.0	0.0	1.6	0.0	0.0	1.4	54.0	54.2
Quincy – Squaw Rock Park	25	4.2	0.0	0.0	0.0	0.0	0.0	0.0	47.8	49.5
Hull – Hull High School near Channel Street	26	6.0	0.0	0.1	6.9	0.0	0.1	7.6	58.8	59.3
Average TA Value			**0.1**	**1.1**	**6.2**	**0.1**	**0.8**	**5.8**	**58.6[3]**	**58.5[3]**

Source: HMMH, 2017.
Notes: Distance from Logan Airport calculated from the Airport Reference Point.
dBA = A-weighted decibel
1 Nine-hour nighttime period from 10:00 PM – 7:00 AM.
2 2015 modeled with INM 7.0d, 2016 modeled with AEDT 2c SP2.
3 Arithmetic average includes all noise monitoring sites.

Noise Abatement

Massport's noise abatement program continues to play a critical role in helping to limit and monitor noise impacts. Massport's emphasis on noise abatement has focused on the benefits of better analysis tools and improved modeling techniques to identify the causes of noise problems. Massport also continues to coordinate with FAA and the Logan Airport CAC on matters related to runway use and the on-going BLANS project.

Installed in 2008, the upgraded NOMS system includes vastly improved analysis and mapping capabilities, better quality flight tracking data, use of multilateration radar (a separate and unique source of operational data), and direct correlation of noise events with radar flight paths and complaints (a feature that the prior system did not have). This latter capability has improved the ability of the system to differentiate between aircraft and community noise sources. All measured data and complaint information in this report were generated through the new NOMS. In 2015, the NOMS system switched its primary feed of radar data at

Logan Airport to FAA's NextGen radar feed. This has led to improved aircraft identification and better-quality flight tracks.

Other continuing elements of Massport's noise mitigation program are discussed below.

- The Massport Noise Abatement Office was initiated in 1977 and it maintains the noise section of the Massport website.[24] The website provides information on Massport's sound insulation program, the Airport's noise monitoring system, various abatement measures, and other information of interest to the public.
- Operational restrictions on certain runways, limit engine runup locations, late night runway preference and noise abatement turns.
- One of the most extensive residential and school sound insulation programs in the nation. To date, Massport has installed sound insulation in 5,467 residences, including 11,515 dwelling units, and 36 schools in East Boston, Roxbury, Dorchester, Winthrop, Revere, Chelsea, and South Boston.
- Historically, the percentage of eligible homeowners who have responded and whose dwellings are ultimately treated varies significantly by community from a high of nearly 90 percent in Revere to a low of about 50 percent in South Boston. Eighty to 85 percent of homeowners in East Boston and Winthrop have historically participated. Approximately 8 percent of applicants also choose the Room-of-Preference option that allows the owner to identify a room (usually a bedroom or living room) for extra acoustical treatment.
- Massport will continue to work with FAA to soundproof eligible homes. Massport will apply to FAA for funds to treat eligible properties, as needed. As of 2015, FAA requires airports to use the AEDT model to establish eligibility. Massport is working with FAA on the AEDT model as applied to Logan Airport operations, and intends to submit an AEDT-derived noise exposure map to be kept on file with FAA.
- Development of annual noise contours (**Figure 6-12** compares the DNL 65 dB contours for 2015 INMv7.0d and 2016 AEDT 2cSP2).
- A website that features an internet flight tracking system known as PublicVue.[25] The PublicVue site allows the user to view flight tracks in near-real time, replay flight tracks, and enter noise complaints.
- Summary reports of operations by airline, runway, aircraft type, and other parameters that help the Noise Office track potential changes in the noise environment. **Tables 6-11** and **6-13** are examples of these reports.
- Where appropriate as part of the BLANS process, FAA designed (with Massport in an advisory role) RNAV departure procedures off most runways to avoid highly populated areas and the use of an over-water visual approach at night to keep aircraft offshore as much as possible.
- Massport supports, where possible, the Massport Community Advisory Committee (CAC). The Massport CAC is a state-legislated body that works with Massport on a range of Authority-wide topics,

24 Logan Airport Noise Abatement Website. http://www.massport.com/logan-airport/about-logan/noise-abatement/.
25 Massport. *Flight Monitor.* http://www.massport.com/logan-airport/about-logan/noise-abatement/flight-monitor/.

including environmental issues. Further information about the Massport CAC can be found at http://massportcac.org/.

- Massport supported FAA RNAV initiatives to develop RNAV arrivals and the Runway 33L departure RNAV procedure.
- Massport strives to participate in research to reduce community noise levels whether through the Airport Cooperative Research Program (ACRP) or with FAA, such as the RNAV evaluation project currently underway.

Airline Fleet Improvements

Commercial air carrier and cargo operators are deploying the newest engine technology at Logan Airport. **Table 6-15** reports the percent of the airlines' fleet which is Stage 3 or Stage 4 equivalent. The majority of major U.S. airlines at Logan Airport are using a fleet composed of 100 percent originally manufactured Stage 3 or Stage 4 aircraft. All new carriers at Logan Airport in 2016 are using Stage 4 equivalent aircraft. The new FAA Stage 5 requirements are already satisfied by 18 percent of jet operations for 2016.

Massport recently initiated terminal and airfield improvements designed to safely handle the next generation of larger and more efficient Group VI aircraft including the Airbus A380, the world's largest and quietest commercial aircraft. Use of these larger aircraft will help to continue the trend of carrying more passengers in fewer flights.

Table 6-15 Airline Operations (percent) in Original Stage 3 or Equivalent Stage 4 Aircraft[1] (2015 to 2016)

Airlines with more than 100 flights	Number of Flights		Percentage of Original Stage 3 and 4 Operations[2]			
	2015	2016	2015 Stage 3	2015 Stage 4 Equiv.	2016 Stage 3	2016 Stage 4 Equiv.
JetBlue Airways	85,852	91,736	0%	100%	0%	100%
American Airlines	48,355	55,782	0%	100%	0%	100%
Delta Air Lines	33,909	33,935	8%	93%	7%	93%
United Airlines	24,644	25,052	0%	100%	0%	100%
Southwest Airlines	21,514	24,436	25%	79%	18%	82%
Spirit Airlines	4,896	7,245	0%	100%	0%	100%
Shuttle America Corp	5,290	6,546	0%	100%	0%	100%
Pinnacle Airlines	7,284	6,260	0%	100%	0%	100%
Air Canada Jazz	5,037	5,832	0%	100%	0%	100%
AWAC - US Air Express	4,998	5,010	0%	100%	0%	100%
Delta Connection/Atlantic SE	4,923	4,032	0%	100%	0%	100%
Federal Express	3,523	3,896	74%	30%	64%	36%
Virgin America	3,426	3,724	0%	100%	0%	100%
Alaska Airlines	3,027	3,256	0%	100%	0%	100%
GoJet Airlines	1,309	2,783	0%	100%	0%	100%
Sky Regional Airlines Inc	3,784	2,738	0%	100%	0%	100%
Air Canada	1,718	2,713	0%	100%	0%	100%
British Airways	2,575	2,702	0%	100%	0%	100%
Aer Lingus	1,973	2,066	2%	97%	1%	99%
United Parcel Service	1,538	1,834	0%	100%	0%	100%
Lufthansa	1,687	1,728	0%	100%	0%	100%
US Airways Express/Republic	4,669	1,458	0%	100%	0%	100%
Emirates Airlines	914	1,382	0%	100%	0%	100%
Endeavor Air	N/A	1,377	N/A	N/A	0%	100%
Sun Country Airlines	1,414	1,374	0%	100%	0%	100%
Icelandair	1,365	1,358	0%	100%	0%	100%
Swiss Air	711	1,020	0%	100%	0%	100%
Hainan Airlines Co. Ltd.	744	961	0%	100%	0%	100%
Air France	910	900	0%	100%	0%	100%
Japan Airlines	728	736	0%	100%	0%	100%
Virgin Atlantic	702	715	0%	100%	0%	100%
WOW Air, LLC.	445	678	N/A	100%	0%	100%
Turkish Airlines	726	658	0%	100%	0%	100%
Norwegian Air Shuttle	N/A	656	N/A	N/A	0%	100%
Compañía Panameña de Aviación S.A.	646	638	0%	100%	0%	100%

Table 6-15 Airline Operations (percent) in Original Stage 3 or Equivalent Stage 4 Aircraft[1] (2015 to 2016) (Continued)

Airlines with more than 100 flights	Number of Flights 2015	Number of Flights 2016	Percentage of Original Stage 3 and 4 Operations[2] 2015 Stage 3	2015 Stage 4 Equiv.	2016 Stage 3	2016 Stage 4 Equiv.
SATA International Airlines	542	630	1%	99%	0%	100%
Aeromexico	345	580	0%	100%	0%	100%
Alitalia	562	558	0%	100%	0%	100%
Qatar Airways	N/A	552	N/A	N/A	0%	100%
ATI	302	502	0%	100%	0%	100%
Scandinavian Airlines of North America, Inc.	N/A	500	N/A	N/A	0%	100%
Mesa Airlines	437	486	0%	100%	0%	100%
Cathay Pacific	279	454	0%	100%	0%	100%
Iberia Air Lines of Spain	336	412	0%	100%	0%	100%
TAP - Air Portugal	N/A	378	N/A	N/A	0%	100%
El Al Israel Airlines Ltd.	152	296	100%	0%	100%	0%
Air Berlin	N/A	192	N/A	N/A	0%	100%
SkyWest Airlines	548	108	0%	100%	0%	100%

Source: Massport, 2017.
N/A Not Available
1 Operations for some carriers differ with those in Chapter 2, *Activity Levels*, and Chapter 7, *Air Quality/Emissions Reduction* because the table only includes jet aircraft, not turboprops, and it includes scheduled and unscheduled air carriers.
2 Original Stage 3 means originally manufactured as a certificated Stage 3 aircraft under FAR Part 36. Stage 4 equivalent means the aircraft is either certificated Stage 4 or certificated Stage 3 and meets Stage 4 requirements.

Noise Complaint Line

In 2016, Massport received 38,046 noise complaints from 83 communities, more than double the 2015 total of 17,685 noise complaints from 84 communities. The community of Milton generated 83 percent of this increase. The number of individual complainants increased by 19 percent. This increase is substantial, but much smaller than the 115 percent increase in calls, indicating that noise annoyance continues to grow among a concentrated population rather than spreading to a larger population. This is consistent with a recent survey of U.S. airports that finds noise complaints concentrated among relatively small numbers of complainants[26] (see Appendix H, *Noise Abatement*). The increase in complaints continues to be primarily related to FAA's RNAV departure procedures.

26 Dourado, E. and Russell, R. October 2016. *Airport Noise NIMBYism: An Empirical Investigation.* Mercatus Center at George Mason University. https://www.mercatus.org/system/files/dourado-airport-noise-mop-v1.pdf.

Table 6-16 is a summary of noise complaints from the Massport Noise Abatement Office. The summary table presents the fifteen communities with the greatest number of complaints for 2016, along with the number of callers and the corresponding numbers from 2015. The communities listed below represent 91 percent of the complaints in 2016 and 72 percent of the complaints in 2015. All remaining communities are summed together into a single line above the grand total. Appendix H, *Noise Abatement* has a full listing of the complaints by community.

Table 6-16 Noise Complaint Line Summary

	2015		2016		Change (2014 to 2015)
Town	**Calls**	**Callers**	**Calls**	**Callers**	
Arlington	1,851	92	1,968	87	117
Belmont	715	95	501	63	(214)
Cambridge	1,697	136	2,154	128	457
Dorchester	115	20	326	36	211
Hull	1,136	152	1,266	220	130
Jamaica Plain	288	60	434	76	146
Lynn	424	13	323	15	(101)
Medford	508	116	1,784	177	1,276
Milton	4,991	343	21,796	466	16,805
Nahant	50	19	339	12	289
Roslindale	285	55	588	103	303
Somerville	1,910	191	1,804	153	(106)
South Boston	263	48	577	42	314
Wenham	285	2	416	9	131
Winchester	733	24	489	16	(244)
Total (Only for Towns listed above)	**15,251**	**1,366**	**34,765**	**1,603**	**19,514**
Total Complaints from Other Towns	**2,434**	**537**	**3,280**	**657**	**846**
Overall Totals	**17,685**	**1,903**	**38,045**	**2,260**	**20,360**

Source: Massport, 2017.
Notes: Changes in ( ) represent a decrease in noise complaints.
Only the top ten communities for each year are listed above. The complete list of complaints is in Appendix H, *Noise Abatement*.

Boston Logan Airport Noise Study (BLANS)

FAA's Record of Decision (ROD) approving construction of the unidirectional Runway 14-32 required that FAA, Massport, and the Logan Airport CAC jointly undertake a study to determine whether changes to existing noise abatement flight track corridors might further reduce noise impacts. In addition, the Massachusetts Environmental Policy Act (MEPA) Certificate for the *Boston-Logan Airside Improvements Planning Environmental Impact Report (EIR)* directed Massport to work with FAA and local communities on a review of the Logan Airport PRAS. FAA has been implementing RNAV procedures at airports across the country such as Seattle and Minneapolis-St. Paul. These noise studies were able to influence the design of these RNAV procedures for implementation at Logan Airport.

Phase 1

FAA noise study was conducted in multiple phases. Phase 1, which was known as the Boston Overflight Noise Study (BONS), was initiated in the winter of 2004 and was completed in fall of 2007. During Phase 1, 55 airspace and operational alternatives to reduce noise related to Logan Airport overflights were identified and screened for safety, operational, and noise benefits. Of the 55 alternatives, 13 measures were identified as potentially implementable in the near term. This phase was completed in 2007 and a NEPA Categorical Exclusion was issued by FAA in October 2007 for several flight path changes mostly along the northeast and southeast shores from the Airport.[27]

The conventional and radar vectored[28] changes which could be implemented without airspace changes were implemented in February 2008. RNAV and other changes began taking place in 2009 when FAA completed design of these procedures. RNAV procedures were published by FAA on October 22, 2009 and were implemented in 2010.

Eight new RNAV procedures were implemented by FAA in 2010 and 2011 for Runways 4R, 9, 15R, 22R, and 22L. Under these procedures, aircraft immediately depart the Airport similar to existing procedures but then aircraft follow a precise path over Boston Harbor, then aircraft cross the shoreline and return over land at a higher altitude than previous procedures. In 2013, Runways 27 and 33L were added to these procedures:

- Starting on 2/1/2010 all six RNAV procedures were in use from Runway 9;
- Starting on 5/3/2010 all six RNAV procedures were in use from Runway 4R;
- Starting on 11/18/2010 all six RNAV procedures were in use from Runways 15R, 22R, and 22L;
- Starting on 3/10/2011 all eight RNAV procedures were in use from Runways 4R, 9, 15R, 22R, and 22L;
- Starting on 3/7/2013 all eight RNAV procedures were in use Runways 4R, 9, 15R, 22R, 22L, and 27; and
- Starting on 6/5/2013 all eight RNAV procedures were in use Runways 4R, 9, 15R, 22R, 22L, 27, and 33L.

27 FAA Documented Categorical Exclusion Record of Decision, October 16, 2007.
28 Radar vector is the heading issued to aircraft to provide guidance by radar.

On December 14, 2011, three new RNAV standard terminal arrival routes were also implemented by FAA. These concentrate arrivals on routes leading into Logan Airport's airspace and improve efficiency of arrivals. These have little effect on the noise environment close to the Airport and the DNL contours. However, usage of these procedures has increased since they were introduced and this increased usage is evident in the modeled flight track graphics.

The Runway 33L departure was the last RNAV departure procedure to be implemented at Logan Airport in June 2013. FAA completed a separate Environmental Assessment (EA) in January 2013. FAA issued a Finding of No Significant Impact/Record of Decision (FONSI/ROD) for the Runway 33L RNAV Standard Instrument Departure Final EA on June 4, 2013. FAA also committed to a six-month and 12-month post-implementation review of the RNAV procedure. The reviews were posted by FAA in April 2014 and September 2014.[29] Both reviews concluded that the BOS Runway 33L RNAV standard instrument departure is performing as designed with aircraft successfully flying within the confines of the procedure's design. All other major Logan Airport runways that are capable of accommodating RNAV procedures have been implemented by FAA previously and are in operation today. Since the modeling is based on the radar data tracks, all changes as they have been implemented have been included in the EDR modeling for each year.

Implementation of several of these FAA RNAV procedures has increased noise complaints in some towns surrounding Logan Airport where the flight tracks have become more concentrated. However, overflights are reduced in areas away from these routes, and aircraft are generally passing at higher altitudes.

Phase 2

Phase 2 of BLANS, which began in late 2007, included consideration of 53 proposed arrival, departure, and ground noise measures. After the first level of screening completed in 2009, 32 measures advanced to the next level of screening. Nine of these measures address ground noise issues, six are approach measures, and 11 address departure measures. The remaining measures address local air traffic issues such as helicopters and altitudes for flights executed under visual flight rules (VFR). The Level 2 screening was completed in 2011 and of the 32 measures, 10 were passed on to Level 3, five were determined as completed, and 17 were eliminated. The Level 3 analysis, which consists of noise modeling for each individual measure along with a change analysis against the future baseline, was completed in 2012. The Level 3 Screening Report was published by FAA in December 2012. Two of the flight measures were modified resulting in 12 measures evaluated (two measures are related to ground movements and 10 are related to flight procedures). Of these measures, eight were recommended for implementation by the Logan Airport CAC (the two ground movements and six flight procedures) and four flight procedures were rejected. FAA and Massport reviewed the Logan Airport CAC recommendations and determined that the two ground measures would meet the criteria for implementation; however, FAA determined that none of the flight procedures would meet the criteria for noise abatement under BLANS.

29 Federal Aviation Administration. *Environmental Reviews: Performance Based Navigation.* http://www.faa.gov/air_traffic/environmental_issues/ared_documentation/#Performance_Based_Navigation_PBN.

The two approved measures, with their status, are described below:[30]

- **Preferred Location for Run-ups away from Communities**. Massport has already tested this measure and identified a new location at the end of Runway 32 to be used when operationally feasible.
- **Holding Area for Delayed Departures**. Massport is prepared to commit to working with FAA to seek approval and funding (subject to FAA operations/safety approval, environmental review, Massport capital budget process, availability of FAA funds) for construction of a hold pad to allow for short-term staging of aircraft at or near the midpoint of the airfield. Massport has initiated its Runway Incursion Mitigation (RIM) program with FAA. A hold pad will be studied as part of this multi-year effort.

In addition, Massport and FAA agreed to implement supplemental programmatic measures recommended by the Logan Airport CAC. One example is Massport's commitment to establish an airport/community noise advisory group. The state of Massachusetts established the Massport CAC though legislation that will meet on a regular basis to continue dialogue on Airport-related noise concerns.

Phase 3

Phase 3 began in August 2013 and evaluated various runway use measures with the goal of developing a runway use program that can be implemented at Logan Airport to further reduce noise. The Logan Airport CAC voted to abandon the PRAS in April 2012 with the goal of using Phase 3 to look at runway use measures that can be successfully implemented. Massport will continue to report PRAS goals and information until a new program is in place.

In November 2014, FAA began the first of up to four runway use tests designed to change runway use during periods of the day to better distribute activity. This test recommends different runway configurations between 6:00 AM and 9:30 AM than the configurations used between 9:00 PM and midnight.

- Test 1 was completed in May 2015.
- Test 2 began in May 2015 and ran until November 2015. In this test, FAA controllers switched the runway configurations at two different points during the day (when weather and safety permitted) to provide respite to communities from excessive overflights.
- Test 3 consisted of information gathering on various aspects of existing runway use, focusing on nighttime operations.

The Logan Airport CAC could not agree on a recommended runway use program. Therefore, the study ended without a recommendation, and a final report on the BLANS program was issued in April 2017.[31]

30 BLANS Level Three Screening Analysis, FAA, December 2012, Page E-3.
31 The final report is available online at: http://www.bostonoverflight.com/.

FAA and Massport RNAV Pilot Project

Over the last several years, the implementation of new Performance Based Navigation (PBN) procedures – including RNAV – has resulted in a concentration of flights. On October 7, 2016, FAA signed a Memorandum of Understanding (MOU) with Massport[32] to frame the process for analyzing opportunities to reduce noise through changes or amendments to PBN. Massport has been working with FAA and others to develop test projects that are designed to help address the concentration of noise from PBN. To more clearly understand the implications of flight concentration, Massport has proposed several ideas for a test program with FAA; this program will study possible strategies to address neighborhood concerns. FAA has agreed to study Massport's ideas for a test program. This is a first-in-the-nation project between FAA and an airport operator that includes analyzing the feasibility of changes to some RNAV approaches and departures from Logan Airport. FAA and Massport are committing to: (1) analyze the feasibility; (2) measure and model the benefits and impacts of changing some RNAV approaches; and (3) test and develop an implementation plan, which will include environmental analysis and community/public outreach.

The preliminary areas of study could include:

1. Using higher altitudes for arrivals, where applicable;
2. Using higher altitudes for departures, where applicable;
3. Determining the feasibility of reducing the persistent level of noise from RNAV departures through a case study analysis of a major departure procedure from Runway 33L;
4. RNAV separation requirements – currently departure and arrival procedures require a separation of 3 miles for head-to-head operations;
5. Analyzing alternative RNAV designs that would bring aircraft over more compatible land use; and
6. Using real-world single-event noise data from communities under RNAV tracks to develop a supplemental metric to measure and track the concentration of flights due to RNAV technology. These metrics would improve data collection for communities and FAA and would better identify the community support, or opposition to proposed procedural changes. The proposed pilot testing will use these supplemental metrics.

The project has been structured in two phases, or "blocks". Block 1 recommendations are those that would not result in shifting noise from one area to another, and that would not have significant operational/technical implications. Block 2 recommendations could result in noise increases in some areas, or face technical barriers that would require further review. An early outcome of the Block 1 process was the development of an RNAV visual approach to Runway 33L. This approach would be similar to the JetBlue Airways RNAV visual to Runway 33L already in place but would be a published procedure for all airlines to use. A copy of the Massport request to FAA from April 2017 is included in Appendix H, Noise Abatement. Since the letter was sent, FAA and Massport have further refined the procedure. A report on Block 1 recommendations was completed in December 2017, and the Massport CAC voted to approve and recommend implementation of the Block 1 procedures. On December 20, 2017, Massport sent a request for FAA review and implementation of the Block 1

32 Massport. October 7, 2016. *Massport and FAA Work to Reduce Overflight Noise.* https://www.massport.com/news-room/news/massport-and-faa-work-to-reduce-overflight-noise/.

recommendations to FAA. A copy of the letter is provided in Appendix H, Noise Abatement. FAA review of Block 1 recommendations began in 2018. The technical team, led by the Massachusetts Institute of Technology (MIT), has begun work on Block 2.

Reduced Engine Taxiing

Single or reduced engine taxiing has the potential to reduce noise at Logan Airport. When used, the largest benefit is achieved by reducing the use of the engines on the side of the aircraft closest to the community. However, this is not always practicable due to airline procedures, taxiway routings, and safety considerations. Massport has reached out to the airlines and encouraged the use of this procedure whenever practicable. The letter sent to airport users for 2016 from Massport is published in Appendix L, *Reduced/Single Engine Taxiing at Logan Airport Memorandum*.

In 2009, MIT in cooperation with Massport and FAA conducted a survey of pilots at Logan Airport and found that the procedure was widely used on arrivals but not frequently used on departures.[33] Key reasons cited for not using the procedure were safety-related or practical reasons such as a short taxi time. The survey indicated that for the procedure to be considered for arrivals, the taxi-in time would have to exceed 10 minutes and for departures, exceed 20 minutes. The average taxi-out times for Logan Airport for 2016 exceeded 20 minutes only during the 5:00 to 6:00 PM and 7:00 and 8:00 PM periods, and for 2015 exceeded 20 minutes only during the 7:00 to 8:00 AM and the 5:00 to 8:00 PM periods. During 2015 and 2016, the average taxi-in time never exceeded 10 minutes. The average taxi-out time at Logan Airport for 2016 increased to 18.1 minutes from 17.9 minutes in 2015. The average taxi-in time increased to 7.2 minutes from 6.8 minutes. Overall, the average taxi/delay time for 2016 increased to 12.8 minutes from 12.3 minutes in 2015.[34] These small changes year to year occur due to several factors such as changes in schedules, weather, and use of the runways. Mandatory single engine taxiing was also one of the proposed measures in the BLANS but was rejected by FAA due to safety concerns, and it is currently being implemented as a voluntary measure, when conditions are appropriate.

Airbus A320 Vortex Generators

Logan Airport also encourages operators to use idle or reduced reserve thrust during landing, and to retrofit Airbus A319/320/321 family of aircraft with vortex generators which reduce tonal noise on approach. These actions are detailed in a letter included in Appendix L, *Reduced/Single Engine Taxiing Memoranda*, which Massport issued to air carriers at Logan Airport. All Airbus A319/320/321 built after 2014 already come equipped with this improvement. As airlines transition to the newer models of the A320 family, the number of aircraft operating at Logan Airport without the vortex generators is expected to decrease.

Noise Abatement Management Plan

Massport's noise abatement goals are achieved through the implementation of multiple elements. **Table 6-17** lists these goals and the associated plan elements and reports on progress toward achieving these goals.

33 The full report was published in the *2009 EDR* in Appendix L, *Survey of Airline Pilots Regarding Fuel Conservation Procedures for Taxi Operations*.

34 FAA Aviation System Performance Metrics: Avg. Taxi Time: Standard Report.

Table 6-17 Noise Abatement Management Plan

Noise Abatement Goal	Plan Elements	2016 Progress Report
Limit total aircraft noise	Limit on Cumulative Noise Index (CNI)	The CNI value for 2016 was 152.6 EPNdB which is well below the cap of 156.5 EPNdB.
	Stage 3 percentage Requirement in Noise Rules	In 2016,100 percent of Logan Airport's total commercial jet traffic satisfied Stage 3 noise criteria or better. The newest Stage 5 category was represented by 18 percent of these operations.
Mitigate noise impacts	Residential Sound Insulation Program (RSIP)	No additional dwelling units were sound insulated in 2016, leaving the total of treated dwelling units at 11,515 since the start of the program in 1986. See Appendix H, *Noise Abatement* for additional details.
	School Sound Insulation Program	Thirty-six eligible schools have been sound insulated since this program began.
	Noise Abatement Arrival and Departure Procedures	Flight track monitoring and data analysis were used to verify adherence to noise abatement flight procedures. See Appendix H, *Noise Abatement* for copies of the 2015 and 2016 Monitoring Reports.
	Preferential Runway Advisory System (PRAS) Runway End Use Goals	Massport continues to report on runway use compared to PRAS goals.
	Runway Restrictions	Noise-based use restrictions 24 hours per day on departures from Runway 4L and arrivals on Runway 22R were continued.
	Reduced-Engine Taxiing	Voluntary use of reduced-engine taxiing is encouraged when appropriate and safe. See Appendix L, *Reduced/Single Engine Taxiing at Logan Airport Memorandum* for information.
Improve Noise Monitoring System	Replace Existing Noise Monitors, Install Multilateration Antennas for Flight Track Monitoring, and Install New Robust Software	The noise monitoring system is completely installed and in use at Logan Airport. The noise monitors provide 1/3 octave band data at all sites to aide with aircraft identification. Noise events, flight events, and complaints are all linked. In 2015, Massport upgraded to FAA's NextGen data feed.
Minimize nighttime noise	Nighttime Stage 2 Aircraft Prohibition	With FAA's ban on all Stage 2 operations for all of 2016, this prohibition is no longer necessary.
	Nighttime Runway Restrictions	Prohibitions on use of Runway 4L for departures and Runway 22R for arrivals between 11:00 PM and 6:00 AM were continued.
	Maximization of Late-Night Over-Water Operation	Efforts to maximize late-night over-water operations were continued. Use of Runway 15R for departures and Runway 33L for arrivals continued.
	Nighttime Engine Run-up and auxiliary power unit (APU) Restrictions	Restriction on nighttime engine run-ups and use of APUs was continued.

Table 6-17 Noise Abatement Management Plan (Continued)

Noise Abatement Goal	Plan Elements	2016 Progress Report
Address/respond to noise issues and complaints	Noise Complaint Line	Massport continued operation of Noise Complaint Line, (617) 561-3333.
	Special Studies	Massport continued to provide technical assistance and analysis using noise monitoring system to support FAA and others in monitoring jet departure tracks from Runway 27 and Runway 33L. The BLANS Phase 3 was completed in 2016. Massport and FAA are conducting an RNAV evaluation project designed to identify ways to reduce noise from the RNAV procedure (which concentrates flights).

Source: Massport.

7

Air Quality/Emissions Reduction

Introduction

The Massachusetts Port Authority (Massport) is a national leader in studying, tracking, and reporting on the air quality environment of Boston-Logan International Airport (Logan Airport or the Airport), and in implementing measures to reduce emissions. Recognized as early as 2008 with an environmental award for Logan Airport's Emissions Reduction Program, Massport annually prepares an inventory of Airport-related emissions of the U.S. Environmental Protection Agency (EPA) criteria pollutants (and their precursors) including carbon monoxide (CO), nitrogen oxides (NO_x), particulate matter (PM),[1] and volatile organic compounds (VOCs). An emissions inventory of greenhouse gases (GHGs) is also included.

One central element of Massport's emissions reduction initiative is a comprehensive strategy to diversify and enhance ground transportation options for passengers and employees. The ground transportation strategy is designed to help reduce automobile-related air emissions and improve air quality by providing a broad range of high occupancy vehicle (HOV), public transit, and shared-ride options for travel to and from Logan Airport. The strategy also aims to reduce drop-off/pick-up by providing parking on-Airport for passengers choosing to drive or with limited HOV options. Continuing improvements to support HOV include: pilot Back Bay Logan Express service (since May 2014), free Massachusetts Bay Transportation Authority (MBTA) Silver Line outbound boarding (from Logan Airport), a new 1,100-car parking garage at the Framingham Logan Express, reduced holiday travel parking rates at Logan Express facilities, and support for private coach bus and van operators.

Massport also supports the use of alternative fuels by taxis; provides an on-Airport public-use, compressed natural gas (CNG) station; provides electric plug-ins for ground service equipment (GSE); and installs and maintains 400 Hz Power and pre-conditioned air at airplane gates to help reduce aircraft emissions. Further, Massport continues to invest in energy efficiency measures, such as the installation of solar panels and constructing facilities to meet the U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED®) standards. Together, these improvements help to reduce emissions associated with Logan Airport. This chapter describes air quality conditions at Logan Airport in 2016, and compares them to those in 2015 and previous years.

1 PM less than or equal to 10 microns (PM_{10}) and PM less than or equal to 2.5 microns ($PM_{2.5}$) are subsets of PM.

Regulatory Framework

The federal Clean Air Act (CAA), National Ambient Air Quality Standards (NAAQS), and similar state laws govern air quality issues in Massachusetts. The NAAQS and the Massachusetts State Implementation Plan (SIP), which describes measures that the state will take to maintain and attain NAAQS compliance, regulate air quality issues in the Boston metropolitan area and the state. These regulations are discussed in the sections that follow.

National Ambient Air Quality Standards (NAAQS)

The U.S. Environmental Protection Agency (EPA) established NAAQS for a group of criteria air pollutants to protect public health, the environment, and quality of life from the detrimental effects of air pollution. These NAAQS are set for the following seven pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM_{10}, $PM_{2.5}$), and sulfur dioxide (SO_2). The NAAQS primary standards (designed to protect human health) and secondary standards (designed to protect human welfare) are summarized in **Table 7-1**.

Based on air monitoring data, and in accordance with CAA, all areas within Massachusetts are presently designated as either attainment and/or maintenance with respect to the NAAQS.[2,3] These regulatory designations for the Boston metropolitan area (including the area around Logan Airport) are listed in **Table 7-2**.

The Boston area is currently designated as "Attainment/Maintenance" for CO, indicating that it is in transition back to "Attainment" for this pollutant. Historically, the entire Boston area was designated as "Attainment" for all other criteria pollutants except O_3, for which it was designated as "Moderate/ Nonattainment" based on the former 1997 Eight-Hour O_3 NAAQS (see **Table 7-2**). This O_3 Nonattainment area encompassed 10 counties in Massachusetts: Barnstable, Bristol, Dukes, Essex, Middlesex, Nantucket, Norfolk, Plymouth, Suffolk, and Worcester.[4]

In May 2012, EPA issued a "Clean Data Finding" for the Boston metropolitan area signifying that the area had attained the 1997 NAAQS for O_3. This re-designated the area as "Attainment/Maintenance," so long as the area continued to demonstrate attainment based on ongoing monitoring data. In addition, the "Anti-Backsliding" requirements of CAA (a rule established to ensure that air quality is not deteriorated due changes in the NAAQS) still obligates the Massachusetts Department of Environmental Protection (MassDEP) to enforce certain elements of the SIP that were established to attain the 1997 NAAQS.

In April 2012, EPA also implemented the newer, stricter, 2008 eight-hour O_3 NAAQS. Since that time, there have been no violations of this standard and this trend has continued through 2016. Based on these recent findings, MassDEP submitted the SIP for O_3 to EPA in 2014 for "Adequacy Review" and the outcome is still pending; thus, the Boston metropolitan area is presently designated as "Attainment/Unclassifiable" with respect to the 2008 standard.

2 Environmental Protection Agency. *Nonattainment Areas for Criteria Pollutants (Green Book).* https://www.epa.gov/green-book.

3 An area with air quality better than the NAAQS is designated as attainment; an area with air quality worse than the NAAQS is designated as nonattainment; and an area that is in transition from nonattainment to attainment is designated as attainment/maintenance. An area may also be designated as unclassifiable when there is a temporary lack of data to form a basis for determining attainment status. Nonattainment areas can be further classified as extreme, severe, serious, moderate, and marginal by the degree of non-compliance with the NAAQS.

4 Logan Airport is located in Suffolk County.

Finally, EPA has again revised (that is, made stricter) the O_3 standard which became effective in 2015. The new Attainment/Nonattainment designations for this standard will be made in 2018 based upon the previous three years of state-wide monitoring data. The status of the Boston metropolitan area in terms of this pending designation will be reported in the *2017 Environmental Status and Planning Report (ESPR)*. The *2016 EDR* provides information on ultrafine particles (UFPs). At this time, there are no state or federal air quality standards for outdoor levels of UFPs. Massport is actively tracking the research and regulatory status of this pollutant, and will comply with future UFP standards if promulgated by EPA.

Massachusetts State Implementation Plan

The Massachusetts SIP is a state's regulatory plan for bringing nonattainment areas into compliance with the NAAQS. As discussed previously, the entire Boston metropolitan area was formerly designated as "Moderate" Nonattainment for the 1997 eight-hour O_3 standard, but has since received a "Clean Data Finding" from EPA classifying the area as "Attainment/Maintenance." Additionally, and as stated above, the area has since been designated Attainment/Unclassifiable for the 2008 eight-hour O_3 standard, and, accordingly the SIP preparation relative to this standard is pending. For the former CO attainment/maintenance designation, MassDEP has also developed another 10-year Maintenance Plan which is presently in place. The most current SIPs applicable to the Boston area are summarized in **Table 7-3**.

The number of commercial and employee parking spaces allowed at Logan Airport is regulated by the Logan Airport Parking Freeze (310 Code of Massachusetts Regulations 7.30), which is an element of the Massachusetts SIP under the Federal Clean Air Act (42 U.S.C. §7401 et seq. [1970]). The intent of the Logan Airport Parking Freeze is to reduce air emissions by shifting air passengers to travel modes that require fewer vehicle trips. However, survey data since the 1970s has consistently shown that constrained parking has the unintended consequence of shifting air passengers to travel modes with higher numbers of vehicle trips, despite Massport's extensive efforts to provide and encourage the use of HOV travel modes. As one element of its comprehensive transportation strategy, Massport proposed to increase the Logan Airport Parking Freeze Cap by 5,000 on-Airport commercial parking spaces at Logan Airport. The goal of the Logan Airport Parking Project is to reduce the number of air passengers choosing more environmentally harmful drop-off/pick-up modes, which generate up to four vehicle trips instead of two. As part of the process to amend the Logan Airport Parking Freeze, MassDEP conducted a stakeholder process, which was followed by a public process to amend the Parking Freeze regulation. MassDEP issued the amended regulation on June 30, 2017 approving the requested parking cap increase. On December 5, 2017, EPA proposed a rule approving the revision of the Massachusetts SIP incorporating the amended Logan Airport Parking Freeze Cap. This amendment was finalized on March 6, 2018 and went into effect on April 5, 2018. For additional information, see Chapter 5, *Ground Access to and from Logan Airport*.

Table 7-1 National Ambient Air Quality Standards

Pollutant	Averaging Time	Standard ppm	Standard μg/m³	Notes
Carbon Monoxide (CO)	1 hour	35	40,000	Not to be exceeded more than once a year.
	8-hour	9	10,000	Not to be exceeded more than once a year.
Lead (Pb)	Rolling 3-Month Average	—	0.15	Not to exceed this level. Final rule October 2008.
	Quarterly	—	1.5	The 1978 standard (1.5 μg/m³ as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.
Nitrogen Dioxide (NO_2)	1 hour	0.100	188	The three-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 0.100 ppm.
	Annual	0.053	100	Not to exceed this level.
Ozone (O_3)	8-hour[1]	0.070	—	Annual fourth-highest daily maximum 8-hour concentration, average over 3 years.
Particulate Matter with a diameter $\leq$ 10μm (PM_{10})	24-hour	—	150	Not to be exceeded more than once a year on average over three years.
Particulate Matter with a diameter $\leq$ 2.5μm ($PM_{2.5}$)	24-hour	—	35	The three-year average of the 98th percentile for each population-oriented monitor within an area is not to exceed this level.
	Annual (Primary)	—	12	The three-year average of the weighted annual mean from single or multiple monitors within an area is not to exceed this level.
Sulfur Dioxide (SO_2)	1 hour	0.075	196	Final rule signed June 2, 2010. The three-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed this level.
	3-hour	0.5	1,300	Not to be exceeded more than once a year.

Source: EPA, 2017 (https://www.epa.gov/criteria-air-pollutants).
Notes:
1 Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O_3 standard additionally remain in effect in some areas. Revocation of the 2008 standard and transitioning to the new standard will be achieved over the next three years.
ppm Parts per million.
μg/m³ Micrograms per cubic meter.

Table 7-2 Attainment/Nonattainment Designations for the Boston Metropolitan Area

Pollutant	Designation
Carbon monoxide (CO)	Attainment/Maintenance[1]
Nitrogen Dioxides (NO_2)	Attainment
Ozone (Eight-hour, 1997 Standard)	Attainment/Maintenance[1]
Ozone (Eight-hour, 2008 Standard)	Attainment/Unclassifiable[2]
Ozone (Eight-hour, 2015 Standard)	To be determined[3]
Particulate matter (PM_{10})	Attainment
Particulate matter ($PM_{2.5}$)	Attainment
Sulfur Dioxide (SO_2)	Attainment
Lead (Pb)	Attainment

Source: EPA, 2017 (https://www.epa.gov/green-book).
Notes:
1 The Boston area was previously designated nonattainment for this pollutant but has since attained compliance with the National Ambient Air Quality Standards (NAAQS).
2 Attainment/Unclassifiable means that the initial data shows attainment but additional data is needed to verify longer term conditions.
3 Attainment designation will be determined by October 1, 2018.

Table 7-3 State Implementation Plan (SIP) for Boston Area

Standard	Title	Status	Comments
Carbon Monoxide	Maintenance Plan	Published in 2014	This Maintenance Plan is required for any area that was formerly designated as non-attainment to show that it will not regress to this status.
Ozone	2008 SIP	Submitted to EPA in 2014 – pending	As of April 2014, MassDEP has determined that the Boston area is still compliant with the 2008 standard, thus the SIP status is currently pending.[1]

Source: MassDEP (http://www.mass.gov/eea/agencies/massdep/air/reports/state-implementation-plans.html).
Notes: The number of commercial and employee parking spaces allowed at Logan Airport is regulated by the Logan Airport Parking Freeze (310 Code of Massachusetts Regulations 7.30 and 40 CFR 52.1120), which is an element of the SIP under the Federal Clean Air Act.
1 In 2007, EPA promulgated a new eight-hour NAAQS for ozone. Informally called the “2008 standard” to differentiate it from the former “1997 standard,” this new standard is stricter (i.e., lower) than the former standard.

Logan Airport Air Quality Permits for Stationary Sources of Emissions

Massport was originally granted a Title V Air Quality Operating Permit for Logan Airport in September 2004 and the most recent renewal was granted in January 2013 which still applied in 2016. This permit covers all of the Massport-operated stationary sources including the Central Heating and Cooling Plant, snow melters, fuel dispensers, boilers, emergency electrical generators, and fuel storage tanks.

Assessment Methodology

For the purposes of the EDR, the analysis of air emissions associated with Logan Airport operations includes the source categories described below, each of which has its own assessment methodology, database, and assumptions. For this *2016 EDR*, Massport has used the Federal Aviation Administration (FAA)'s new Aviation Environmental Design Tool (AEDT)[5] for air quality modeling of aircraft-related emissions, which has replaced the legacy Emissions and Dispersion Modeling System (EDMS).

Aviation Environmental Design Tool (AEDT)

The AEDT model is FAA's recently approved computer model for calculating emissions from aircraft-related sources (e.g., aircraft engines, auxiliary power units (APUs), GSE, etc.). As discussed in Chapter 6, *Noise Abatement*, AEDT is also designed to assess airport noise and replaces the legacy models namely the EDMS and the Integrated Noise Model (INM). The AEDT model was developed to incorporate the most updated and best-available science, resulting in differences when comparing AEDT and EDMS results.

With respect to computing air emissions, AEDT has many of the same, or similar, attributes and functions as EDMS. These include the preparation of emission inventories and conducting atmospheric dispersion modeling. In both cases, the types of pollutants analyzed manly comprise EPA criteria pollutants (and their precursors). Greenhouse gases (GHGs) and hazardous air pollutants (HAPs) can also be included as part of the emissions inventory. Overall, the adjustments made to AEDT contribute to the most accurate and up-to-date representation of aircraft emissions modeling.

There are important differences between AEDT and EDMS when estimating airport emissions in general, and aircraft engine emissions, in particular. Many updates and corrections have been incorporated into AEDT, resulting in differences when comparing results from AEDT with EDMS. An overview of the primary differences between the two models is briefly described below:

- **Input Data** – Among the EDMS and AEDT input data, aircraft take-off weight has an effect on emissions. Because these values differ somewhat between the two models, aircraft-related emissions also differ during the take-off mode of operation. EDMS allows adjustments to take-off weights to any value in the range. AEDT does not allow adjustment to the take-off weights.

5 AEDT is a software system that models aircraft performance in space and time to estimate fuel consumption, emissions, noise, and air quality consequences. AEDT is a comprehensive tool that provides information to FAA stakeholders on each of these specific environmental impacts. AEDT facilitates environmental review activities by consolidating the modeling of these environmental impacts in a single tool. AEDT is designed to model individual studies ranging in scope from a single flight at an airport to scenarios at the regional, national, and global levels (https://aedt.faa.gov/).

- **Aircraft Operational Modes** – The aircraft operational modes differ between the models. AEDT provides a more detailed output than EDMS. This results in a variance in aircraft operational characteristics and a difference in emissions as a result of the more detailed times in mode for AEDT.
  - In EDMS, the four primary operational modes are: (i.) Take-off, (ii.) Climb out, (iii.) Cruise, and (iv.) Taxi/Idle.
  - In AEDT, the operating modes are more numerous and include: (i.) Take-off, (ii.) Climb Taxi, (iii.) Climb Ground, (iv.) Climb below 1,000 feet, (v.) Climb Below Mixing Height, (vi.) Climb Below 10,000 feet, (vii.) Cruise Above 10,000 feet, (viii.) Descend Below 10,000 feet, (ix.) Descend Below Atmospheric Mixing Height, (x.) Descend Below 1,000 feet, (xi.) Descend to Ground, (xii.) Descend Taxi, and (xiii.) Full Flight.
- **Times-In-Modes (TIM)** – Due in part to the variances in operational modes described above combined with the changes in how the aircraft climb out and cruise times are calculated, there are resultant differences in the TIMs between the two models – particularly for the airborne flight segments of the Landing-and-Takeoff (LTO) cycles. This TIM difference has an effect on total emissions over the LTO. The TIM updates to AEDT, compared to EDMS, allow for a more accurate and up-to-date representation of emissions.
- **Emission Factors** – Both AEDT and EDMS contain an array of aircraft engine emission factors that are differentiated mainly by engine model, fuel type, and operational mode. Although the majority of factors are the same in both models, there are also differences between the two. For example, the emission factors for TIO-540-J2B2 engine of the Cessna 402 is marginally different between the two models. Although a small difference, when these aircraft are a large proportion of the overall fleet combined with numerous LTOs – the resultant emissions are compounded and can vary significantly between the two models depending on the fleet mix.
- **Missing Aircraft/Engine Combinations** – Mostly pertaining to newer aircraft, there are some aircraft/engine combinations that exist in EDMS but do not exist in AEDT. For example, the A350-900/Trent XWB combination in EDMS does not exist in AEDT. The only engine option for this aircraft is the Trent 772. Also, the B787-900/Trent 1000-A combination exists in EDMS but not in AEDT. Therefore, a different engine is used in AEDT for such aircraft. The EDMS engine database is no longer being updated, and the AEDT engine database is the most current. Therefore, the AEDT aircraft/engine combinations are considered the most appropriate.

AEDT computes somewhat higher emissions of NO_x, VOC, and CO in comparison to EDMS model results. However, for the $PM_{10}/PM_{2.5}$ estimates, the results are reversed with EDMS producing higher modeled emissions than AEDT.[6] The AEDT model was developed to incorporate the most updated and best-available science, resulting in differences between AEDT and EDMS results.

6 It is important to note that the differences in aircraft emissions discussed above may not occur in all applications of AEDT and EDMS at other airports, nor will the differences necessarily be of the same magnitude. Rather, these observations are provided here to reveal the potential differences between the two models.

The differences between the AEDT and EDMS aircraft emissions results, illustrated in **Table 7-4,** are largely due to variances in operational modes between the two models and a slight change in engine emission factors. Since its release, FAA continues to enhance the AEDT model by expanding its capabilities, correcting computational errors, and making it more "user-friendly." These improvements are reflected in periodic releases of the model which are expected to continue for the foreseeable future.

Table 7-4 AEDT/EDMS Aircraft Emissions Inventory Comparison

	Pollutant (kg/day)			
Model	**VOC**	**NOx**	**CO**	**$PM_{10}/PM_{2.5}$**
2016 EDMS	760	4,293	6,144	70
2016 AEDT	798	4,897	6,166	60
% Difference between 2016 EDMS and AEDT	**5.0%**	**14.0%**	**0.4%**	**(14.3%)**

Source: Massport, KBE.
Notes: Negative numbers are shown in ( ).

2016 Assessment Methodology

- **Aircraft Emissions** – FAA's AEDT is now the EPA-preferred and the FAA-required model for calculating aircraft-related emissions. The most recent version of AEDT, Version 2c Service Pack 2 (AEDT 2c SP2), was used in support of the 2016 air quality analysis. For consistency with prior EDRs, FAA's EDMS model findings were also used for comparison purposes to discern which changes are attributable to the model differences or to changes in operations and other factors.

  As for past years, the actual 2016 aircraft fleet mix at Logan Airport was used as input to AEDT and the legacy EDM model. In a few instances where the aircraft/engine type combinations operating at Logan Airport were not available in the AEDT database, guidance appropriate substitutions were made based on the closest match of aircraft and engine types. **Tables I-4** and **I-5** in Appendix I, *Air Quality/Emissions Reduction* contain the data that were used to program the models, including the aircraft and engine types, numbers of LTOs, and aircraft taxi/delay times for 2016. As is customary, the Logan Airport aircraft fleet was grouped into four categories: commercial air carriers, commuter aircraft, general aviation (GA), and cargo aircraft.

  According to these data, from 2015 to 2016 total LTOs increased by 4.9 percent with air carrier LTOs increasing by 10.2 percent, commuter LTOs decreasing by 12.9 percent, air cargo LTOs increasing by about 10.2 percent, and GA increasing by 9.4 percent.

  Updated aircraft taxi/delay times are based on data obtained from the FAA Aviation System Performance Metrics (ASPM) database for 2016.[7] According to this database, the average aircraft taxi/delay times at Logan Airport decreased from 25.9 to 25.3 minutes from 2015 to 2016 or 2.3 percent.

- **Ground Service Equipment**- Estimates of GSE emissions were based on AEDT emission factors and continue to reflect emission reductions attributable to Massport's Alternative Fuel Vehicle (AFV)

7 FAA Aviation System Performance Metrics (ASPM) database for 2016 (https://aspm.faa.gov/).

Program and the conversion of Massport and/or tenant GSE and fleet vehicles to CNG or electricity. GSE emission factors decreased measurably for most equipment in 2016 when compared to 2015. Other AEDT input data are based on the updated Logan Airport-specific GSE time-in-mode survey conducted in 2017, combined with the most recent GSE fuel use (gasoline, diesel, CNG, liquid petroleum gas, and electric) data from Massport's Vehicle Aerodrome Permit Application Program for Logan Airport. To compare EDMS to AEDT, the EDMS model used EDMS-specific emission factors for 2016, similar to the AEDT-specific emission factors used in the AEDT model for 2016.

- **Motor Vehicles** - Motor vehicle emission factors were obtained from the new, and most recent, version of EPA's MOVES model (MOVES2014a) combined with MassDEP-recommended motor vehicle fleet mix data, operating conditions, and other Massachusetts-specific input parameters.[8] In general, the emission factors obtained from MOVES2014a for 2016 were lower for VOCs, NO_x, CO, and PM when compared to 2015. The MOVES input/output files are included in Appendix I, *Air Quality/Emissions Reduction*. In addition, Chapter 5, *Ground Access to and from Logan Airport* of this *2016 EDR* provides a discussion of the on-Airport vehicle miles traveled (VMT) data used for this analysis. On-Airport VMT and vehicle speed data were predicted by the traffic simulation model, VISSIM.[9] (Refer to Chapter 5, *Ground Access to and from Logan Airport* for more information.)
- **Other Sources** - Emissions associated with fuel storage and handling, the Central Heating and Cooling Plant, snow melters, generators, space heaters, and fire training at Logan Airport were based on annual fuel throughput records for 2016, combined with appropriate EPA emission factors (for example, compilation of *Air Pollution Emission Factors* (*AP-42*) or emission factors obtained from NO_x Reasonably Available Control Technology compliance testing). When comparing 2016 to 2015, No. 2 fuel oil and natural gas usage from boiler usage increased by 76.7 percent and decreased 7.3 percent, respectively. The large increase in No. 2 fuel oil usage is primarily attributable to seasonal fluctuations and reporting based on material deliveries and not actual fuel burned. Diesel fuel used for snow melters decreased by 76.2 percent in 2016 due to a decrease from record snow levels reported in 2015. Emissions from other sources[10] represent 33.4 percent of total VOC emissions and 4 percent, or less, of total NO_x, CO, and $PM_{10}/PM_{2.5}$ emissions.

In November 2014, Massport converted the Central Heating and Cooling Plant fuel oil system from No. 6 to No. 2 fuel oil. During the conversion, the plant retained the ability to burn natural gas, which it burns approximately 97 percent of the time. Converting the Central Heating and Cooling Plant fuel oil system allows Massport to reduce energy use and air emissions while maintaining the ability to use backup fuel oil in the event of a disruption of natural gas service.

- **Particulate Matter** - Estimates of PM emissions associated with Logan Airport activities were first reported in the *2005 EDR* in response to the then recent availability of an FAA-updated method (*First Order Approximation*) for computing aircraft $PM_{10}/PM_{2.5}$ emission factors. $PM_{10}/PM_{2.5}$ emissions are now routinely reported in the EDRs including this *2016 EDR*.

8 The U.S. EPA MOVES model is an advancement to the former MOBILE6 model as it contains the most up-to-date emission factors, emission control measures, and other area-specific parameters for motor vehicle fleets nationwide (including the Boston area). For consistency with the Massachusetts State Implementation Plan (SIP), MOVES is also recommended for use by MassDEP.

9 PTV America. (2011). Verkehr In Städen Simulationsmodell- VISSIM version 5.40 [computer software]. Portland, OR.

10 Other sources include Central Heating and Cooling Plant, emergency generators, snow melters and live fire training facility.

- **Greenhouse Gases** - GHG emissions are calculated in much the same way as criteria pollutants (and their precursors). This includes the use of input data such as activity levels or material throughput rates (such as, fuel usage, VMT, electrical consumption, etc.) that are applied to appropriate emission factors (for example, in units of GHG emissions per gallon of fuel). Again, these input data were either based on Massport records or data derived from the models. Emission factors were obtained from the U.S. Energy Information Administration, the Intergovernmental Panel on Climate Change (IPCC), and EPA.

Consistent with prior EDR years, the 2016 GHG emissions inventory includes aircraft operations within the taxi-idle/delay mode and up to the top of the 3,000–foot LTO cycle. GHG emissions associated with GSE, following the guidance issued by the Airport Cooperative Research Program, ACRP Report 11, *Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories,* APUs, motor vehicles, a variety of stationary sources, and electricity usage were also included.

Massport has direct ownership or control over a very small percentage (approximately 12.5 percent in 2016) of Logan Airport-related GHG emissions and their sources (mostly limited to Massport fleet vehicles, stationary sources, and electrical consumption within Massport buildings). As with most commercial service airports, the vast majority of the GHG emission sources are owned, controlled, or generated by the airlines, other airport tenants, and the general public (motor vehicles).

In all cases, Massport undertakes a variety of programs to reduce non-Massport emissions through its support of HOV initiatives, including: subsidizing free outbound Silver Line Service from Logan Airport, supporting use of alternative fuels by airport taxis, providing an on-Airport CNG station, and providing electric plug-ins for GSE, 400 Hz Power, and pre-conditioned air at airplane gates.

Emissions Inventory in 2016

This section provides the results of the 2016 Logan Airport emissions inventory for the pollutants CO, NO_x, PM_{10}/$PM_{2.5}$, and VOCs using the AEDT and MOVES2014a models and standard emission factors for stationary sources. The following section reports on aircraft-related emissions using the AEDT model and compares it to the EDMS model for aircraft-related emissions. Emissions of O_3 are not directly computed as it is a secondary pollutant formed by the interactions of NO_x and VOCs throughout the region. Emissions of SO_2 and Pb are also not computed, as Logan Airport emission sources are very small generators of these two EPA criteria pollutants.

As stated above, the aircraft emissions inventory was computed based on the actual number of aircraft operations (LTOs), fleet mix, and operational times-in-mode at the Airport in 2016. Similarly, emissions associated with GSE, APUs, motor vehicles, fuel storage and transfer facilities, and a variety of stationary sources (such as, steam boilers, snow melters, live-fire training, and emergency generators) associated with Logan Airport were also computed based on actual conditions.

As in previous EDRs, the 2016 emissions inventory for Logan Airport is used for short-term comparisons to the *2015 EDR* results as well as for long-term comparisons to previous EDRs and ESPRs extending back to 1990. For ease of review, the tables and figures containing the 2016 results also show the results for 1990 and 2000 and then annually for 2010 to 2015. In this way, the changes in Logan Airport air quality conditions can be evaluated in both the short- and long-term time frames and on a common basis.

Table 7-5 AEDT/EDMS Total Emissions Inventory Comparison

	Pollutant (kg/day)			
Model	**VOC**	**NOx**	**CO**	**PM_{10}/$PM_{2.5}$**
2015 EDMS	1,188	4,262	7,243	98
2016 EDMS	1,242	4,696	7,328	106
2016 AEDT	1,280	5,300	7,350	96
% Difference between 2016 EDMS and 2016 AEDT	**3.0%**	**12.9%**	**0.3%**	**(9.4%)**
% Difference between 2015 EDMS and 2016 AEDT	**7.7%**	**24.4%**	**1.5%**	**(2.0%)**

Source: Massport, KBE.
Notes: Negative numbers are shown in ( )

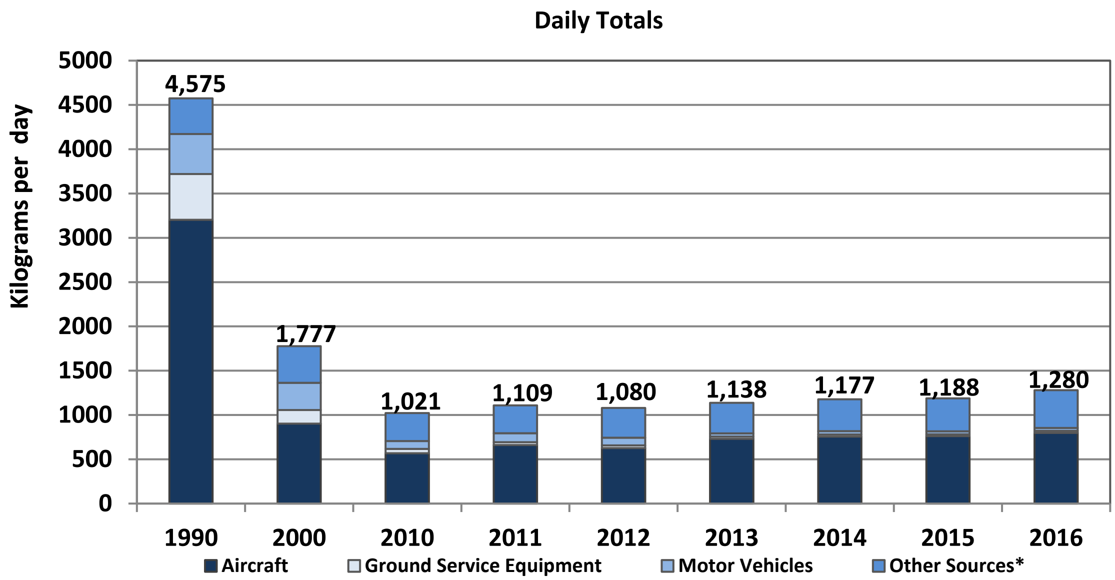
As shown in **Table 7-5**, AEDT estimates greater amounts of aircraft emissions of VOCs, NO_X, and CO in comparison to EDMS. However, EDMS estimates higher PM_{10} and $PM_{2.5}$. These model differences are discussed above.

Volatile Organic Compounds

In 2016, total VOC emissions at Logan Airport were 515 tons per year (tpy) (or 1,280 kg/day) – an increase of 7.7 percent from 2015 levels. This change is mostly due to the increase in VOC emissions associated with the fuel storage and handling at the Airport, and an increase in aircraft-related VOC emissions due to modeling changes. The long-term trend for VOC emissions over the past twenty-five years reveals a substantial decrease in these emissions associated with the Airport. **Figure 7-1** depicts the overall, long-term downward trend in VOC emissions at Logan Airport and **Figure 7-2** shows the percent breakdown of these emissions by source category in 2016. Similarly, **Table 7-6** shows the computed VOC emissions in kg/day for each emission source from 1990, 2000, and 2010 to 2016. Other key findings from this analysis include the following:

- Total aircraft-related VOC emissions increased by 4.9 percent in 2016 (AEDT) compared with 2015 (EDMS). Comparing the 2016 EDMS results to the 2016 AEDT results, aircraft-related VOC emissions increased by 5.0 percent. The increase in 2016 compared to 2015 was largely due to differences in mode calculations between AEDT and EDMS as well as variations in engine emission factors in some cases.
- GSE-related VOC emissions were approximately 14.3 percent higher in 2016 than in 2015. This was largely due to the increase in aircraft LTOs and the increase in APU operating times for narrow body air carriers and commuter aircraft, based on the updated GSE time-in-mode survey.
- VOC emissions from motor vehicles in 2016 decreased by about 8.8 percent from 2015 levels, despite an increase in on-Airport VMT. This decrease was mostly attributable to lower motor vehicle emission factors.
- VOC emissions from stationary and other non-mobile sources (fuel storage/handling, Central Heating and Cooling Plant, snow melter usage, firefighter training) increased by approximately 14.8 percent from 2015 to 2016. This change was mostly due to the increase in evaporative emissions from refueling activities.

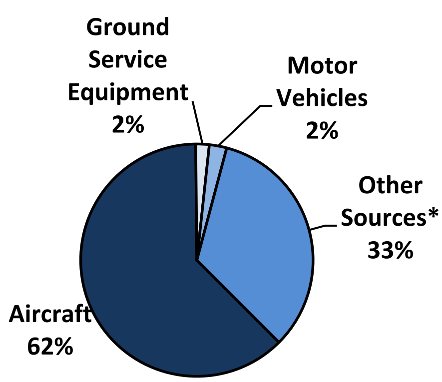
Figure 7-1 Modeled Emissions of VOCs at Logan Airport, 1990, 2000, and 2010-2016



Source: Massport and KBE 2017.
Notes: * Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.) and fueling sources. In 2016, aircraft-related emissions were calculated using AEDT.

As shown in **Figure 7-2**, in 2016 aircraft continued to represent the largest source (62.3 percent) of VOC emissions associated with Logan Airport, followed by stationary sources (33.4 percent), motor vehicles (2.4 percent), and GSE (1.9 percent).

Figure 7-2 Sources of VOC Emissions, 2016



Source: Massport and KBE 2017.
Notes: *Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.) and fueling sources. In 2016, aircraft-related emissions were calculated using AEDT.

Table 7-6 Estimated VOC Emissions (in kg/day) at Logan Airport, 1990, 2000, and 2010-2016[1]

Aircraft/GSE Model:	**Logan Dispersion Modeling System (LDMS)**	**EDMS v4.03**	**EDMS v5.1.2**	**EDMS v5.1.3**				**EDMS v5.1.4.1**					**AEDT Version 2c SP2**
Motor Vehicle Model:	**MOBILE 5a**	**MOBILE 6.0**	**MOBILE 6.2.03**					**MOVES 2010b**	**MOVES 2014**		**MOVES 2014a**		
Year:	**1990**	**2000**	**2010**		**2011**	**2012**	**2013**		**2014**		**2015**	**2016**	
Aircraft Sources													
Air carriers	2,175	514	292	292	305	378	448	447	480	480	491	504	553
Commuter aircraft	681	140	129	125	110	91	91	91	85	85	87	79	74
Cargo aircraft	303	207	70	70	69	63	44	44	48	48	47	56	61
General aviation	44	42	81	81	176	93	149	149	144	144	135	121	110
Total aircraft sources	3,203	903	572	568	660	626	732	731	757	757	761	760	798
Ground Service Equipment[2]	518	153	49	49	33	30	26	26	23	23	21	24	24
Motor Vehicles													
Ted Williams Tunnel through-traffic	N/A	12	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]
Parking/curbside[4]	192	89	20	20	20	18	17	5	3	4	4	3	3
On-airport vehicles	258	206	68	68	81	70	67	31	16	34	30	28	28
Total motor vehicle sources	450	307	86	86	101	88	84	36	19	38	34	31	31

Source: Massport

Notes: Years 2010, 2013 and 2016 were computed with previous years EDMS version to provide for a common basis of comparison. Years 2013 and 2014 were also computed with the previous year motor vehicle emission factors model.

kg/day kilograms per day. 1 kg/day is equivalent to approximately 0.40234 tons per year (tpy).

N/A Not Available.

1 See Appendix I, *Air Quality/Emissions Reduction* for 1993 to 2009 emission inventory results.

2 GSE emissions include aircraft APUs as well as vehicles and equipment converted to alternative fuels.

3 Due to the new roadway configuration and opening of the Ted Williams Tunnel there was no Ted Williams Tunnel through-traffic (which is defined as traffic passing through but not destined for the Airport) at Logan Airport beginning in 2003.

4 Parking/curbside is based on VMT analysis.

5 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

Table 7-6 Estimated VOC Emissions (in kg/day) at Logan Airport, 1990, 2000, and 2010-2016[1] (Continued)

Aircraft/GSE Model:	Logan Dispersion Modeling System (LDMS)	EDMS v4.03	EDMS v5.1.2	EDMS v5.1.3				EDMS v5.1.4.1					AEDT Version 2c SP2
Motor Vehicle Model:	**MOBILE 5a**	**MOBILE 6.0**	**MOBILE 6.2.03**					**MOVES 2010b**	**MOVES 2014**		**MOVES 2014a**		
Year:	**1990**	**2000**	**2010**		**2011**	**2012**	**2013**		**2014**		**2015**	**2016**	
Other Sources													
Fuel storage/handling	400	412	311	311	311	332	340	340	354	354	366	422	422
Miscellaneous sources[5]	4	2	5	5	4	4	5	5	5	5	6	5	5
Total other sources	404	414	316	316	315	336	345	345	359	359	372	427	427
Total Airport Sources	4,575	1,777	1,025	1,021	1,109	1,080	1,187	1,138	1,158	1,177	1,188	1,242	1,280

Source: Massport

Notes: Years 2010, 2013 and 2016 were computed with previous years EDMS version to provide for a common basis of comparison. Years 2013 and 2014 were also computed with the previous year motor vehicle emission factors model.

kg/day kilograms per day. 1 kg/day is equivalent to approximately 0.40234 tons per year (tpy).

N/A Not Available.

1 See Appendix I, *Air Quality/Emissions Reduction* for 1993 to 2009 emission inventory results.

2 GSE emissions include aircraft APUs as well as vehicles and equipment converted to alternative fuels.

3 Due to the new roadway configuration and opening of the Ted Williams Tunnel there was no Ted Williams Tunnel through-traffic (which is defined as traffic passing through but not destined for the Airport) at Logan Airport beginning in 2003.

4 Parking/curbside is based on VMT analysis.

5 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

Oxides of Nitrogen

In 2016, total NO_x emissions from all Airport-related sources were estimated to be 2,132 tpy (5,300 kg/day), which represents an increase of 24.4 percent from 2015 levels. This increase is largely due to modeling changes from EDMS to AEDT as discussed above. However, this occurrence should also be taken within the context of an overall, and long-term, decrease of 8.2 percent from 1999 levels. **Figure 7-3** illustrates these short- and long-term trends in NO_x emissions and **Table 7-7** shows the NO_x contribution for each emission source in 1990, 2000, and 2010 through 2016.

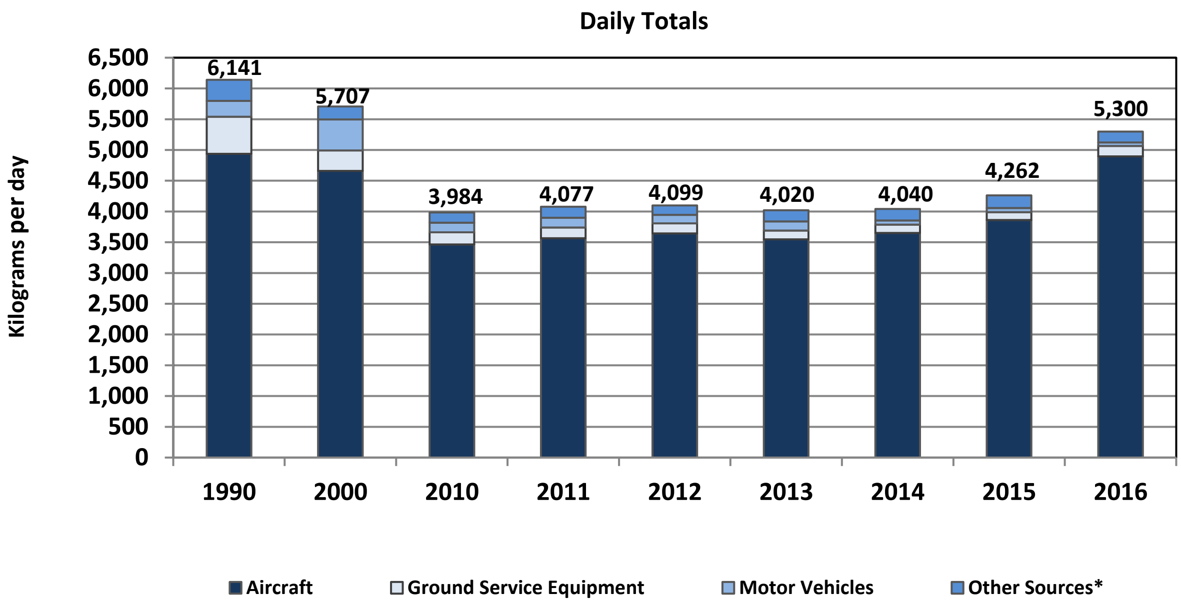
Other findings related to the 2016 NO_X emissions inventory results include the following:

- When compared to 2015 values, total aircraft-related NO_X emissions were 26.8 percent higher in 2016. Comparing the 2016 EDMS results to the 2016 AEDT results, aircraft-related NO_X emissions increased by 14.0 percent in AEDT. The increase from 2015 to 2016 was largely due to differences in how AEDT and EDMS calculate operational modes as well as minor differences in some engine emission factors and the corresponding increase in aircraft operations.
- GSE emissions of NO_X rose by 30.5 percent in 2016 compared to 2015, due mostly to an increase in aircraft operations and increased APU operating times for narrow body air carriers and commuter aircraft based on the updated GSE time-in-mode survey.
- NO_X emissions from motor vehicles in 2016 decreased by approximately 13.6 percent from 2015 levels. This reduction was largely attributable to lower NO_X motor vehicle emission factors.
- Stationary sources showed a decrease of approximately 13.1 percent in NO_X emissions in 2016 compared to 2015. This was due to decreased usage of the Massport boilers during this period compared to the previous year of unusually heavy snowfall and sustained cold weather which caused an increase in comfort heating system use.

As with VOCs, the overall, long-term trend over the past two decades reveals a substantial decrease in total NO_x emissions associated with Airport activities.

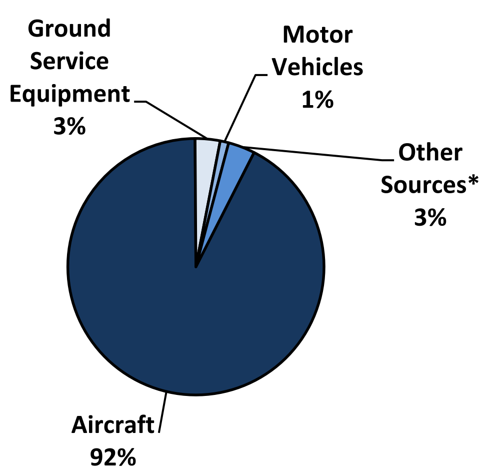
As shown in **Figure 7-4**, aircraft emissions continued to represent the largest source (92.4 percent) of NO_X at Logan Airport, followed by stationary sources (3.4 percent), GSE (3.2 percent), and motor vehicles (1.1 percent).

Figure 7-3 Modeled Emissions of NO_X at Logan Airport, 1990, 2000, and 2010-2016



Source: Massport and KBE 2017.
Notes: * Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, firefighter training, etc.). In 2016, aircraft-related emissions were calculated using AEDT.

Figure 7-4 Sources of NO_X Emissions, 2016



Source: Massport and KBE 2017.
Notes: * Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.). In 2016, aircraft-related emissions were calculated using AEDT.

Table 7-7 Estimated NOx Emissions (in kg/day) at Logan Airport, 1990, 2000, and 2010-2016[1]

Aircraft/GSE Model:	**Logan Dispersion Modeling System (LDMS)**	**EDMS v4.03**	**EDMS v5.1.2**	**EDMS v5.1.3**				**EDMS v5.1.4.1**					**AEDT Version 2c SP2**
Motor Vehicle Model:	**MOBILE 5a**	**MOBILE 6.0**	**MOBILE 6.2.03**					**MOVES 2010b**		**MOVES 2014**	**MOVES 2014a**		
Year:	**1990**	**2000**	**2010**		**2011**	**2012**	**2013**		**2014**		**2015**	**2016**	
Aircraft Sources													
Air carriers	4,554	4,202	3,031	3,037	3,128	3,154	3,090	3,158	3,245	3,245	3,470	3,912	4,476
Commuter aircraft	133	125	203	204	199	182	168	152	155	155	139	97	126
Cargo aircraft	237	284	197	197	196	192	188	188	203	203	201	224	228
General aviation	13	49	29	26	43	115	46	48	48	48	53	60	67
Total aircraft sources	4,937	4,660	3,460	3,464	3,566	3,644	3,492	3,546	3,651	3,651	3,862	4,293	4,897
Ground Service Equipment[2]	603	333	198	198	173	164	145	145	134	134	128	167	167
Motor Vehicles													
Ted Williams Tunnel through-traffic	N/A	26	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	– 3	– 3
Parking/curbside[4]	25	52	12	12	11	10	9	16	11	6	7	6	6
On-airport vehicles	232	425	144	144	148	128	117	131	90	62	59	51	51
Total motor vehicle sources	257	503	156	156	159	137	126	147	101	68	66	57	57

Source: Massport

Notes: Years 2010, 2013, and 2016 were computed with previous years EDMS version to provide for a common basis of comparison. Years 2013 and 2014 were also computed with the previous year motor vehicle emission factors model.

kg/day kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy).

N/A Not Available.

1 See Appendix I, *Air Quality/Emissions Reduction* for 1993 to 2009 emission inventory results.

2 GSE emissions include APUs as well as vehicles and equipment converted to alternative fuels.

3 Due to the new roadway configuration and opening of the Ted Williams Tunnel (TWT) there was no TWT through-traffic at Logan Airport beginning in 2003.

4 Parking/curbside data is based on VMT analysis.

5 Fuel storage/handling facilities are not a source of NOx emissions.

6 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

Table 7-7 Estimated NOx Emissions (in kg/day) at Logan Airport, 1990, 2000, and 2010-2016[1] (Continued)

Aircraft/GSE Model:	**Logan Dispersion Modeling System (LDMS)**	**EDMS v4.03**	**EDMS v5.1.2**	**EDMS v5.1.3**				**EDMS v5.1.4.1**					**AEDT Version 2c SP2**
Motor Vehicle Model:	**MOBILE 5a**	**MOBILE 6.0**	**MOBILE 6.2.03**					**MOVES 2010b**		**MOVES 2014**	**MOVES 2014a**		
Year:	**1990**	**2000**	**2010**		**2011**	**2012**	**2013**		**2014**		**2015**	**2016**	
Other Sources													
Fuel storage/handling[5]	0	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous sources[6]	344	211	166	166	179	154	182	182	187	187	206	179	179
Total other sources	344	211	166	166	179	154	182	182	187	187	206	179	179
Total Airport Sources	6,141	5,707	3,980	3,984	4,077	4,099	3,945	4,020	4,073	4,040	4,262	4,696	5,300

Source: Massport

Notes: Years 2010, 2013, and 2016 were computed with previous years EDMS version to provide for a common basis of comparison. Years 2013 and 2014 were also computed with the previous year motor vehicle emission factors model.

kg/day kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy).

N/A Not Available.

1 See Appendix I, *Air Quality/Emissions Reduction* for 1993 to 2009 emission inventory results.

2 GSE emissions include APUs as well as vehicles and equipment converted to alternative fuels.

3 Due to the new roadway configuration and opening of the Ted Williams Tunnel (TWT) there was no TWT through-traffic at Logan Airport beginning in 2003.

4 Parking/curbside data is based on VMT analysis.

5 Fuel storage/handling facilities are not a source of NOx emissions.

6 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

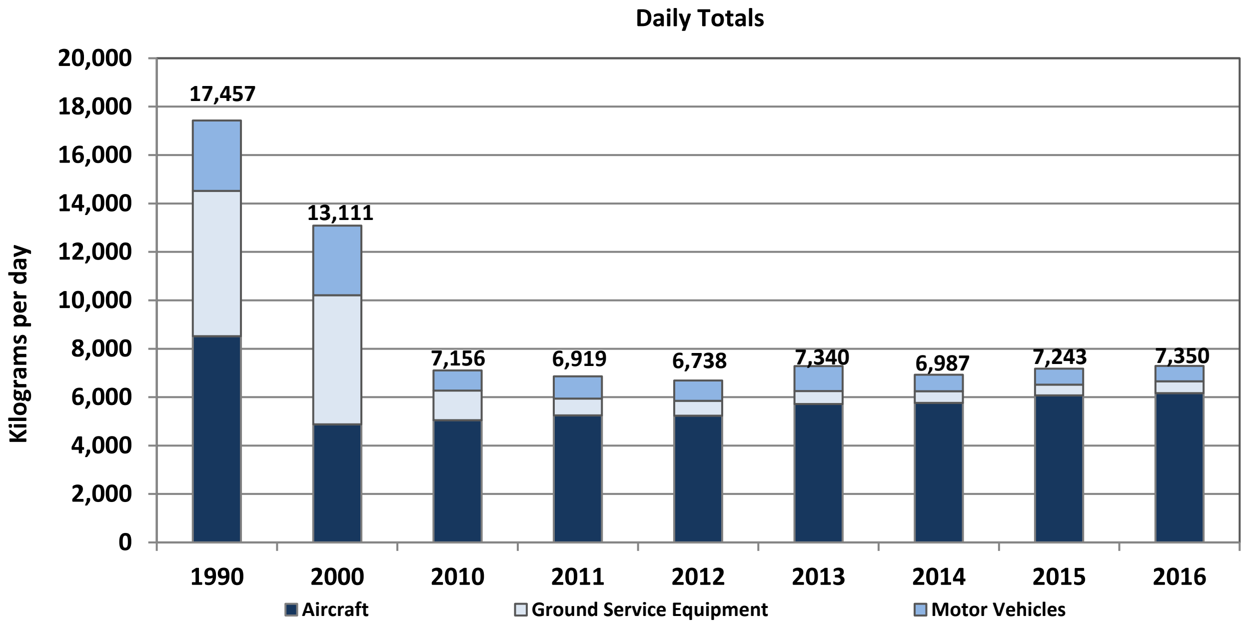
Carbon Monoxide

Total CO emissions at Logan Airport in 2016 were 2,957 tpy (7,350 kg/day) a 1.5 percent higher than 2015 levels. However, **Figure 7-5** shows the continued long-term downward trend (57.9 percent overall reduction from 1990 levels) in CO emissions associated with Airport activities. **Table 7-8** also shows the breakdown of these emissions, by source category for the years 1990, 2000, and 2010 to 2016. Other notable findings of the CO emissions inventory include:

- Aircraft-related CO emissions increased in 2016 by 1.5 percent compared to 2015 levels, mostly due to the increase in aircraft LTOs. Comparing the 2016 results between EDMS to AEDT models, aircraft-related CO emissions increased by 0.4 percent using AEDT.
- GSE CO emissions increased by approximately 11.5 percent in 2016 compared to 2015, due mostly to the increase in aircraft LTOs and increased APU operating times for narrow body air carriers and commuter aircraft based on the updated GSE time-in-mode survey.
- CO emissions from motor vehicles decreased in 2016 by approximately 3.8 percent from 2015 levels. This reduction was attributable mostly to the lower CO emission factors of the motor vehicle fleet.
- Stationary sources showed a decrease in CO emissions in 2016 by approximately 14.7 percent from 2015, largely due to decreased usage of the boilers and snow melters compared to usage during record high snow levels reported in 2015.

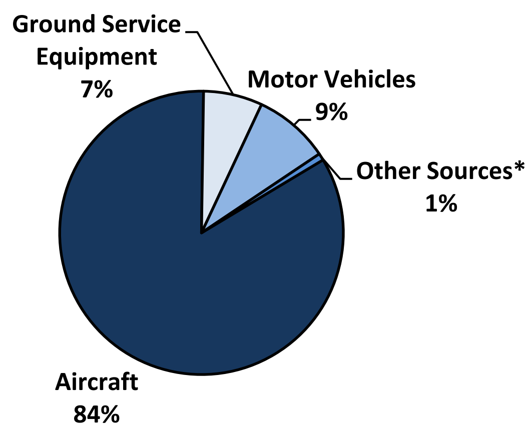
As shown in **Figure 7-6**, for 2016, aircraft emissions continued to represent the largest source (83.9 percent) of CO at Logan Airport, followed by motor vehicles (8.6 percent), GSE (6.7 percent), and stationary sources (less than 1 percent).

Figure 7-5 Modeled Emissions of CO at Logan Airport, 1990, 2000, and 2010-2016



Source: Massport and KBE 2017.
Notes: Other stationary sources not shown (this source made up less than 1 percent of the total). In 2016, aircraft-related emissions were calculated using AEDT.

Figure 7-6 Sources of CO Emissions, 2016



Source: Massport and KBE 2017.
Notes: * Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.) In 2016, aircraft-related emissions were calculated using AEDT.

Table 7-8 Estimated CO Emissions (in kg/day) at Logan Airport, 1990, 2000, and 2010-2016[1]													
Aircraft/GSE Model:	**Logan Dispersion Modeling System (LDMS)**	**EDMS v4.03**	**EDMS v5.1.2**	**EDMS v5.1.3**				**EDMS v5.1.4.1**				**AEDT Version 2c SP2**	
Motor Vehicle Model:	**MOBILE 5a**	**MOBILE 6.0**	**MOBILE 6.2.03**					**MOVES 2010b**		**MOVES 2014**	**MOVES 2014a**		
Year:	**1990**	**2000**	**2010**		**2011**	**2012**	**2013**		**2014**		**2015**	**2016**	
Aircraft Sources													
Air carriers	6,613	2,994	2,531	2,531	2,592	2,816	3,320	3,323	3,486	3,486	3,729	3,879	3,653
Commuter aircraft	977	1,188	2,629	2,086	2,042	1,928	1,978	1,907	1,795	1,795	1,826	1,737	1,998
Cargo aircraft	576	400	248	259	246	183	155	155	164	164	167	192	201
General aviation	352	295	177	173	370	304	345	334	319	319	353	336	314
Total aircraft sources	8,518	4,876	5,585	5,049	5,250	5,232	5,798	5,719	5,764	5,764	6,075	6,144	6,166
Ground Service Equipment[2]	6,001	5,335	1,222	1,222	694	618	533	533	484	484	442	493	493
Motor Vehicles													
Ted Williams Tunnel through-traffic	N/A	133	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]
Parking/curbside[4]	1,218	495	106	106	110	104	104	94	57	51	28	37	37
On-airport vehicles	1,689	2,245	726	726	806	737	742	935	591	630	630	596	596

Table 7-8 Estimated CO Emissions (in kg/day) at Logan Airport, 1990, 2000, and 2010-2016[1] (Continued)

Aircraft/GSE Model:	Logan Dispersion Modeling System (LDMS)	EDMS v4.03	EDMS v5.1.2	EDMS v5.1.3				EDMS v5.1.4.1				AEDT Version 2c SP2	
Motor Vehicle Model:	**MOBILE 5a**	**MOBILE 6.0**	**MOBILE 6.2.03**					**MOVES 2010b**		**MOVES 2014**	**MOVES 2014a**		
Year:	**1990**	**2000**	**2010**		**2011**	**2012**	**2013**		**2014**		**2015**	**2016**	
Other Sources													
Fuel storage/handling[5]	0	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous sources[6]	31	27	53	53	59	48	59	59	58	58	68	58	58
Total other sources	31	27	53	53	59	48	59	59	58	58	68	58	58
Total Airport Sources	17,457	13,111	7,962	7,156	6,919	6,738	7,236	7,340	6,954	6,987	7,243	7,328	7,350

Source: Massport

Notes: Years 2010 and 2013 were computed with previous years EDMS version to provide for a common basis of comparison. Years 2013 and 2014 were also computed with the previous year motor vehicle emission factors model.

N/A Not Available.

1 See Appendix I, *Air Quality/Emissions Reduction* for 1993 to 2009 emission inventory results.

2 GSE emissions include aircraft APUs as well as vehicles and equipment converted to alternative fuels.

3 Due to the new roadway configuration and opening of the Ted Williams Tunnel, there was no Ted Williams Tunnel through-traffic at Logan Airport beginning in 2003.

4 Parking/curbside is based on VMT analysis.

5 Fuel storage/handling facilities are not a source of NOx emissions.

6 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

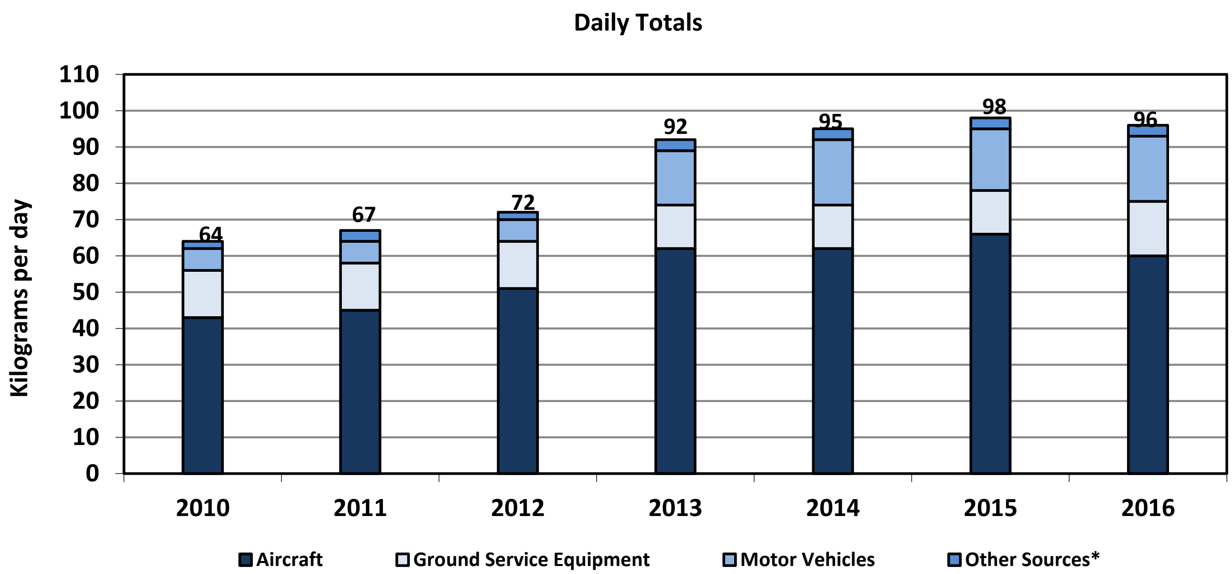
Particulate Matter

Estimated $PM_{10}/PM_{2.5}$ emissions at Logan Airport in 2016 are presented in **Table 7-9**. These results show total emissions of 39 tpy (96 kg/day), or 2.0 percent lower than 2015 levels. Explanations of these results and other key findings include the following:

- Estimated aircraft-related $PM_{10}/PM_{2.5}$ emissions decreased by approximately 9.1 percent in 2016 compared to 2015 levels, due mostly to differences in modeling. Comparing the 2016 results between EDMS and AEDT models, aircraft-related $PM_{10}/PM_{2.5}$ emissions decreased by 14.3 percent in AEDT.
- $PM_{10}/PM_{2.5}$ associated with GSE/APU emissions increased by 25 percent in 2016 when compared to 2015, largely due to the increase in aircraft LTOs and increased APU operating times for narrow body air carriers and commuter aircraft based on the updated GSE time-in-mode survey.
- $PM_{10}/PM_{2.5}$ emissions from motor vehicles increased by 5.9 percent in 2016 when compared to 2015 levels, primarily attributable to lower motor vehicle emission factors being offset by an increase in motor vehicle volumes.
- Stationary source emissions of $PM_{10}/PM_{2.5}$ remained about the same in 2016 compared to 2015.

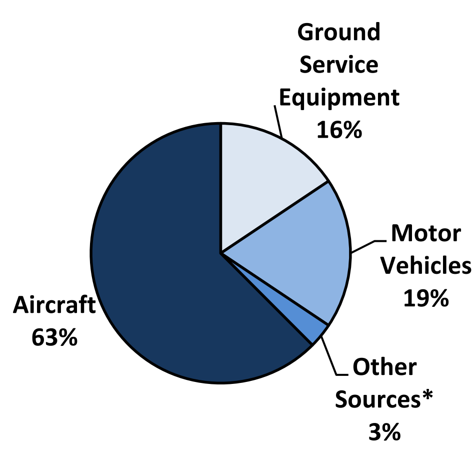
As shown in **Figures 7-7** and **7-8**, aircraft emissions represent the largest source (62.5 percent) of $PM_{10}/PM_{2.5}$ at Logan Airport, followed by motor vehicles (18.8 percent), GSE (15.6 percent), and stationary sources, such as the Central Heating and Cooling Plant, snow melter usage, and fire training (3.1 percent).

Figure 7-7 Modeled Emissions of $PM_{10}/PM_{2.5}$ at Logan Airport, 2010-2016



Source: Massport and KBE 2017.
Notes: 2005 (not shown) was the first year PM was included in the EDR/ESPR emission inventories.
The increase in emissions from 2012 to 2013 were primarily due to changes in the current EDMS and MOVES computer models.
In 2016, aircraft-related emissions were calculated using AEDT.
* Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.).

Figure 7-8 Sources of $PM_{10}/PM_{2.5}$ Emissions, 2016



Source: Massport and KBE 2017.
Note: * Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.

Table 7-9 Estimated PM_{10}/$PM_{2.5}$ Emissions (in kg/day) at Logan Airport, 2010-2016[1]

Aircraft/GSE Model:	EDMS v5.1.2	EDMS v5.1.3				EDMS v5.1.4.1					AEDT Version 2c SP2
Motor Vehicle Model:	**MOBILE 6.2.03**					**MOVES 2010b**		**MOVES 2014**	**MOVES 2014a**		
Year:	**2010**		**2011**	**2012**	**2013**		**2014**		**2015**	**2016**	
Aircraft Sources											
Air carriers	34	34	35	43	41	48	48	48	53	57	52
Commuter aircraft	4	4	3	2	2	7	7	7	7	6	4
Cargo aircraft	3	3	3	3	2	3	3	3	3	3	2
General aviation	2	2	4	3	3	4	4	4	4	4	2
Total aircraft sources	43	43	45	51	48	62	62	62	66	70	60
Ground Service Equipment[2]	13	13	13	13	12	12	12	12	12	15	15
Motor Vehicles											
Parking/curbside[3]	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
On-airport vehicles	6	6	6	6	6	14	14	18	16	17	17
Total motor vehicle sources	6	6	6	6	6	15	14	18	17	18	18
Other Sources											
Fuel storage/handling[4]	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous sources[5]	2	2	3	2	3	3	3	3	3	3	3
Total other sources	2	2	3	2	3	3	3	3	3	3	3
Total Airport Sources	64	64	67	72	69	92	91	95	98	106	96

Source: Massport

Notes: Years 2010 and 2013 were computed with previous years EDMS version to provide for a common basis of comparison. Years 2013 and 2014 were also computed with the previous year motor vehicle emission factors model.

kg/day kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy); PM - particulate matter

1 It is assumed that all PM are less than 2.5 microns in diameter (PM2.5). See Appendix I, *Air Quality/Emissions Reduction* for 2005 to 2009 emission inventory results.

2 GSE emissions include APUs as well as vehicles and equipment converted to alternative fuels.

3 Parking/curbside is based on VMT analysis.

4 Fuel storage and handling facilities are not sources of PM emissions.

5 Includes the Central Heating and Cooling Plant, emergency electricity generation, fire training, snow melters, and other stationary sources.

Greenhouse Gas (GHG) Assessment

GHGs are known to contribute to climate change, although there is still some uncertainty regarding the global magnitude of this impact and the associated short- and long-term remedies. In April 2009, EPA issued a proposed finding that GHGs also contribute to air pollution that may endanger public health or welfare. This action has laid the initial legal groundwork for the regulation of GHG emissions nation-wide under CAA, although currently there are no specific U.S. laws or regulations that call for the regulation of GHGs for airports directly.[11] Current estimates of aviation-related GHG emission contributions to man-made totals range from 2 to 4 percent world-wide, and approximately 3 percent in the United States.[12,13]

In May 2010, the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) revised the *Massachusetts Environmental Policy Act (MEPA) Greenhouse Gas Emissions Policy and Protocol*.[14] Under the revised policy, certain projects subject to review under MEPA (though not these annual EDR/ESPR filings) are required to:

- Quantify GHG emissions generated by a proposed project; and
- Identify measures to avoid, minimize, or mitigate such emissions.[15]

With respect to this *2016 EDR* GHG emissions inventory[16] the following information is noteworthy:

- Even though the *2016 EDR* is not subject to the MEPA GHG policy, since it does not propose any discrete projects, Massport continues to voluntarily prepare an inventory of GHG emissions both directly and indirectly associated with the Airport starting with the *2007 EDR*.
- The emission source categories in the *2016 EDR* satisfy MEPA's requirement to analyze the environmental impacts of direct and indirect mobile and stationary source emissions.
- Consistent with previous years, the 2016 GHG emissions inventory was prepared following methodological guidance by the Transportation Research Board's (TRB) Airport Cooperative Research

11 GHG emission reduction measures have been adopted by the EPA for new aircraft engines, but these regulations do not apply directly to airports.

12 Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, New York City, NY. November 2014.

13 U.S. Governmental Accountability Office (GAO), Aviation and the Environment, NextGen and Research and Development Are Keys to Reducing Emissions and Their Impact on Health and Climate, May 6, 2008.

14 Revised MEPA Greenhouse Gas Emissions Policy and Protocol, Massachusetts Executive Office of Energy and Environmental Affairs, effective May 5, 2010.

15 These GHG are comprised primarily of carbon dioxide (CO_2), methane (CH_4), nitrous oxides (N_2O), and three groups of fluorinated gases (i.e., sulfur hexafluoride [SF_6], hydrofluorocarbons [HFCs], and perfluorocarbons [PFCs]). GHG emission sources associated with airports are generally limited to CO_2, CH_4, and N_2O.

16 This EDR GHG inventory is one of the three that Massport prepares annually; however, the other two comprise only stationary sources of GHGs and are filed with MassDEP and the EPA respectively. These reports are for Massport-owned and -operated equipment only, and do not cover any tenant owned/operated-equipment or facilities.

Program (ACRP).[17] The inventory assigns GHG emissions based on ownership or control (whether it is controlled by Massport, the airlines or other airport tenants, or the general public).

- The 2016 GHG emissions inventory includes aircraft operations within the ground-based taxi-idle/delay mode and up to the top of the 3,000–foot LTO cycle. For estimating GHGs, the LTO cycle (up to 3,000 feet) uses the default mixing height in EDMS and AEDT. GHG emissions associated with GSE/APU, motor vehicles, a variety of stationary sources, and electricity usage were also included.
- Massport has direct ownership or control over a small percentage of the GHG emission sources (which include Massport fleet vehicles, stationary sources, and electrical consumption within Massport buildings). The vast majority of the emission sources are owned or controlled by the airlines, other airport tenants (such as rental car companies), and the general public (such as passenger motor vehicles).
- Massport also prepares two other GHG emissions inventories for stationary sources at Logan Airport:
  - A GHG emissions inventory for the MassDEP GHG Emissions Reporting Program for those sources meeting the criteria for Category 1 and Scope 1 (only those sources under the direct ownership and control of Massport);[18] and
  - EPA Greenhouse Gas Summary Report.[19]

This EDR analysis followed EEA guidelines and uses widely-accepted emission factors that are considered appropriate for airports, including International Organization for Standardization (ISO) New England electricity-based values. The analysis is also consistent with ACRP guidance.

For consistency and comparative purposes, GHG emissions are segregated by ownership and control into categories. These three categories (listed in **Table 7-10**) are further characterized by the degree of control that Massport has over the GHG emission sources.

- **Category 1: Massport Owned** – By definition, these GHG emissions arise from sources that are owned and controlled by the reporting entity (in this case, Massport). More precisely, Category 1 typically represents sources which are owned by the entity - or sources which are not owned by the entity, but over which the entity can exert control. At Logan Airport, these sources include Massport-owned and controlled stationary sources (boilers, generators, etc.), fleet vehicles, and purchased electricity. On-airport ground transportation and off-airport employee vehicle trips are also included as Category 1 emissions as they are partly controlled by the airport.
- **Category 2: Tenant Owned** – This category comprises sources owned and controlled by airlines and airport tenants, and include aircraft (on-ground taxi/idle and within the LTO up to 3,000 feet), GSE/APU, electrical consumption, and tenant employee vehicles.
- **Category 3: Public/Private Owned** – This category comprises GHG emissions associated with passenger ground access vehicles. These include private automobiles, taxis, limousines, buses, and shuttle vans operating on the off-airport roadway network.

17 Transportation Research Board, Airport Cooperative Research Program, ACRP Report 11, Project 02-06, *Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories*. http://onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_011.pdf.
18 Boston-Logan International Airport, Massachusetts Department of Environmental Protection GHG Emissions Reporting Program, 2017.
19 U.S. EPA Greenhouse Gas Summary Report for Boston-Logan International Airport for calendar year 2016.

Consistent with ACRP guidelines, the operational boundaries of the GHG emissions are also delineated, reflecting the scope of the emission source (**Table 7-10**) and include:

- **Scope 1/Direct** – GHG emissions from sources that are owned and controlled by the reporting entity (in this case, Massport) such as stationary sources and airport-owned fleet motor vehicles.
- **Scope 2/Indirect** – GHG emissions associated with the generation of electricity consumed, but generated off-site at public utilities.
- **Scope 3/Indirect and Optional** – GHG emissions that are associated with the activities of the reporting entity (in this case, Massport), but are associated with sources that are owned and controlled by others. These include aircraft-related emissions, emissions from airport tenant's activities, as well as ground transportation to and from the airport.

It is also important to note that the GHG emissions inventory computed for this *2016 EDR* is consistent with the data provided by Massport for the MassDEP and EPA GHG inventories for Logan Airport. However, the *2016 EDR* emissions inventory presented to MEPA is more comprehensive, as it covers all three scopes of GHG emissions including those from tenants and the public.[20] By comparison, the EPA GHG Reporting Program covers only stationary sources (Category 1 and Scope 1).

Table 7-11 presents the 2016 GHG emissions inventory, reported in CO_2 equivalent values.[21] As shown, Massport-controlled emissions represent only 12.4 percent of total GHG emissions at the Airport. By comparison, aircraft, GSE, and other tenant-based emissions represent 70.0 percent, purchased electricity represents 8.3 percent, and passenger ground access vehicle emissions represents 9.3 percent of total GHG emissions. Aircraft represent the largest source of emissions followed by motor vehicles and electricity generation as shown in **Figure 7-9**.

When segregated by scopes, aircraft, GSE, and passenger vehicles (Scope 3) represent the largest source of GHG emissions at 79.3 percent, with electrical consumption (Scope 2) at 8.3 percent, and Massport-controlled sources (Scope 1) at 12.4 percent (refer to **Figure 7-9**).

Overall, total GHG emissions in 2016 increased by 2.8 percent from 2015 levels. Comparing the 2016 EDMS results and the 2016 AEDT results, aircraft-related GHG emissions increased by 2.8 percent. The increase from 2015 to 2016 is largely due to differences in the operational mode calculations between EDMS and AEDT. Total Logan Airport GHG emissions remained less than 1 percent of state-wide emissions as shown in **Figure 7-10**. Massport plans to continue to annually update this GHG Emissions Inventory for Logan Airport.

20 However, aircraft cruise mode emissions above the 3,000-foot LTO cycle were not included.

21 CO_2 equivalent values are based upon the Global Warming Potential values of 1 for CO_2, 28 for CH_4, and 265 for N_2O (based on a 100-year period) as presented in the IPCC Fifth Assessment Report (2014).

Table 7-10 Ownership Categorization and Emissions Category/Scope

Owning/Controlling Entity Categories	Source	Category/Scope
Massport Owned and/or Controlled	Massport Fleet Vehicle	Category 1/Scope 1
	On-airport Ground Transportation	Category 1/Scope 1
	Off-airport Employee Vehicle Trips	Category 1/Scope 3
	On-airport Parking Lots	Category 1/Scope 1
	Stationary Sources (includes generators, boilers, etc.)	Category 1/Scope 1
	Fire Training	Category 1/Scope 1
	Electrical Consumption	Category 1/Scope 2
Tenant Owned and/or Controlled (includes airlines, government, concessionaires, aircraft operators, fixed-based operators, etc.)	Aircraft (on-ground, within the LTO up to 3,000 feet)	Category 2/Scope 3
	Auxiliary Power Units	Category 2/Scope 3
	Ground Support Equipment	Category 2/Scope 3
	Off-airport Employee Vehicle Trips	Category 2/Scope 3
	Electrical Consumption	Category 2/Scope 2
Public Owned and Controlled	Off-airport Vehicle Trips (Includes private automobiles, taxis, limousines, buses, shuttle vans, etc., operating on the off-airport roadway network)	Category 3/Scope 3

Notes: Follows ACRP guidance.
LTO Landing and Takeoff.

Table 7-11 Estimated Greenhouse Gas Emissions Inventory (in MMT of CO_2eq) at Logan Airport, 2016[1]

Source	Category	Scope	CO_2	N_2O	CH_4	Totals
Massport-Controlled Emissions						
Ground Support Equipment[2]	1	1	0.01	<0.01	<0.01	0.01
Massport Shuttle Bus	1	1	<0.01	<0.01	<0.01	<0.01
Massport Express Bus	1	1	<0.01	<0.01	<0.01	<0.01
On-Airport Roadways[3]	1	1	0.03	<0.01	<0.01	0.03
Off-Airport Roadways (Employees)[4]	1	3	<0.01	<0.01	<0.01	<0.01
Parking Lots	1	1	0.01	<0.01	<0.01	0.01
Stationary Sources[5]	1	1	0.03	<0.01	<0.01	0.03
Total Massport Emissions (12.4%)			**0.08**	**<0.01**	**<0.01**	**0.08**
Tenant Emissions						
Aircraft – Ground[6]	2	3	0.19	<0.01	<-[11]	0.19
Aircraft – Ground to 3000 feet[7]	2	3	0.21	<0.01	<0.01	0.22
Aircraft Engine Startup	2	3	<0.01	<0.01	<0.01	<0.01
Ground Support Equipment	2	3	0.01	<0.01	<0.01	0.01
Auxiliary Power Units	2	3	0.01	<0.01	-[11]	0.01
Off-Airport Roadways (Employees)[4]	2	3	0.03	<0.01	<0.01	0.03
Total Tenant Emissions (70.0%)			**0.45**	**<0.01**	**<0.01**	**0.46**
Purchased Electricity Emissions[8]						
Massport	1	2	<0.01	<0.01	<0.01	0.01
Tenant and Common Area	2 and 3	2	0.05	<0.01	<0.01	0.05
Total Purchased Electricity Emissions (8.3%)			**0.05**	**<0.01**	**<0.01**	**0.05**
Passenger Vehicle Emissions						
Off-Airport Roadways[4]	3	3	0.06	<0.01	<0.01	0.06
Total Passenger Vehicle Emissions (9.3%)			**0.06**	**<0.01**	**<0.01**	**0.06**
Total Logan Airport Emissions[9]			**0.65**	**<0.01**	**<0.01**	**0.65**
Percent of Statewide Totals[10]			<1.0%	<1.0%	<1.0%	<1.0%

Source: Massport
Notes:

1 MMT - million metric tons of CO_2 equivalents (1 MMT = 1.1M Short Tons). CO_2 equivalents (CO_2eq) are bases for reporting the three primary GHGs (e.g., CO_2, N_2O, and CH_4) in common units. Quantities are reported as "rounded" and truncated values for ease of addition.

2 Ground Support Equipment include the Logan Airport fleet. Emissions were calculated based on fuel usage.

3 On-airport roadways based on on-site vehicle miles traveled (VMT) and includes all vehicles.

4 Off-site roadways based on off-site Airport-related VMT and an average round trip distance of 60.5 miles (2010 Passenger Ground Access Survey).

5 Other sources include Central Heating and Cooling Plant, emergency generators, snow melters, and live fire training facility.

6 Aircraft – Ground emissions include taxi-in, taxi-out and ground-based delay emissions based on AEDT fuel usages.

7 Aircraft – Ground to 3,000 feet include takeoff, climb out, and approach emissions up to a height of 3,000 feet based on AEDT fuel usages.

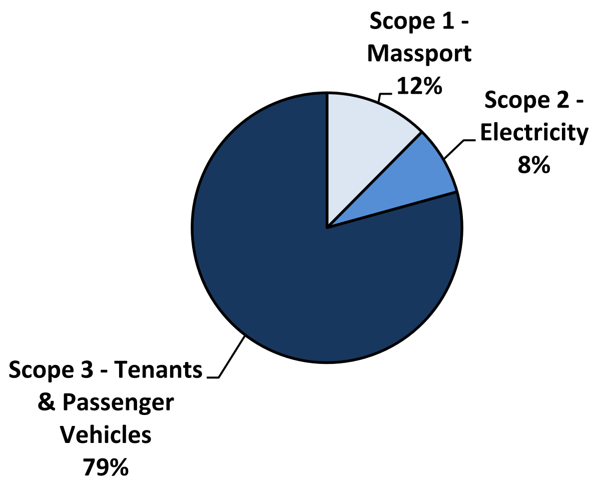
8 Emissions from electrical consumption occurs off-airport at power generating plants.

9 Total Emissions = Airport + Tenant + Public.

10 Percentage based on relative amount of total emissions to statewide total from World Resources Institute (cait.wri.org).

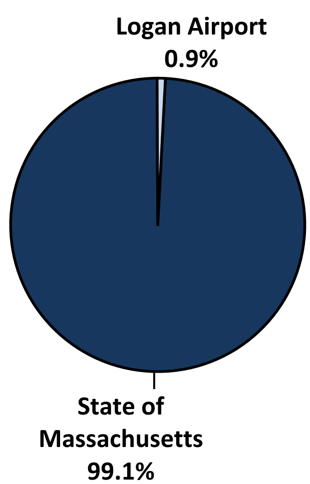
11 Contributions of CH_4 emissions from commercial aircraft are reported as zero. Years of scientific measurement campaigns conducted at the exhaust exit plane of commercial aircraft gas turbine engines have repeatedly indicated that CH_4 emissions are consumed over the full emission flight envelope [Reference: Aircraft Emissions of Methane and Nitrous Oxide during the Alternative Aviation Fuel Experiment, Santoni et al., Environ. Sci. Technol., July 2011, Volume 45, pp. 7075-7082]. As a result, the EPA published that: "…methane is no longer considered to be an emission from aircraft gas turbine engines burning Jet A at higher power settings and is, in fact, consumed in net at these higher powers." [Reference: EPA, Recommended Best Practice for Quantifying Speciated Organic Gas Emissions from Aircraft Equipped with Turbofan, Turbojet, and Turboprop Engines, May 27, 2009 [EPA-420-R-09-901], http://www.epa.gov/otaq/aviation.htm]. In accordance with the following statements in the 2006 IPCC Guidelines (IPCC 2006), FAA does not calculate CH_4 emissions for either the domestic or international bunker commercial aircraft jet fuel emissions inventories. "Methane (CH_4) may be emitted by gas turbines during idle and by older technology engines, but recent data suggest that little or no CH_4 is emitted by modern engines." "Current scientific understanding does not allow other gases (e.g., N_2O and CH_4) to be included in calculation of cruise emissions." (IPCC 1999).

Figure 7-9 Sources of GHG Emissions, 2016



Source: Massport and KBE 2017.
Notes: Scope 1 emissions are from sources that are owned or controlled by Massport, Scope 2 emissions are from electrical consumption, which are generated off-Airport at power generating plants, and Scope 3 emissions are from aircraft, GSE, and ground transportation to and from the Airport.

Figure 7-10 Logan Airport GHG Emissions Compared to State-Wide Emissions



Source: World Resources Institute, Massport, and KBE 2017.

Table 7-12 provides GHG data for Logan Airport from 2007 through 2016, by source and by comparison to statewide totals.

Table 7-12 Comparison of Estimated Total Greenhouse Gas (GHG) Emissions (MMT of CO2eq) at Logan Airport – 2007 through 2016

Source	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Direct Emissions[2]										
Aircraft[3]	0.22	0.21	0.19	0.18	0.19	0.19	0.19	0.20	0.21	0.19
GSE/APUs	0.08	0.08	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01
Motor vehicles[4]	0.03	0.03	0.03	0.03	0.04	0.03	0.05	0.05	0.05	0.05
Other sources[5]	0.04	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
Total Direct Emissions	0.37	0.35	0.27	0.27	0.28	0.26	0.29	0.29	0.32	0.29
Indirect Emissions[6]										
Aircraft[7]	0.18	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.22
Motor vehicles[8]	0.05	0.05	0.05	0.05	0.06	0.05	0.08	0.07	0.08	0.09
Electrical consumption[9]	0.09	0.08	0.07	0.07	0.08	0.08	0.06	0.06	0.06	0.05
Total Indirect Emissions	0.32	0.30	0.29	0.29	0.30	0.30	0.31	0.30	0.32	0.36
Total Emissions[10]	0.69	0.65	0.56	0.56	0.58	0.57	0.60	0.60	0.63	0.65
Percent of State Totals[11]	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Sources: Massport and KBE.

Notes:

1 MMT – million metric tons of CO_2 equivalents (1 MMT = 1.1M Short Tons). CO_2 equivalents (CO_2eq) are bases for reporting the three primary GHGs (e.g., CO_2, N_2O and CH_4) in common units. Quantities are reported as "rounded" and truncated values for ease of addition.

2 Direct emissions are those that occur in areas located within the Airport's geographic boundaries.

3 Direct aircraft emissions based engine start-up, taxi-in, taxi-out and ground-based delay emissions.

4 Direct motor vehicle emissions based on on-site vehicle miles traveled (VMT).

5 Other sources include Central Heating and Cooling Plant, emergency generators, snow melters and live fire training facility.

6 Indirect emissions are those that occur off the Airport site.

7 Indirect aircraft emissions are based on take-off, climb-out and landing emissions which occur up to an altitude of 3,000 ft., the limits of the LTO cycle.

8 Indirect motor vehicle emissions based on off-site Airport-related VMT and an average round trip distance of approximately 60 miles.

9 Electrical consumption emissions occur off-airport at power generating plants.

10 Total Emissions = Direct +Indirect.

11 Percentage based on relative amount of Airport total of direct emissions to statewide total from World Resources Institute (cait.wri.org).

GHG Emissions Normalized by Passengers and Building Area

In response to the March 9, 2018 Certificate from the Secretary of the Executive Office of Energy and Environmental Affairs on the *2016 EDR Notice of Project Change*, Massport has augmented its GHG reporting to include the following metrics:

- GHG emissions (Scopes 1 and 2) per passenger (lbs CO_2e);
- Building energy use intensity (kBTU per square foot); and
- Building GHG emissions per square foot (lbs CO_2e per square foot).

As shown in **Table 7-12**, total GHG emissions at Logan Airport have remained relatively constant over the past 10 years while the number of passengers passing through the Airport have increased by over 29 percent. The total square footage of Logan Airport buildings has also increased over this time-period to more efficiently accommodate growing passenger levels. Normalizing the data by number of passengers and square feet shows that Logan Airport's energy efficiency has increased over time.

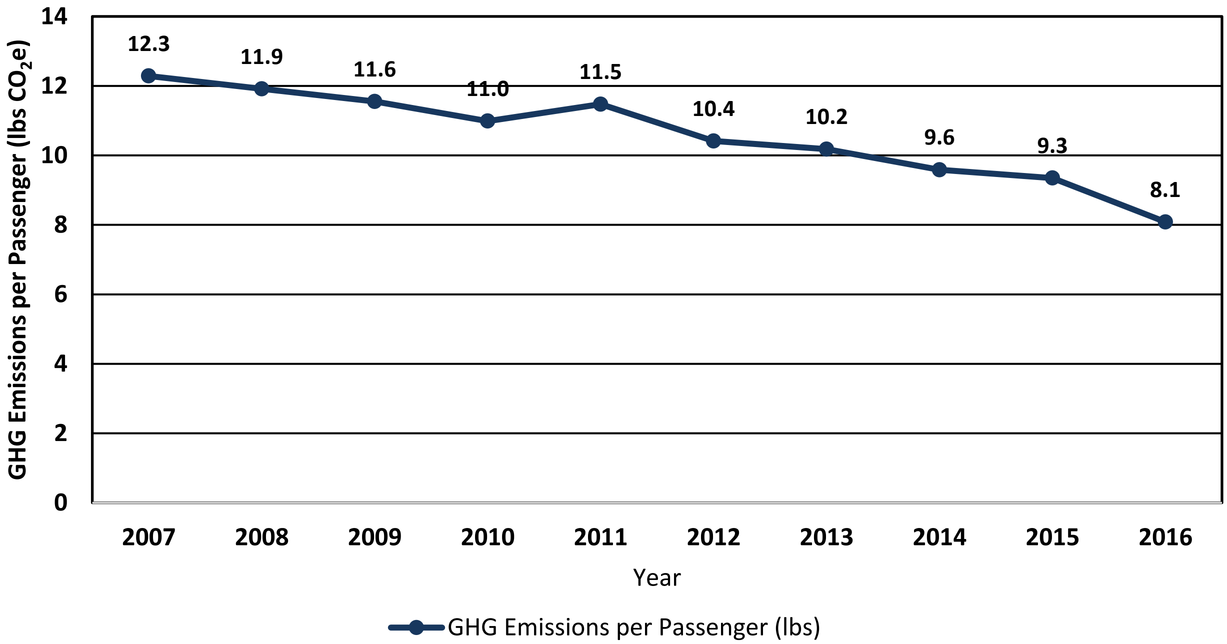
GHG emissions per passenger have decreased by over 34 percent from 2007 to 2016. **Figure 7-11** includes Scopes 1 and 2 emissions only; these emissions are from sources that are owned or controlled by Massport or are from on-Airport electrical consumption.

Figure 7-12 shows Logan Airport's building energy use intensity, which is a measure of energy consumption per square foot. Logan Airport's energy use intensity has decreased by over 23 percent from 2007 to 2016. **Figure 7-13** shows Logan Airport's building GHG emissions per square foot, which has decreased by over 43 percent from 2007 to 2016.

These figures demonstrate that Logan Airport is operating more efficiently over time, shifting to cleaner fuel sources, and serving more passengers in a larger building footprint with less energy. The following Massport initiatives have contributed to this success:

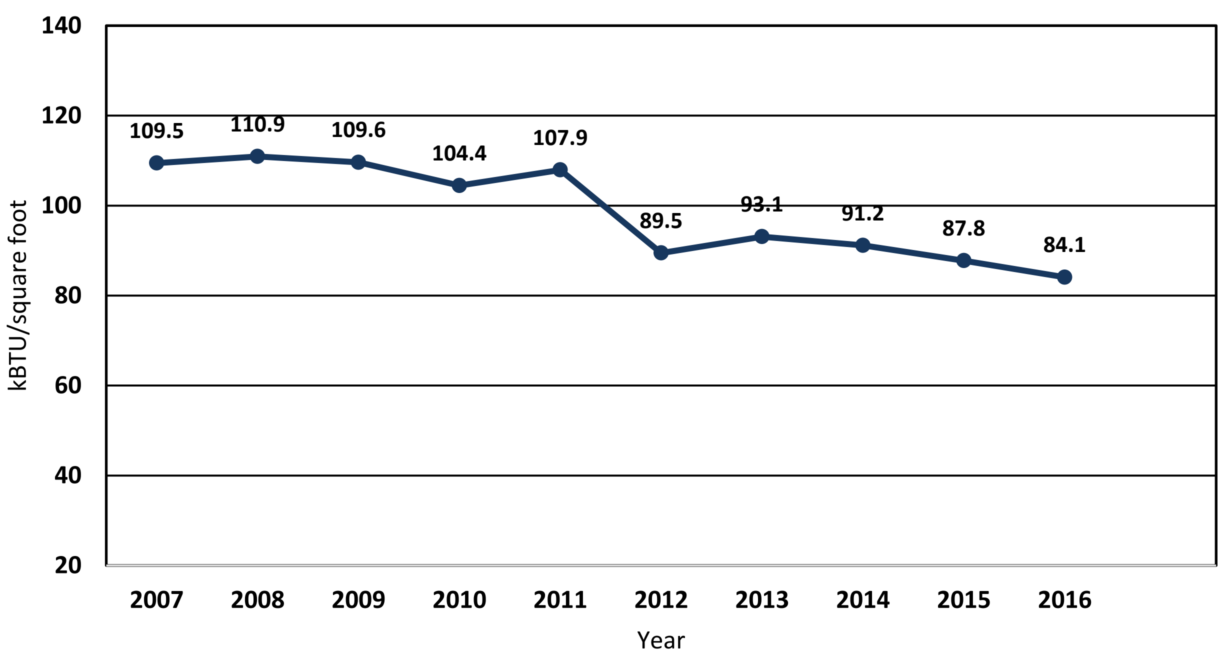
- Commitment to Sustainable Design Standards and Guidelines;
- Constructing and operating facilities to LEED standards;
- Ongoing energy efficiency projects, such as converting to light-emitting diode (LED) lighting and upgrading to energy-efficient heating, ventilation, and air conditioning (HVAC) equipment; and
- Installation of on-site renewable energy sources, including solar and wind.

Figure 7-11 Greenhouse Gas Emissions (Scopes 1 and 2) per Passenger (lbs CO_2e), 2007-2016



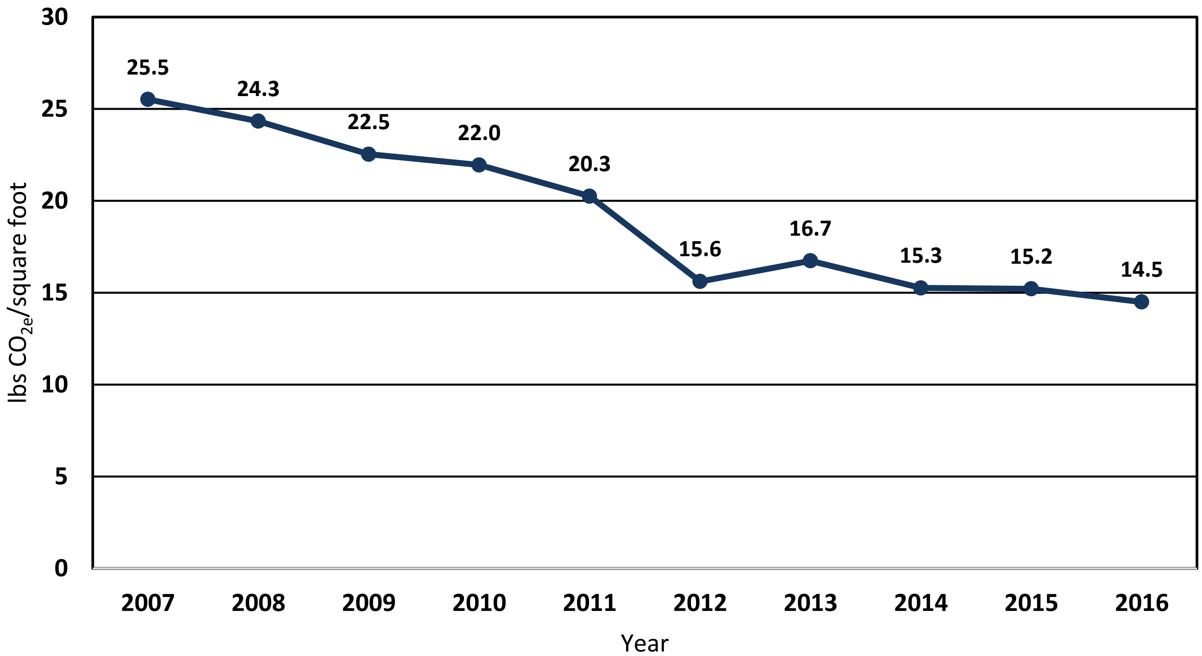
Source: Massport.
Note: Includes Scopes 1 and 2 data as shown in Table 7-12.

Figure 7-12 Building Energy Use Intensity (kBTU/Square Foot), 2007-2016



Source: Massport.
Note: kBTU = thousand British thermal units.

Figure 7-13 **Building Greenhouse Gas Emissions (lbs CO_2e) per Square Foot, 2007-2016**



Source: Massport.

Air Quality Emissions Reduction

As part of implementing and advancing its ongoing air quality management strategy for Logan Airport, Massport has established a number of goals and objectives to address air emissions from Airport operations, including the minimization of Airport-related emissions through the reduction of ground service equipment (GSE) and Massport vehicle fleet emissions. This section presents an update on these initiatives at Logan Airport.

Alternative Fuel Vehicles Program

A component of Massport's Air Quality Management Program is the AFV Program. The AFV Program is designed to replace Massport's conventionally-fueled fleet with alternatively fueled or powered vehicles, when feasible, to help reduce emissions associated with Logan Airport operations. Massport now operates 99 vehicles powered by CNG, propane, E85 flex fuel, or operates hybrids powered by gasoline or diesel. Massport also established a vehicle procurement policy in 2006 that requires consideration of AFVs when purchases are made. For example, beginning in 2013, as part of the Southwest Service Area (SWSA) redevelopment, the existing fleet of diesel rental car shuttle buses was replaced by CNG or clean diesel-electric hybrid buses. For 2016, one additional CNG NABI bus was put into service, and two CNG pick-up trucks, one propane forklift, and three E85 flex fuel pick-up trucks were retired. **Table 7-13** shows the number of Massport AFVs by vehicle type in 2016. As discussed in Chapter 1, *Introduction/Executive Summary,* several projects and programs support AFVs at Logan Airport including:

- The replacement of 94 diesel rental car buses and older CNG buses with a fleet of 54 alternative fuel (diesel-electric hybrids and CNG) buses, serve the new Rental Car Center (RCC), Massport terminals, and other airport shuttle routes. Partially funded by FAA's Voluntary Airport Low Emissions (VALE) Program grant, one additional CNG bus was also put into service in 2016.
- Operation for almost two decades of one of the largest privately operated, publicly accessible, CNG stations in New England. In 2016, the station dispensed approximately 22,650 gasoline-equivalent gallons per month for Massport vehicles.
- The use of battery powered tugs and belt loaders for the Delta Air Lines ground service fleet at Terminal A.
- A total of 125 electric GSE (or eGSE) in service at Logan Airport. As part of its long-range emission reduction strategy, Massport is working with the airlines to replace 25 percent of all GSE with electric alternatives by 2022, and 100 percent by 2027.
- Installation of 13 electric vehicle-charging stations to accommodate a total of 26 vehicles in the Central Garage and Terminal B parking areas. There are also two charging stations at the new Framingham Logan Express Garage.
- Continued operation of Massport's "Clean-Air-Cab" incentive program for AFVs, which allows hybrid or alternative fuel taxis to go to the head of the taxi line to serve passengers.

In addition, Logan Airport's Green Bus Depot is designed to maintain the expanded CNG-fueled and clean diesel-electric hybrid shuttle bus fleet. Since 2007, Massport also offers preferred parking for customers driving hybrid and AFVs.

Table 7-13 Massport's Alternative Fuel Vehicle Fleet Inventory at Logan Airport

Fuel Type	Vehicle	2016
Diesel/Electric Hybrid	Shuttle Bus[1]	32
Compressed Natural Gas (CNG)	Van	3
	Pick-Up Truck	3
	Honda Civic	9
	CNG NABI Bus[2]	22
Gasoline/Electric Hybrid	Ford Escape	2
Propane	Non-Road Vehicles (Forklifts)	1
E85 Flex Fuel	Pick-Up Truck	18
	Van	2
	Ford Escape	2
	Total	**94**

Source: Massport.
Notes:
1 The 32 diesel/electric hybrid shuttle buses, added to the fleet in 2013, replaced the diesel rental car buses.
2 The CNG NABI buses replaced the 26 aging CNG shuttle buses.

Air Quality Management Goals

Massport's air quality management strategy for Logan Airport focuses on decreasing emissions, when feasible, from all Airport-related sources, in addition to furthering innovative means to achieve emissions reductions Airport-wide. Massport's air quality improvement goals, the measures proposed to accomplish them, and some of the 2016 milestones are listed in **Table 7-14**.

Massport continues to comply with the Logan Airport Parking Freeze,[22] in accordance with 10 CMR 7.30 and 40 CFR 52.1135. Chapter 5, *Ground Access to and from Logan Airport* provides detailed discussion of Massport's compliance with the Parking Freeze regulation, and the counterproductive effect of constrained parking at Logan Airport on VMT and associated emissions.

Table 7-14 Air Quality Management Strategy Status

Air Quality Emissions Reduction Goals	Plan Elements	2016 Status
Reduce emissions from Massport fleet vehicles	Convert Massport fleet vehicles to electricity or compressed natural gas (CNG) by retrofitting or procurement.	Massport uses the Energy Policy Act (EPAct) of 1992 to expedite its Alternative Fuel Vehicle (AFV)/Alternative Power Vehicle (APV) program. In 2016, one additional CNG NABI bus was acquired.
Encourage use of alternative fuel and alternative power vehicles by private fleet and airside service vehicle owners	Provide infrastructure to support alternative fuels including CNG and electricity.	Massport continues to operate one of New England's largest retail CNG stations, which is open to the public. In calendar year 2016, the CNG station pumped approximately 22,650-gallon equivalents per month for all Massport fleet vehicles (non-Massport vehicles were also using CNG). Massport plans to support the current and future standard systems for plug-in electric vehicles (EVs). For example, the Rental Car Center (RCC) in the Southwest Service Area (SWSA) includes the infrastructure necessary to accommodate future plug-in stations for electric vehicles. In 2012, Massport installed 13 electric vehicle charging stations to accommodate a total of 26 vehicles in the Central Garage and Terminal B parking areas. There are also two charging stations at the new Framingham Logan Express Garage.
	Work with ground access fleet and airside service-vehicle owners to encourage conversion.	Massport encourages conversion to AFVs/APVs by others through such policies as 50 percent discounts in AFV/APV ground access fees to limousines, vans, and buses; limited "front-of-line" taxi pool privileges to hybrid and AFVs/APVs; and preferred parking for hybrid and AFVs/APVs at Logan Airport parking facilities.

22 310 Code of Massachusetts Regulations 7.30 and 40 Code of Federal Regulations 52.1120.

Table 7-14 Air Quality Management Strategy Status (Continued)

Air Quality Emissions Reduction Goals	Plan Elements	2016 Status
Minimize emissions from motor vehicles	Implement a program to increase high occupancy vehicle (HOV) ridership by air passengers.	As described in detail in Chapter 5, *Ground Access to and from Logan Airport,* there are a number of HOV services serving Logan Airport that are aimed at air passengers, including the Massachusetts Bay Transportation Authority (MBTA) Blue Line and Sliver Line, Logan Express, and water transportation. Massport promotes the use of these services by employees, primarily through the Logan Airport Employee Transportation Management Association (Logan TMA) and various pricing incentives.
	Expand the Logan TMA for Airport employees.	Massport continues to provide commuting information to all Airport employees including Sunrise and Logan Express Shuttles with reductions in employee parking. Logan Express extended service now provides nearly 24-hour service at several Logan Express locations, with discounts provided to employees.
	Encourage employees to use bicycling as a mode of commuting.	Massport includes bike racks at all new facilities and at appropriate existing facilities to promote employees biking to work. Bicycle racks are currently provided at Terminal A, Terminal E, Logan Office Center, MBTA's Airport Station, Economy Parking Garage, Signature general aviation facility, and the Green Bus Depot (Bus Maintenance Facility). Additional racks were installed at the RCC facility in 2014.
Minimize emissions from Construction Equipment	Incorporate Clean Air Construction Initiative (CACI) into major earthwork construction projects.	For all large construction projects, heavy construction equipment is required to be equipped with diesel particulate filters or diesel oxidation catalysts in accordance with CACI.
Reduce emissions from fuel vapor loss	Provide state-of-the-art fuel storage and distribution equipment.	The Fuel Storage and Distribution System is in operation.
	Implement Tank Management Program.	Refer to Chapter 8, *Water Quality/Environmental Compliance and Management* provides details regarding tank management focuses on proper maintenance.

Table 7-14 Air Quality Management Strategy Status (Continued)

Air Quality Emissions Reduction Goals	Plan Elements	2016 Status
Reduce emissions from stationary sources	Employ Reasonable Available Control Technologies (RACT) for NO_x at Central Heating and Cooling Plant.	RACT policies have been implemented.
	Use alternative fuels in snow melters.	Massport is required to use Ultra Low Sulfur Diesel fuel in all Massport snow melting equipment. Massport installed two new stationary snow melters using natural gas in 2016 and will install two additional snow melters in 2018. These installations will reduce the need for Ultra Low Sulfur Diesel fuel fired portable snow melters.
	Incorporate green building technologies and energy use reduction strategies.	Logan Airport has five U.S. Green Building Council (USGBC)'s Leadership in Energy and Environmental Design (LEED®) certified facilities. Terminal A (the first LEED® certified terminal in the world), the Signature Flight Support GA Facility, the Green Bus Deport (LEED® Silver certified), and the RCC (LEED® Gold), and a recently renovated portion of Terminal E (LEED® Gold). An overview of sustainability initiatives is presented in Chapter 1, *Introduction/Executive Summary*.
	Install diesel particulate filters on large emergency generators	Massport has voluntarily installed diesel particulate filters on all large (>500 kilowatts) stationary emergency generators beginning in 2011.
Reduce aircraft emissions	Work with FAA to study and implement airfield-improvement concepts and operational changes that may have air quality benefits.	Massport promoted such concepts through the *Logan Airside Improvements Planning Project Environmental Impact Statement*, which recommended physical and operational improvements to Logan Airport including construction of the new Runway 14-32 and Centerfield Taxiway, and taxiway improvements. Runway 14-32 became operational in November 2006 and the Centerfield Taxiway was fully opened in summer of 2009. In addition, in coordination with Massport, the Massachusetts Institute of Technology (MIT) completed a detailed survey of pilots at Logan Airport to better understand the use of single engine taxiing and issued a paper in March 2010, and in January 2011, MIT issued a paper on aircraft pushback control strategy to reduce congestion and taxi delay.
Reduce aircraft emissions (Continued)	Use of pre-conditioned air at new and renovated terminals and terminal gates.	The majority of contact gates have pre-conditioned air and/or 400-Hz power. This reduces the need for auxiliary power unit (APUs) and, consequently, reduces associated emissions. The recent improvements of Terminal B included the installation of pre-conditioned air at all renovated gates.

Table 7-14 Air Quality Management Strategy Status (Continued)

Air Quality Emissions Reduction Goals	Plan Elements	2016 Status
Reduce energy intensity and greenhouse gas emissions while increasing portion of Logan Airport's energy generated from renewable sources	Reduce energy consumption Increase the portion of Massport's energy being generated from renewable sources Reduce overall GHG emissions associated with energy consumed in Massport operated facilities at Logan Airport Reduce GHG emissions from Massport-operated mobile sources	This goal was identified as part of the Logan Airport Sustainability Management Plan (SMP)[1], which was released in April 2015. Progress on this goal will be reported in future sustainability reports.

Notes:

1 Progress towards goals identified as part of the Logan Airport Sustainability Management Plan (SMP) will be reported separately, as part of Massport's annual sustainability reporting.

Updates on Other Air Quality Efforts

This section further highlights other Logan Airport-related air quality efforts in 2016.

Massachusetts Department of Public Health Study

In 2004, the Massachusetts Legislature appropriated funds for the Department of Public Health (DPH) to undertake an assessment of potential health impacts of Logan Airport in the East Boston section of the city and any other communities located within a five-mile radius of the Airport, with a focus on noise and air quality. This study was completed in May 2014 and consisted of an epidemiological survey combined with computer modeling of noise levels and air pollution concentrations. Massport has cooperated in this effort by providing funding to complete the study and Airport operational data in support of the study. In the spring of 2011, Massport also gave technical assistance in support of the DPH study by providing geographic information systems (GIS) analysis of the roadway network in and around Logan Airport in a format compatible with FAA's EDMS. Massport is working with DPH and East Boston Health Center on implementing DPH recommendations related to Massport.

In response to the DPH study recommendations, Massport has:

- Entered into an agreement to provide funding to The East Boston Neighborhood Health Center to help expand the efforts of their Asthma and Chronic Obstructive Pulmonary Disease (COPD) Prevention and

Treatment Program in East Boston and launch a program in Winthrop including screening children, providing asthma kits, and home visits, among others.

- Entered into an agreement with the Massachusetts League of Community Health Centers for the evaluation and assessment of the Asthma and COPD Prevention and Treatment Program, and engagement of community health centers in the North End, Charlestown, Chelsea, and South Boston. The East Boston Neighborhood Health Center will conduct the same evaluations for the East Boston and Winthrop community programs.
- Entered into an agreement with DPH to expand or establish the Asthma and COPD Prevention and Treatment Program in South Boston, the North End, Chelsea, and Charlestown in collaboration with the Massachusetts General Hospital, South Boston Neighborhood Health Center, and conduct training on the Community Health Worker assessments.

The findings from this study can be viewed from DPH website at: http://www.mass.gov/eohhs/docs/dph/environmental/investigations/logan/logan-airport-health-study-final.pdf.

Massport Air Quality Monitoring Study

Massport has also completed a $1.6 million air quality monitoring study in and around Logan Airport in compliance with its MEPA Section 61 findings for the Centerfield Taxiway component of the Logan Airside Improvements Project. The study gathered air quality data in the communities around Logan Airport before and after the new Centerfield Taxiway became operational, with an emphasis on ambient (or "outdoor") levels of particulate matter and hazardous air pollutants (HAPs). The intent of the study was to assess potential air quality changes related to the operation of the new taxiway. Massport worked cooperatively with MassDEP and DPH to develop the scope of the monitoring study.

Air monitoring commenced in 2007 at ten different stations located on and off the Airport. The monitoring comprised both real-time and time-integrated monitoring methods, and includes measurement of fine particulates, VOCs, carbonyls, black carbon, and polynuclear aromatic hydrocarbons (PAHs). Massport also met periodically with MassDEP and DPH regarding the progress and results of the air monitoring.

The first year of the two-year study was completed September 2008 and the second phase concluded in September 2011 following the completion of the Centerfield Taxiway, which is now fully operational. The report is posted on Massport's website. For details on the study see Massport's website at: http://www.massport.com/massport/business/capital-improvements/sustainability/air-quality/.

Single Engine Taxiing

Single engine taxiing is one measure that is being used by air carriers to help reduce fuel use and emissions. As a result, Massport supports the use of single engine taxiing when it can be done safely, voluntarily and at the discretion of the pilot. Massport has conducted three surveys of Logan Airport air carriers (2006, 2009, and 2010) to understand the extent single engine taxiing is used at Logan Airport. In addition, Massport is an active member of the FAA Partnership for Air Transportation Noise and Emissions Reduction (PARTNER) program on reducing noise and emissions. In 2009, Massport offered to facilitate a more detailed survey of pilots at

Logan Airport by the Massachusetts Institute of Technology (MIT) to better understand the use of single engine taxiing. MIT completed its survey and issued a paper in March 2010, which was provided in the *2009 EDR*. The MIT survey confirms earlier Massport survey findings that single engine taxiing is an important operational measure used by airlines to conserve fuel and is extensively used at Logan Airport. MIT issued a paper in January 2011 reporting on a control strategy to minimize airport surface congestion, and thus taxiing time, by regulating the rate at which aircraft are pushed back from their gates. Also in January 2011, Massport sent a memorandum to air carriers in support of single engine taxiing when consistent with safety procedures. The memorandum highlighted best practices for single engine taxiing use based on the MIT survey findings. In May 2015, Massport sent an additional memorandum to air carriers in support of single/reduced-engine taxiing and the use of idle reverse thrust as strategies. Copies of these memoranda are provided in Appendix L, *Reduced/Single Engine Taxiing at Logan Airport Memorandum*.

MIT and the Center for Air Transportation Systems Research developed a methodology to account for single engine taxi procedures during the taxi-in or -out modes.[23,24,25] Some of the single engine taxi challenges noted in these studies include: (1) excessive thrust and associated issues (2) maneuverability problems particularly related to tight taxiways turns and weather; (3) problems starting the second engine; and (4) distractions and workload issues. Thus, pilots do not use single engine taxiing during each aircraft operation in practice, and when they do use it, it is not for the entire operation. Pilots use single engine taxiing even less often during taxi out.

When using the MIT methodology and available data (such as aircraft pilot surveys) applied to the most recent set of aircraft operational data for Logan Airport (i.e., 2016), the results show a savings of approximately 1,645,000 gallons of jet fuel and the reduction of approximately 16,200 metric tons of GHG emissions associated with this initiative.

As the design for the Terminal E Modernization Project advances, energy efficiency measures will be summarized in future EDR/ESPR filings.

Engagement in Aviation-Related Environmental Issues

Massport maintains memberships and active participation in a number of organizations involved in addressing aviation related environmental issues, including air quality. These include serving on environmental committees for TRB, the American Association of Airport Executives (AAAE), and the Airports Council International-North America (ACI-NA).

Ultrafine Particles

Within the field of air quality, airborne particles are collectively categorized as PMs and subdivided into size categories based on their diameters. These divisions are total suspended particles (TSP) with diameters ranging from 2.5 to 40 micrometers (μm), course particles (PM_{10}) with diameters ranging from 2.5 to 10 μm, fine

23 A Survey of Airline Pilots Regarding Fuel Conservation Procedures for Taxi Operations, Massachusetts Institute of Technology.
24 Opportunities for Reducing Surface Emissions through Airport Surface Movement Optimization, Massachusetts Institute of Technology, 2008.
25 Analysis of Emissions Inventory for Single Engine Taxi-out Operations, Center for Air Transportation Systems Research.

particles ($PM_{2.5}$) with diameters less than 2.5 μm, and UFPs with diameters less than 0.1 μm. The majority of these particles originate from the exhaust gases generated by fossil fuel-powered engines and other high-temperature combustion sources including aircraft.

Under CAA, EPA has established NAAQS for six criteria air pollutants including PM_{10} and $PM_{2.5}$. Outdoor concentrations within EPA standards are considered safe for the public. Presently, UFPs (by themselves) are not regulated ambient pollutants. UFPs cannot be considered a part of $PM_{2.5}$ because $PM_{2.5}$ regulates on a mass basis, and UFPs are so small by comparison, they make up a negligible mass. Any eventual UFP regulation would be a number concentration.

EPA has begun to reconsider a NAAQS for UFPs on the basis of the unique physical attributes and potential human health hazards. Under CAA, reassessments of the NAAQS for $PM_{10/2.5}$ are underway and should be finalized by 2022.[26] This would be the next opportunity to consider including UFPs among the criteria pollutants. However, the link between UFP exposure and adverse health effects, although suggestive, may not rise to the level of promulgating a new NAAQS at this time.

With respect to airport-related UFP studies, the collection of materials is limited. However, recent studies have focused on understanding UFP measurements in the vicinity of airports. Studies conducted at Zurich Airport in Switzerland and Heathrow Airport in London have demonstrated that UFP dispersion is highly dependent on wind speed and direction at the airport with UFP particle numbers being on the order of 10 times more when measured downwind of the airport.[27, 28] A study conducted at Brussels Airport demonstrated the UFP emissions from the airport can significantly impact concentrations up to 7 kilometers (4.3 miles) away from the source.[29] These studies have begun to understand the dispersion characteristics of UFPs from airports, however specific health studies to assess impacts of UFPs from airport sources have yet to be conducted. FAA conducts research through the Center for Excellence Aviation Sustainability Center (ASCENT) Program on UFPs.

Black Carbon

Particulate matter at all sizes is comprised of multiple components, one of the more significant being Black Carbon (BC). BC particles, also referred to as soot, form as a result of incomplete combustion, particularly at the higher temperatures at which aircraft burn fuel, making BC emissions common from aircraft. BC from aviation activities largely contributes to smaller PM particles (i.e., $PM_{2.5}$ and UFPs). $PM_{2.5}$ is classified as a criteria air pollutant by EPA and regulated under NAAQS.

BC is known to have negative impacts on both human health and the environment. According to EPA, BC is associated with respiratory distress, cardiovascular disease, cancer, and birth defects. A recent study using air

26 U.S. EPA Final Integrated Review Plan for the Ambient Air Quality Standards for Particulate Matter, December 2016 (https://www3.epa.gov/ttn/naaqs/standards/pm/data/201612-final-integrated-review-plan.pdf).
27 Fleuti, E., Maraini, S., Bieri, L., 2017. *Ultrafine Particle Measurements at Zurich Airport.* Flughafen Zurich AG.
28 Masiol, M., Harrison, R. M., Vu, T. V., and Beddows, D. C. S. *Sources of Submicrometre Particles Near a Major International Airport,* Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2017-150, in review, 2017.
29 Peters, J., Berghmans, P., and Frijns, E. 2016. *Ultrafine Particles and Black Carbon monitoring in the surroundings of Brussels Airport.* Brussels Environmental Agency.

quality monitors near an airport, has shown that airports can contribute to 24 to 28 percent of total BC within 4 km.[30] However, modeling studies, commonly used to ascertain the extent of impacts on human health and the environment, have shown the level of contribution by an airport to be less, only on the order of 2 to 5 percent. Researchers are working on understanding the reasons for this discrepancy. It may be an indication that emissions estimates from airports need improvement.[31]

To fully understand the extent of impacts from airport related BC emission much more research is needed. It is important for research to focus on improving emissions estimates of BC from airports and improved modeling studies. FAA conducts research through the ASCENT program on black carbon.

Statewide, National, and International Initiatives

Advancements on the national and international levels to decrease Airport-related air emissions have continued to focus primarily on three initiatives through the 2012 and 2013 time-periods: the advanced quantification of PM and HAPs emissions from aircraft engines; the continued phasing-in of AFV; and the implementation of GHG emissions reduction strategies. These initiatives are briefly described below.

- **Particulate Matter and Hazardous Air Pollutant Research -** Conducted by the International Civil Aviation Organization (ICAO), FAA, EPA, and others, research continues to better characterize PM and HAPs emissions (including lead) from aircraft engines. Similarly, air quality monitoring efforts at other airports were also conducted at various locations to advance what is known about ambient levels of these air pollutants in the vicinities of the nation's airports. Massport continues to closely track these issues through its involvement in aviation industry organizations such as ACI-NA and AAAE.
- **Alternative Fuel Vehicle Conversions—**Airlines and other GSE users are continually replacing their older fossil-fueled vehicles and equipment with more fuel-efficient, low- and non-emitting (e.g., electric) technologies. Airport-fleet vehicles are also being converted to alternative fuels (e.g., electric, propane). In response, GSE and automobile manufacturers are offering a wider selection of AFVs, many of which are designed specifically for airport use. Massport continues to support the conversion of fossil-fueled vehicles and equipment to alternative, electric, or lower-emitting fuels.
- **Participation in Massachusetts Climate Protection Plan—**Massport was one of 15 state agencies and authorities that participated in the development of the state's Climate Protection Plan, the Commonwealth's initial step towards reducing GHG emissions. Massport is participating on two of the Plan's teams: Transportation System Planning and Transportation Technologies and Operations, with a focus in GHG emission reductions associated with Airport operations. Current reduction strategies include:
  - Incorporating energy use and GHG emissions as criteria in transportation decisions;
  - Maintaining and update public transit systems;
  - Expanding programs to promote efficient travel;

30 Dodson R. E.; Houseman E. A.; Morin B.; Levy J. I. *An analysis of continuous black carbon concentrations in proximity to an airport and major roadways.* Atmos. Environ. 2009, 43243764–3773.

31 Arunachalam S.; Valencia A.; Yang D.; Davis N, Baek B.H.; Dodson R.E.; Houseman A.E.; Levy J.I.; *Comparing Monitoring-Based and Modeling-Based Approaches for Evaluating Black Carbon Contributions from a US Airport.* Air Pol. Mod. 2011, 619-623

- Seeking opportunities to reduce emissions at Logan Airport;
- Improving aircraft movement efficiency;
- Promoting the use of cleaner vehicles and fuels in public transit fleets;
- Continuing to promote the use of clean diesel equipment on publicly-funded construction projects;
- Eliminating unnecessary idling of buses; and
- Advocating for aircraft efficiency at regional and national levels.

This Page Intentionally Left Blank.

8

Water Quality/Environmental Compliance and Management

Introduction

The Massachusetts Port Authority's (Massport) approach to environmental management and compliance is a key component of its commitment to sustainability and responsible stewardship at Boston-Logan International Airport (Logan Airport or the Airport) (refer to Chapter 1, *Introduction/Executive Summary* for details). Through monitoring and documentation, environmental performance is assessed, allowing policies and programs to be developed, implemented, evaluated, and continuously improved. In October 2000, the Massport Board approved a Massport-wide Environmental Management Policy, which articulates the agency's commitment to protect the environment and to implement sustainable design principles:

> *"Massport is committed to operate all of its facilities in an environmentally sound and responsible manner. Massport will strive to minimize the impact of its operations on the environment through the continuous improvement of its environmental performance and the implementation of pollution prevention measures, both to the extent feasible and practicable in a manner that is consistent with Massport's overall mission and goals."*

Massport's overall environmental compliance and management efforts address the following goals:

- Protect water quality Airport-wide;
- Protect groundwater resources;
- Protect surface waters (Boston Harbor) and preserve coastal resources adjacent to the Airport;
- Minimize air quality impacts;[1]
- Protect resources during construction;
- Mitigate construction impacts; and
- Reduce occurrences of fuel leaks and spills.

Massport is responsible for ensuring compliance with applicable state and federal environmental laws and regulations. Massport promotes appropriate environmental practices through pollution prevention and remediation measures. Massport also works closely with Airport tenants and Airport operations staff in an effort to continuously improve compliance.

1 Air quality impacts are reported in Chapter 7, *Air Quality/Emissions Reduction*.

This chapter reports on Massport's environmental programs pertaining to water quality and environmental compliance and management, which include:

- Environmental Management System (EMS) implementation;
- Sustainability Management Plan (SMP);
- Water quality and stormwater management;
- Fuel use and spills;
- Storage tank management and compliance; and
- Site Assessment and Remediation (in accordance with the Massachusetts Contingency Plan [MCP]).

Table 8-1 provides a progress report of environmental compliance and management efforts in 2016. The progress report summarizes Massport's mechanisms for implementing its environmental management goals and details where changes to these efforts occurred in 2016.

Table 8-1 Progress Report for Environmental Compliance and Management

Plan Elements	Progress Report for 2016
Environmental Compliance Inspections	In 2016, Massport performed tenant inspections at a number of its National Pollutant Discharge Elimination System (NPDES) co-permittees' (Logan Airport tenants) leaseholds and made recommendations on how to rectify issues identified during the inspections.
Environmental Management System (EMS) and International Organization for Standardization (ISO) 14001	ISO 14001 certification began for Facilities II (Vehicle maintenance, Landscaping, and Snow Removal) in December 2006. In 2010, Massport expanded the Logan Airport EMS to include Facilities I (Central Heating and Cooling Plant, and heating, ventilation, and air conditioning [HVAC]), and Facilities III (Electrical, Structural, Central Stockroom and sign shop). The most recent certification audit took place in June 2014, and a certificate was issued in July 2014; this certificate is valid through July 2017.
Tenant Technical Assistance	Massport continued publication of *EnviroNews,* which was rebranded in late 2016 as "*Sustainable Massport.*" This quarterly newsletter informs tenants of regulatory calendar milestones, permitting requirements, pollution prevention, and best management practices. It recommends use of sustainable materials and provides information on Massport and other environmental requirements (2016 newsletters are provided in Appendix J, *Water Quality/Environmental Compliance and Management)*.
Stormwater Pollution Prevention Plan (SWPPP)	In accordance with the requirements of the current NPDES stormwater permit for Logan Airport that was issued on July 31, 2007, Massport and the 22 co-permittees were required to develop SWPPPs. Massport completed its SWPPP in December of 2007 with regular updates since that time. The most recent update to the SWPPP was completed in December 2016 and distributed to Massport and its stormwater co-permittees. Massport's SWPPP addresses stormwater pollutants in general, deicing and anti-icing chemicals, potential bacteria, fuel and oil, and other sources of stormwater pollutants. Best management practices (BMPs) are included in the SWPPP. In accordance with the other requirements of the NPDES permit, Massport conducts training for personnel responsible for implementing activities identified in the SWPPP. The 2016 Annual Certificates of Compliance were submitted jointly to the U.S. Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (MassDEP) in December 2016 for Massport and co-permittees.

Table 8-1 Progress Report for Environmental Compliance and Management (Continued)

Plan Elements	Progress Report for 2016
Design and Construction	Massport developed Sustainable Design Standards and Guidelines (SDSG) for use by architects, engineers, and planners for Massport capital improvement projects.[1] The SDSGs, first issued in 2009 and revised in 2011, are designed to foster innovation yet include clear targets to achieve more sustainable project design and practices. The SDSGs are intended to evolve over time, based on changes in technologies and industries. In addition to the SDSGs, Massport aims to construct buildings at Logan Airport to achieve U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED®) Silver certification or higher. Massport requires contractors to comply with the EPA Construction General Permit for all construction projects impacting an acre or more. For smaller projects, Massport requires compliance with the Logan Airport SWPPP's Best Management Practices. For all construction projects, Massport requires the use of ultra-low-sulfur diesel fuel in construction equipment, recycling of all construction waste to the maximum extent possible, and construction equipment retrofits with pollution control devices such as diesel oxidation catalysts and/or particulate filters.
Spill Prevention Control and Countermeasure (SPCC) Plans [2]	Tenants meeting certain thresholds are required to prepare their own SPCC plans for their facilities. Massport checks for SPCC plans during environmental compliance inspections. Additionally, tenants receive information on Massport BMPs which focus on spill management and prevention.

Source: Massport
Notes:
1 More information on SDSGs is provided in Chapter 1, *Introduction/Executive Summary*.
2 In accordance with the Clean Water Act, 40 CFR 112, Oil Pollution Prevention.

International Organization for Standardization (ISO) 14001 Certified Environmental Management System (EMS)

Since 2006, Massport has had an ISO 14001 certified EMS in place, a systematic approach which Massport uses to promote continual improvement of environmental management at Logan Airport. The goals of Massport's EMS are to meet regulatory requirements and to improve Massport's environmental performance beyond compliance on an ongoing basis.

The EMS consists of policies, procedures, and records that are collectively used by Massport employees to prevent pollution and address potential environmental impacts associated with Airport operations. Responding to environmental regulations and international standards, Logan Airport's EMS provides a structure for regulatory compliance and monitoring of a wide range of activities at the Airport that affect the environment, such as air quality, recycling, stormwater pollution prevention, and energy use.

Logan Airport's EMS is independently certified to the ISO 14001:2004 international standard. Certification for Facilities II (Vehicle Maintenance, Landscaping, and Snow Removal) began in December 2006. In 2010, Massport expanded the Logan Airport EMS to include Facilities I (Central Heating and Cooling Plant), Facilities II (Vehicle Maintenance, Landscaping, and Snow Removal), and Facilities III (Electrical and Structural). The most recent certification audit took place in June 2014, and a certificate was issued in July 2014; this current certificate is in effect through July 2017.

Logan Airport Sustainability Management Plan

In 2013, Massport was awarded a grant by the Federal Aviation Administration (FAA) to prepare a SMP for Logan Airport. The Logan Airport SMP planning effort began in May 2013 and was completed in April 2015. The SMP integrates with the existing EMS framework to promote continuous environmental, social, and economic improvement. The completion of the SMP demonstrates Massport's leadership and commitment to a sustainable future for Logan Airport and its surrounding communities. The plan builds on Massport's rich history of advancing sustainability and serves as a roadmap for prioritizing initiatives and moving goals forward. The SMP is intended to guide Massport's sustainability practices over the next decade and supports Massport's ongoing commitment to environmental stewardship.

The SMP represents the combined efforts of over 125 employees and tenants who came together to establish Massport's baseline sustainability performance, shape goals, and identify new sustainability initiatives. Massport is focused on a holistic approach with an emphasis on economic viability, operational efficiency, natural resource conservation, and social responsibility. As part of the SMP process, Massport developed a Sustainability Mission Statement:

> *"Massport will maintain its role as an innovative industry leader through continuous improvement in operational efficiency, facility design and construction, and environmental stewardship while engaging passengers, employees, and the community in a sustainable manner."*

Most recently, Massport published second *Logan Airport Annual Sustainability Report* in April of 2018. The report highlights progress towards Massport's sustainability goals and targets since the release of the SMP in 2015. Massport has also published four *Sustainable Massport* calendars (2015, through 2018), which highlight Massport's sustainability successes. The 2015 *SMP Highlights Report*, *Logan Airport Annual Sustainability Reports,* and latest *Sustainable Massport* calendars can be viewed on Massport's website at the following address: http://www.massport.com/massport/business/capital-improvements/sustainability/sustainability-management/.

Water Quality and Stormwater Management in 2016

Massport's primary water quality goal is to prevent or minimize pollutant discharges in stormwater, thus limiting adverse water quality impacts associated with Airport activities to Boston Harbor. Massport employs several programs to promote awareness of Massport and tenant activities to support improved surface and groundwater quality. Programs include: implementing best management practices (BMPs) for pollution prevention by Massport, its tenants, and its construction contractors; staff and tenant training; a comprehensive Stormwater Pollution Prevention Plan (SWPPP); and project-specific construction SWPPPs.

The Clean Water Act of 1972 requires permits for pollutant discharges into U.S. waters from point sources and for stormwater discharges associated with industrial activities. Massport holds permits under the U.S. Environmental Protection Agency's (EPA) and MassDEP's National Pollutant Discharge Elimination System (NPDES) Program. The individual NPDES permit covers Massport and its co-permittees at Logan Airport. It establishes effluent limitations and monitoring requirements for discharges from specified stormwater outfalls.

On July 31, 2007, EPA and MassDEP issued an individual NPDES Stormwater permit for Logan Airport (NPDES Permit MA0000787). The permit became effective on September 29, 2007, replacing the previous NPDES Permit dated March 1, 1978. The NPDES permit is on EPA's website at https://www3.epa.gov/region1/npdes/logan/pdfs/finalma0000787rtc.pdf. The permit remains in effect until a new permit is issued by the EPA. Massport holds a separate NPDES permit for the Fire Training Facility (NPDES Permit MA0032751). The following sections describe the requirements of the two permits and Massport's compliance with these requirements.

Stormwater Outfall NPDES Permit Requirements and Compliance

The following sections describe stormwater outfalls that are subject to the NPDES Permit No. MA0000787, the monitoring requirements, and the monitoring results for 2016.

NPDES Permitted Outfalls

The NPDES permit regulates stormwater discharges from all Logan Airport outfalls including the North, West, Northwest, Porter Street, and Maverick Street Outfalls, and airfield outfalls. The acreage associated with each outfall are as follows: North Outfall Drainage Area (152 acres); West Outfall Drainage Area (449 acres); Northwest Outfall Drainage Area (23 acres); Porter Street Outfall Drainage Area (182 acres); Maverick Street Outfall Drainage Area (34 acres); and Airfield Outfall Drainage Areas (A1 through A44), which drain the remainder of the airfield including runways, taxiways, and the perimeter roadway (910 acres). The North and West Outfall Drainage Areas also drain a portion of the airfield. These drainage areas are shown in **Figure 8-1** and further described in **Table 8-2**. The North and West Outfalls have end-of-pipe pollution control facilities to remove debris and floating oil and grease from stormwater prior to discharge into Boston Harbor.

Table 8-2 Stormwater Outfalls Subject to NPDES Permit Requirements

Outfall Name and Number	Drainage Area (Acres)	Boston Harbor Discharge Location	Major Land Uses
North (001)	152	Wood Island Bay	Terminal E, apron, taxiway, cargo areas, fuel farms, and runways
West (002)	449	Bird Island Flats	Taxiways, terminal areas, aprons, cargo areas, runways, and roadways
Porter Street (003)	182	Bird Island Flats	Hangars, vehicle maintenance facilities, cargo areas, and car rental facilities
Maverick Street (004)	34	Jeffries Cove	Car rental facilities, bus/limousine pools, and parking areas
Northwest (005)	23	Wood Island Bay	Flight kitchens and bus maintenance facility
Airfield (A1 through A44)[1]	910	Perimeter of Airfield	Runways, taxiways, perimeter roadways, fire training facility, and Massport Fire/Rescue Station 2

Source: Massport

Notes:

1 In accordance with the requirements of the NPDES permit, Massport developed an *Airfield Stormwater Outfall Sampling Plan* (March 27, 2008). The plan requires quarterly wet weather sampling at a minimum of seven of the airfield outfalls (A1 through A44) to obtain representative samples of the quality of stormwater runoff from the airfield.

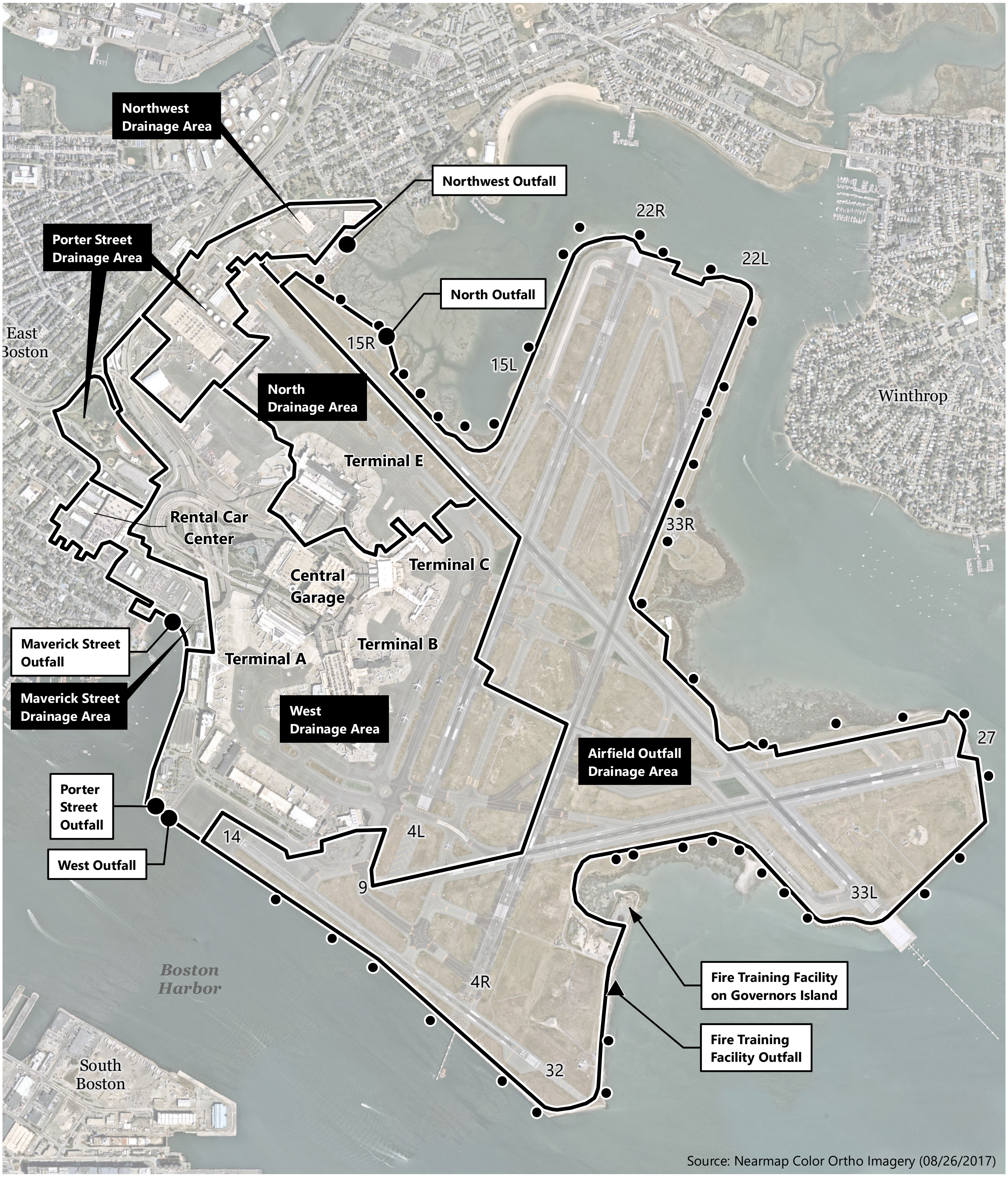


FIGURE 8-1 Logan Airport Outfalls

2016 Environmental Data Report

▲ Fire Training Facility Outfall

● Airfield Stormwater Outfalls

▭ Drainage Area

0 500 1000 2000 Feet

Monitoring Requirements

The NPDES permit (No. MA0000787) requires grab samples (single samples collected at a particular time and place) to be taken monthly from the North, West, Porter Street, and Maverick Street Outfalls. Samples are tested for pH, oil and grease, total suspended solids (TSS), benzene, surfactants, fecal coliform bacteria, and *Enterococcus* bacteria during both wet and dry weather. Grab samples are also taken quarterly from these four outfalls during wet weather to test for eight different polycyclic aromatic hydrocarbons (PAHs).

Additional NPDES permit sampling requirements include sampling for deicing compounds twice per deicing season (October through April) at the North, West, and Porter Street Outfalls. The NPDES permit sets discharge limitations for pH, oil and grease, and TSS from the North, West, and Maverick Street Outfalls and for pH from the Porter Street Outfall. The NPDES permit does not include any discharge limitations for the Northwest Outfall, airfield outfalls, or the deicing monitoring, and requires only that the sampling results be reported. Appendix J, *Water Quality/ Environmental Compliance and Management,* contains additional information on the sampling requirements of the NPDES permits.

2016 Monitoring Results

In 2016, approximately 98.6 percent of stormwater samples were in compliance with standards (Refer to **Table J-15** in Appendix J, *Water Quality/Environmental Compliance and Management* for more details). Due to the large size of the drainage areas and relatively low concentration of pollutants, it is not always possible to trace exceedances to specific events. Where a known event such as a spill is reported, Massport checks the drainage system for impacts from the event and takes any necessary corrective actions.

During 2016, one out of 11 wet weather event stormwater samples collected from the Maverick Street Outfall exceeded the TSS limit with a concentration of 260 mg/L on November 15, 2016. The TSS permit limit is 100 mg/L. There was no discernable source of the TSS exceedance.

One out of 11 wet weather event stormwater samples collected from the Maverick Street Outfall was measured outside of the limits for pH established in the NPDES permit with a reading of 5.59 on March 2, 2016. One out of 11 wet weather event stormwater samples collected from the North Outfall was measured outside of the limits for pH established in the NPDES permit with a reading of 5.50 on April 12, 2016. The boundary limits established for pH in the NPDES Permit are 6.0 to 8.5.

Sampling results at Porter Street are averaged among the three Porter Street Outfalls. The averages for the three Porter Street Outfalls were all within range during 2016.

The NPDES permit requires reporting of sampling results for the Porter Street, Northwest Outfall, and all airfield outfalls. These specific outfalls do not have specific discharge limits with the exception of pH. In 2016, the highest average concentrations observed at the Porter Street Outfalls were 206 mg/L of TSS (December 21, 2016) and 9.7 mg/L of oil and grease (November 9, 2016). In 2016, the highest concentration of TSS observed at the Northwest Outfall was 220 mg/L (September 19, 2016). The highest concentration of oil and grease measured at the Northwest Outfall was 4.6 mg/L (September 19, 2016).

The highest average concentrations observed at the airfield outfalls were 14.2 mg/L of TSS (September 19, 2016) and 1.9 mg/L of oil and grease (September 19, 2016).[2]

The NPDES water quality monitoring results are posted on Massport's website (http://www.massport.com/massport/business/capital-improvements/sustainability/water-quality/). Massport provides copies of the monitoring results to EPA and MassDEP. The 2016 water quality monitoring results for discharge from the outfalls is provided in Appendix J, *Water Quality/ Environmental Compliance and Management,* along with the history of water quality monitoring results dating back to 1993.

Deicing Monitoring

Deicing is typically conducted at Logan Airport from October or November through March or April. Deicing operations at Logan Airport have been subject to comprehensive discharge regulations since 1990. Deicer use is subject to the 2007 NPDES permit, which requires Massport and each airline and/or fixed base operator conducting deicing at Logan Airport to develop tailored plans to reduce deicer usage. Massport and its co-permittees were actively engaged in a *Deicing Management Feasibility Study* to evaluate various technologies to reduce aircraft deicing fluid discharges to Boston Harbor. Massport submitted the results of the *Deicing Management Feasibility Study* to EPA in May 2017.

Deicing sampling at the North, West, Porter Street, and airfield outfalls occurred during wet weather on February 8 and March 21, 2016. Sampling results are reported as required by the EPA and MassDEP and listed in Appendix J, *Water Quality/ Environmental Compliance and Management* (see **Tables J-13** through **J-14** for deicing monitoring results).[3]

Stormwater and Sanitary Sewer System Inspections and Repairs

Between 2006 and 2008, Massport conducted inspections of the sanitary sewer and stormwater drainage system serving Logan Airport to document the condition of the systems and identify potential impacts from the sewer to the stormwater drainage system. Such impacts could result from leaks or breaks from the sanitary sewer or from direct, inadvertent, illegal cross-connections to the stormwater drainage system. As a result of these surveys, the Boston Water and Sewer Commission (BWSC) and Massport completed replacement of sections of the sanitary sewer system as detailed in previous EDRs.

Massport's Facilities Department continues its inspection and cleaning of manhole and catch basin structures at locations throughout the Airport. The drainage system maintenance program also includes inspection and cleaning of Stormceptor water quality control structures. In accordance with Part I.B.10. h. of the Logan Airport NPDES Permit, the inspection and cleaning activities focus on manhole and catch basin structures within 100 yards of aircraft, vehicle, and equipment maintenance facilities.

Drainage structures, including catch basins and manholes, were inspected and cleaned as needed. From April 9 to June 3, 2016, a total of 56 Stormceptor units were inspected. The maximum depth of sediment measured in the units was 12 inches. None of the Stormceptor units were found to contain sediment depths that required cleaning; however, each unit was cleaned and any limited accumulated sediment was

2 The 2007 NPDES permit does not set maximum daily discharge limitations for the Runway/Perimeter Stormwater Outfalls.

3 Wet weather deicing monitoring was only required during the first and third year of the NPDES permit.

removed. Less than 5 cubic yards of sediment was removed from the units. From September 23 to October 4, 2016, the Stormceptor units were again inspected. The maximum depth of sediment measured was 12 inches and none of the Stormceptor units contained sediment depths that required cleaning.

2016 Bacteria Source Tracking

Massport continues to monitor bacteria levels at stormwater outfalls by obtaining samples during wet weather and dry weather events for laboratory analysis. Review of the analytical data indicates that bacteria levels continue to be highly variable, with no consistent trends that would indicate an ongoing source such as a cross-connection to a sanitary sewer line. Sampling results are available in Appendix J, *Water Quality/Environmental Compliance and Management*.

Fire Training Facility NPDES Permit Requirements and Compliance

NPDES Permit No. MA0032751 regulates treated wastewater from the Fire Training Facility on Governors Island (**Figure 8-1**).[4] This Permit is effective on the signature date (August 15, 2004) and expires five years from the last day of the month preceding the effective date (August 31, 2019). The treated wastewater from fire training exercises is stored, treated by separation and a carbon filter to remove fuel contaminants, and is typically beneficially reused onsite to recharge the fire training pit for training exercises. If no storage is available, treated wastewater is tested prior to discharge to the storm sewer to ensure compliance with the Fire Training Facility's NPDES Permit. Discharge monitoring reports are submitted monthly to EPA. In 2016, Massport reused all wastewater generated at the Fire Training Facility. There were no discharges into Boston Harbor nor were there any shipments of wastewater off-site.

Fuel Use and Spills in 2016

Management of fueling operations at Logan Airport is designed to minimize impacts on water quality by implementing stormwater pollution prevention plan BMPs, including the use of reliable storage, secondary containment, and effective spill cleanup procedures. Massport's jet fuel storage and distribution infrastructure, installed in 2000 and 2001, includes a zoned leak detection system for underground fuel piping, which identifies volumetric changes of product in the pipe at operating pressure and zero pressure. The system combined the storage facility with a hydrant fuel system that reduced the need for trucks and dispensing. The former individual fuel farms were removed in 2000.

The fuel storage and distribution system was designed to ensure, to the extent technologically feasible, the reliable detection of leaks. The consolidated above ground jet fuel storage facility and distribution system are leased and operated by BOSFuel Corporation, an airline consortium. The management of the facility by one entity was put in place to minimize potential fuel spills and maximize water quality protection for the storage and distribution facilities. Cathodic protection, leak detection, secondary containment, and tank overfill protection methods such as alarms, inventory-gauging sensors in the tanks, and emergency fuel shut-off systems have been installed. The operation and maintenance of these controls have been included in the operation and maintenance manual used by BOSFuel's contractor to operate and maintain the facility. Built-in environmental controls, unified operations, and the ongoing contingency planning provide heightened environmental protection and more efficient fuel handling

4 NPDES Permit No. MA0032751 - *Logan International Airport Fire Training Facility*. Issued November 1, 2006.

operations than the previous system. In 2010, BOSFuel, in coordination with Massport, completed the replacement of the portion of the jet fuel distribution system that had not been part of the fuel storage and distribution system improvements completed in 2001. The fuel line replacement, which began in 2008, involved the installation of approximately 6,500 linear feet of pipe in the vicinity of Terminals B and C.

The Massport Fire Rescue Department keeps logs of all spills at Logan Airport (see **Table 8-3**). State environmental regulations require that oil spills of 10 gallons or more in volume be reported to MassDEP. Spills that enter storm drains of any volume must also be reported to Massport. During 2016, five fuel spills entered the storm drainage system. Massport keeps records of all spills, including those less than the reporting threshold. In 2016, of the oil and hazardous material spills reported to the Massport Fire Rescue Department, 14 spills (6.1 percent) were reportable due to their volume. Of the 14 reportable spills in 2016, commercial airlines were responsible for 58 percent of the spills, 14 percent from fixed base operators' equipment, 7 percent from Massport, 7 percent from aircraft fueling, 7 percent from general aviation, and 7 percent from trucking companies. By volume, jet fuel spills accounted for 48 percent of total fuel spilled; diesel fuel accounted for 26 percent; hydraulic oil accounted for 19 percent; gasoline accounted for 1 percent; and 6 percent was from other fluids such as antifreeze, transmission fluid, and glycol.

A summary of Logan Airport jet fuel usage and spill records from 1990 to 2016, and details pertaining to type and quantity of the spills can be found in Appendix J, *Water Quality/Environmental Compliance and Management*.

Table 8-3 Logan Airport Oil and Hazardous Material Spills and Jet Fuel Handling[1]

Year	Total Number of all Spills	Total Number of all Spills >10 gallons	Total Volume of all Spills (Gallons)	Estimated Volume of Jet Fuel Handled (Gallons)	Total Volume of Jet Fuel Spilled (Gallons)
2010	87	15	476	335,693,997	360
2011	108	12	572	340,421,373	337
2012	132	5	593	343,731,127	439
2013	94	6	452	349,397,940	351
2014	129	17	2,785	370,222,342	785
2015	196	16	1,278	374,985,216	885
2016	231	14	1,158	456,003,328	558

Source: Massport Fire Rescue and Massport Environmental Management

Notes: Oil and hazardous material spills and jet fuel handling data from 1990 through 2016 are provided in Appendix J, *Water Quality/Environmental Compliance and Management.*

1 Material Spills include: jet fuel, hydraulic oil, diesel fuel, gasoline, and other materials such as glycol and paint.

Tank Management Program

Since 1993, Massport has maintained a Tank Management Program that is designed to ensure that all Massport-owned tanks are in regulatory compliance with federal and state tank regulations. The program includes tank permitting, monitoring, upgrades, and replacement. From 1993 through 2005, Massport completed six construction phases of storage tank modifications that included removal, replacement, and upgrades to existing tanks and the related piping systems to comply with federal and state tank regulations. In 2009, Massport installed a remote tank monitoring system for heating oil underground storage tanks (USTs) to allow for continuous monitoring of inventory levels, as well as leak detection. As a BMP, Massport continues to monitor tank systems, upgrade facilities, and remove tanks as needed.

In 2016, Massport and its tenant tank owners continued to comply with new state storage tank regulations, these regulations can be found through the MassDEP UST Program.[5] These new regulations transferred jurisdiction of all USTs from the Massachusetts Department of Fire Services (DFS) to MassDEP. Jurisdiction of all aboveground storage tanks (ASTs) with capacity volumes greater than 10,000 gallons remains with the DFS, and those ASTs with less than a 10,000-gallon capacity are now under local Massport Fire Department jurisdiction. There are three ASTs at Logan Airport with volumes greater than 10,000 gallons. Two of these tanks are located in the North Service Area and contain potassium acetate runway deicing fluid. The third tank is located at the Central Heating Plant, and is used for the storage of heating oil. Compliance with the new tank regulations included:

- Re-permitting all ASTs using a newly created Massport Fire Department tank permit;[6] and
- Updating and tracking AST permit status, using the Massport AST database.

Massport is also implementing a tank management program that includes:

- A continuing program of monthly inspections, testing, and minor repairs of all Massport-owned tanks, related piping, tank monitoring systems, and related equipment.
- Annual Stage I Vapor Recovery testing was conducted in May 2016, for Massport's gasoline USTs and piping systems at the Airport, and Massport personnel were trained on the proper operation and inspection of the Stage I systems. Stage I vapor recovery involves the recovery of vapors from the gasoline tank by the tanker truck when deliveries occur. Stage I systems will continue to be operated, maintained, and tested on an annual basis.
- Annual DFS inspections of all three of Massport's ASTs greater than 10,000 gallons in volume, and submittal of the inspection documentation to DFS.

---

5 310 Code of Massachusetts Regulations (CMR) 80.00.

6 Although aboveground storage tanks (ASTs) with a capacity of less than 10,000 gallons are no longer under the jurisdiction of the Massachusetts Department of Fire Services, the tanks are still subject to the Massachusetts fire regulations. The ASTs with a capacity of less than 10,000 gallons are now under the jurisdiction of the Massport Fire Department. Each tank requires a permit from the Massport Fire Department, which does not expire unless the tank is moved to a different location. ASTs with capacity of over 10,000 gallons need to obtain both an annual permit from the Massport Fire Department and the required permit from the Massachusetts Department of Fire Services.

- Review of all proposed tenant tank upgrades, installations, and tank removals (under Massport's Tenant Alteration Application process[7]) to ensure compliance with applicable state and federal regulations and with Massport policy.
- Ongoing upgrade and maintenance of a database that contains information on all USTs located on Massport property. For each tank, the database tracks location, permit status, third party inspection status, compliance status with applicable tank regulations, and tank and monitoring system equipment summaries. Information on ASTs is kept in a separate database, which was developed in 2010.
- Information provided to tenants regarding the revised storage tank regulatory requirements and assistance with tenants' tank permitting procedures.

Site Assessment and Remediation

Massport complies with the Massachusetts Contingency Plan (MCP) by monitoring fuel spills and tracking the status of spill response actions. The MCP (310 Code of Massachusetts Regulations 40.0000) lays out a set of regulations that govern the reporting, assessment, and cleanup of spills of oil and hazardous materials in Massachusetts. The MCP, which is administered by MassDEP, prescribes the site cleanup process based on the nature and extent of a release's contamination. The MCP defines the roles for those parties affected by and potentially responsible for the release and establishes the release reporting program and submission deadlines for tracking events from initial release to regulatory closure.

In accordance with the MCP, Massport continues to assess, remediate, and bring to regulatory closure areas of subsurface contamination. There are several phases of investigation for contaminated sites. Phase I involves initial site investigations for the presence of contamination and Phase II assessments are more comprehensive site investigations. Phase III identifies, evaluates, and selects remediation actions and Phase IV involves the implementation of selected remedial actions. Phase V involves the operation, maintenance, and/or monitoring of the remediation program. Massport leads the performance of a variety of response actions, including remediation at sites where Massport is the responsible party, where there are multiple responsible parties, and where no responsible party has been identified. **Table 8-4** describes Massport's progress in 2016 in achieving regulatory closure of the MCP sites identified in **Figure 8-2**.

7 The Tenant Alteration Application is an internal Massport process for tenants who want to make modifications to their leasehold.

FIGURE 8-2 **Massachusetts Contingency Plan Sites**

2016 Environmental Data Report

Note: Refer to Table 8-4 for the numbered projects.

Table 8-4 MCP Activities Status of Massport Sites at Logan Airport

Location (Release Tracking Number) and MassDEP Reporting Status	Action/Status
Fuel Distribution System (FDS) (3-1287)	
2011	A Periodic Review of the Temporary Solution for the FDS was submitted in April 2011. Three Post-Class C RAO Status Reports were submitted for the FDS in February, June, and December 2011, summarizing the routine inspection and monitoring activities.
2012	Post-Class C RAO Status Reports were submitted in May and November 2012, summarizing the routine inspection and monitoring activities.
2013	Post-Class C RAO Status Reports were submitted in May and November 2013, summarizing the routine inspection and monitoring activities.
2014	Post-Class C RAO Status Reports were submitted in May and November 2014, summarizing the routine inspection and monitoring activities. In addition, a RAM Plan was submitted in April 2014 to address construction in the area of the FDS followed by a RAM Completion Report submitted in August 2014.
2015	Post-Temporary Solution Status Reports were submitted in May and November 2015, summarizing the routine inspection and monitoring activities.
2016	RAO-C 5-year periodic review submitted in July 2016. Two Post-Temporary Solution Status Reports were submitted in 2016 summarizing the routine inspection, monitoring, and product recovery activities.
Former Robie Park (3-10027) - CLOSED	
2011	Phase IV Project Status Reports 2 and 3 were submitted in March and September 2011, respectively.
2012	Phase V Status Reports 4 and 5 were submitted in March and September 2012, respectively.
2013	Phase V Status Reports 6 and 7 were submitted in March and September 2013, respectively.
2014	Phase V Status Reports 8 and 9 were submitted in March and September 2014, respectively.
2015	Phase V Reports 10 and 11 were submitted in March and September 2015, respectively.
2016	A Permanent Solution Statement was submitted in 2016.

Table 8-4 MCP Activities Status of Massport Sites at Logan Airport (Continued)

Location (Release Tracking Number) and MassDEP Reporting Status	Action/Status
Fire Training Facility (3-28199)	
2011	A RAM Completion Statement was submitted on April 25, 2011. A Phase II Scope of Work was prepared and submitted to MassDEP on January 18, 2011. Phase II and Phase III Reports were submitted on December 8, 2011. A RAM Completion Statement was submitted on April 25, 2011.
2012	Phase 4 Status Report transmitted in June 2012; the Phase IV Remedy Implementation Plan was submitted in December 2012.
2013	Phase 4 Status Report transmitted in June 2013, the Phase IV Completion Report was transmitted in December 2013.
2014	Phase 5 Remedy Operation Status Reports submitted in June and December 2014.
2015	Phase 5 Remedy Operation Status Reports submitted in June and December 2015.
2016	Phase 5 Remedy Operation Status Reports submitted in June and December 2016.
Taxi Pool Site (3-32022)	
2014	MassDEP notified of 72-hour Reportable Condition on March 10, 2014.
2015	Phase I Report and Tier Classification submitted March 9, 2015.
2016	Permanent Solution Statement scheduled to be submitted in 2017.

Source: Massport

Notes: This list includes active Massport MCP sites only. Additional sites are the responsibility of Logan Airport tenants. Refer to Figure 8-2 for location of MCP sites. Complete information dating back to 1997 is included in Appendix J, *Water Quality/Environmental Compliance Management*.

AUL Activity and Use Limitation
MCP Massachusetts Contingency Plan
RAM Release Abatement Measure
RAO Response Action Outcome
FDS Fuel Distribution System
IRA Immediate Response Action
Phase I Initial Site Investigation
Phase II Comprehensive Site Assessment
Phase III Identification, Evaluation, and Selection of Comprehensive Remedial Actions
Phase IV Implementation of Selected Remediation Action
Phase V Operation, Maintenance and/or Monitoring

9

Project Mitigation Tracking

Introduction

This *2016 Environmental Data Report (EDR)* provides an update on Massachusetts Port Authority's (Massport) mitigation commitments under the Massachusetts Environmental Policy Act (MEPA) for projects at Boston-Logan International Airport (Logan Airport or the Airport) for which an Environmental Impact Report (EIR) was filed. Each of the projects completed the state and federal environmental review processes and adopted a mitigation plan that has been formalized with individual Section 61 Findings.[1] Massport tracks both Massport and Logan Airport tenants' progress toward implementing and meeting their environmental mitigation commitments on schedule and in accordance with the requirements set out in the Section 61 Findings for each project. As each project moves forward through its design and construction phases, its mitigation plan is implemented with ongoing tracking to ensure compliance. This chapter provides updates in 2016 for projects with ongoing or upcoming Section 61 mitigation commitments, as documented in **Tables 9-1** through **9-8**. Projects for which mitigation has been completed are not reported on in EDRs and Environmental Status and Planning Reports (ESPRs). For projects with ongoing requirements, once those projects are constructed, mitigation tracking will report only on the continuing requirements.

Projects with Ongoing Mitigation

- **West Garage Project**, Executive Office of Energy and Environmental Affairs (EEA) #9790: Phase I and Phase II construction was completed in 2007. The status of continuing mitigation requirements is documented in this chapter.
- **International Gateway Project**, EEA #9791: Phase I was completed in 2004; Phase II was completed in 2007; and the final phase has been changed to the Terminal E Modernization Project (EEA #15434). The status of continuing mitigation requirements for Phases I and II are documented in this chapter.
- **Replacement Terminal A Project**, EEA #12096: Terminal A opened March 16, 2005. The status of continuing mitigation requirements is documented in this chapter.
- **Logan Airside Improvements Planning Project**, EEA #10458: Runway 14-32 opened on November 23, 2006. The Centerfield Taxiway was completed and became fully operational in 2009. The status of continuing mitigation requirements is documented in this chapter.
- **Southwest Service Area (SWSA) Redevelopment Program**, EEA #14137: Construction of the Rental Car Center (RCC) program began in summer of 2010, and the first phase of the facility opened in the fall

1 Massachusetts General Law, Chapter 30, Section 61 (M.G.L. c. 30, § 61).

of 2013. Other phases of the project were completed in 2014. The status of ongoing mitigation requirements is documented in this chapter.

- **Logan Airport Runway Safety Areas (RSA) Project**, EEA #14442: Construction on the Runway 33L RSA began in June 2011 and was completed in November 2012. The replacement of the Runway 33L approach light pier was completed concurrently with Runway 33L RSA construction. Construction of the Runway 22R Inclined Safety Area (ISA) was completed in the fall of 2014.
- **Terminal E Modernization Project**, EEA #15434: The project will accommodate existing and long range forecasted passenger demand for international service and will include the three gates permitted and approved as part of the International Gateway/West Concourse Project in 1996 (but never constructed), and four additional new aircraft contact gates. An Environmental Notification Form (ENF) was filed in October 2015, the Draft Environmental Assessment (EA)/EIR was filed in May 2016, and the Secretary of the EEA issued a Certificate on the Draft EA/EIR on September 16, 2016 noting that the project adequately and properly complies with MEPA. Massport filed the Final EA/EIR on September 30, 2016. On November 10, 2016, the Federal Aviation Administration (FAA) issued a Finding of No Significant Impact (FONSI) and on November 14, 2016, a Record of Decision (ROD) for the project, indicating that Massport can now update the Airport Layout Plan (ALP) with the proposed Terminal E Modernization Project. Final design is underway in anticipation of a 2018 construction start (see Chapter 3, *Airport Planning* for additional information).

Projects with Section 61 Mitigation

The following section documents the status of projects with Section 61 mitigation commitments, in chronological order, starting with the West Garage Project from 1995 to the Terminal E Modernization Project from 2016. Massport will continue to report on the status of mitigation in EDRs and ESPRs to provide a solid accounting of Massport's commitment to regulatory compliance and to provide information to the community.

West Garage Project – EEA #9790

Permitting History

- Certificate on the Final EIR issued on March 16, 1995.
- Section 61 Findings approved on March 27, 1995.

Project Status

The West Garage Project (**Figure 9-1**) was initially proposed to be constructed in two phases. Phase I of the Project provided 3,150 parking spaces that were consolidated from other areas of Logan Airport. The West Garage is directly connected to the Central Garage, centralizing the two structures' parking into a larger, single functioning, easily accessible garage. The West Garage Project also included construction of elevated walkways connecting the West Garage to Terminals A and E, and improvements to the terminal roadways. The original design of Phase II of the West Garage included the construction of a new structured parking facility adjacent to the West Garage. Instead, Massport concluded it was more cost efficient to proceed with Phase II by adding three additional levels (Levels 5, 6, and 7) to the existing Central Garage. Phase II of the West Garage Project provided approximately 2,800 additional parking spaces.

- **Phase I** – Construction commenced in October 1995 and the garage opened on September 8, 1998. The elevated walkways to the terminals were completed in 2002. Improvements to terminal roadways were completed in 2003.
- **Phase II** – Permitting was completed in 2000 to add three levels to the Central Garage. Construction commenced in 2004 and the entire facility enhancement was completed in 2007.

Table 9-1 lists each of the continuing Section 61 mitigation commitments for the West Garage Project and Massport's progress in achieving these measures. **Table 9-2** details the elements and status of the Alternative Fuels Program, which was a key mitigation effort associated with the West Garage Project. **Tables 9-1** and **9-2** detail the Section 61 mitigation measures from the *West Garage Project Final EIR*, dated January 31, 1995, and those measures referenced in the Massport Board vote on the West Garage Project. Many of the mitigation measures for this project have long since been implemented, but it is noted in the tables when there have been recent updates.

Unrelated to this project, in late 2015, Massport completed the West Garage Parking Consolidation Project, which consolidated 2,050 temporary parking spaces as part of an addition to the West Garage and at the existing surface lot between the Logan Office Center and the Harborside Hyatt. The West Garage addition is located on the site of the existing Hilton Hotel parking lot. Construction of these spaces constituted all of the remaining spaces permitted under the Logan Airport Parking Freeze as of that date. [2] On March 20, 2014, EEA issued an Advisory Opinion confirming that no MEPA review was required for this project. Construction commenced in spring 2015 and was completed in late 2015.

2 310 Code of Massachusetts Regulations 7.30 and 40 CFR 52.1120.

FIGURE 9-1 West Garage Project | **2016 Environmental Data Report**

◆ West Garage Project EEA #9790

Phase I West Garage Construction
Phase II Addition to Central Garage

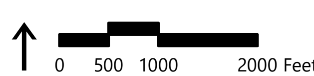


Table 9-1 West Garage Project Status Report (EEA #9790) Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016)

Mitigation Measure	Status
Parking Pricing	
Parking pricing initiatives: keeping first-hour price high enough to provide a disincentive for drop-off/pick-up.	**Implemented.** Massport continues to evaluate and adjust the first-hour price of parking. In light of the security prohibition on curbside parking, in 2002, Massport reduced the cost of the first half-hour from $4 to $2, the first time it had changed since the first-hour free rate was rescinded in 1998. In June 2007, rates increased to $3 for the first half-hour. Parking rates increased in 2012, 2014, and 2016 for on-Airport parking; further details on parking rate increases are provided in **Table 5-6** of Chapter 5, *Ground Access to and from Logan Airport*.
Parking pricing initiatives: keeping the weekly price low enough to encourage vacation travelers to park for a week.	**Implemented.** Massport encourages long-term parking by providing lower cost parking at its Economy Lot. Data on long-term parking use are provided in Chapter 5, *Ground Access to and from Logan Airport*.
Massport will consider means to encourage the use of limited amount of on-Airport commercial parking for long-term parking and promote environmentally positive modes of airport access by air passengers.	**Implemented.** An important element of Massport's strategy to reduce the impact of Airport-related traffic on regional highways and local streets in neighboring communities is the Massport Parking Pricing Policy. Massport's Parking Pricing Policy encourages long-term parking over short-term parking by charging a premium for time spent in the on-Airport parking facilities between one and four hours and substantially reducing the per hour rate for parking durations longer than four hours. This strategy has proved to be a successful incentive for passengers to drive themselves and park long-term at Logan Airport rather than having someone else drop them off or pick them up. Additional information on parking is provided in Chapter 5, *Ground Access to and from Logan Airport*.
Once sufficient data have been collected, Massport will evaluate parking behavior that may be attributable to the modified rates and consider further adjustments in pricing that will assist in achieving Massport's ground transportation goals.	**Implemented.** Massport's parking rate structure is compatible with continued growth in long-term parking, and the continued goal to increase the total high occupancy vehicle (HOV) use by air passengers. Adjustments to hourly parking rates are been made over time to reflect usage patterns. Additional information on parking pricing is provided in Chapter 5, *Ground Access to and from Logan Airport*.
Executive Director shall report to Massport annually regarding the effectiveness of parking pricing policy in achieving Massport's ground access goals initiatives and recommend appropriate policy adjustments.	**Implemented**. Through the annual Environmental Data Report (EDR)/Environmental Status and Planning Report (ESPR) filings, Massport reports on parking pricing strategies. Please refer to Chapter 5, *Ground Access to and from Logan Airport*, for additional details on Massport's parking pricing efforts.

Table 9-1 West Garage Project Status Report (EEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Concurrent Ground Access Improvement Mitigation Measures	
Employee Trip Reduction Measures	
Massport will form a Transportation Management Association (Logan TMA) for Logan Airport employees to provide new opportunities for the development of targeted transportation demand management (TDM) strategies for Massport and airport tenant employees.	**Implemented.** In the 1995 Board Resolution, Massport's Executive Director was authorized to expend an initial amount of up to $50,000 for the purpose of organizing the Logan TMA. The Logan TMA was created in March 1997. Massport continues to support the Logan TDM strategies by funding the Logan Sunrise Shuttle at an annual cost of $65,000.
Massport will seek to develop, coordinate, and implement effective TDM strategies to reduce the number of single-occupant trips made by all Logan Airport employees, including outreach to employees about transportation options.	**Implemented.** Massport supports TDM strategies by providing services and by periodically conducting the Logan Airport Employee Survey. The most recent survey was conducted in the spring of 2016. The results of this study are summarized in Chapter 5, *Ground Access to and from Logan Airport*.
Massport will encourage participation by all employees, but will particularly target the Airport's largest employers.	**Implemented.** Refer to Chapter 5*, Ground Access to and from Logan Airport* for more details on the Logan TMA.
Massport will report on the formation and activities of the Logan TMA in the next Generic Environmental Impact Report (GEIR).	**Implemented.** The current status of the Logan TMA is summarized in Chapter 5, *Ground Access to and from Logan Airport*.
Massport proposes to implement a new Logan Express service or other HOV service depending on the needs of the targeted market before Phase II of the West Garage Project is operational.	**Implemented**. The Peabody Logan Express facility opened in September 2001 (See Chapter 5, *Ground Access to and from Logan Airport* for additional information on Peabody Logan Express.) Despite low ridership, Massport continues to operate this service. In 2014, Massport initiated the Back Bay Logan Express pilot service, which provides travelers with three scheduled trips per hour between the Hynes Convention Center, Copley Square Station, and Logan Airport. This route was established as an interim/pilot service to supplement ground access to Logan Airport while the Massachusetts Bay Transportation Authority (MBTA) Green Line station was temporarily closed for reconstruction. The new Government Center station reopened in March 2016. The Back Bay Logan Express pilot service is still operating at the time of this document filing.

Table 9-1 West Garage Project Status Report (EEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Provide an airport shuttle service from South Station Transportation Center. Massport is preparing a feasibility and business plan for a South Station-Logan Airport shuttle service and will implement this service when the Third Harbor Tunnel is opened for commercial traffic. This service will be modeled on the existing, successful Logan Express services and will include frequent bus service between South Station and the airport terminals.	**Implemented.** In 1997, Massport sponsored the development of a joint public/private partnership with intercity bus operators serving the South Station Transportation Center. The service had limited success largely because of variable operator schedules and the fact that the service operates out of the South Station Transportation Center instead of a location closer to the South Station Red Line stop. Following the interim Logan DART service between Logan Airport and South Station in 2000, in June 2005, Massport and the MBTA jointly commenced full Silver Line Airport Service providing a direct connection between South Station and each Logan Airport terminal. Refer to Chapter 5, *Ground Access to and from Logan Airport* for additional information on the Silver Line.
Massport will regularly evaluate the frequency of, and demand for, such shuttle service and will provide such service at the greatest frequency that is practical and effective.	**Implemented.** Massport continues regular collaboration with the MBTA on the Silver Line Airport Service and makes adjustments as necessary. Since May 2012, Massport has sponsored a pilot program offering free rides on the Silver Line from Logan Airport to downtown Boston to promote HOV usage and heighten awareness of public transit options. The purpose of the program is to promote ridership, operations, and customer service. Free service from Logan Airport continues as of the date of this *2016 EDR*.
Massport will implement a new water shuttle service in Boston Harbor before the opening of Phase I of the West Garage Project. The water shuttle would run between Logan Airport and one, or possibly, more sites in the Harbor.	**Implemented.** Massport identified a number of possible destinations for a new water shuttle service, with the Quincy Shipyard and Long Wharf sites meeting the basic service parameters. Harbor Express was chosen as the water shuttle operator and began operation between the Airport and these two sites in November 1996. Massport continues to support the Rowes Wharf Water Taxi and City Water Taxi operations. Refer to Chapter 5, *Ground Access to and from Logan Airport* for water shuttle ridership information.
The Executive Director shall make recommendations to Massport for budgetary appropriations to establish and implement the new ground access services on a schedule that permits Massport to implement the new ground access services within these time frames.	**Implemented.** Massport's Executive Director/CEO recommends budgetary appropriations for ground access services on an annual basis.
Enhancement of Existing HOV Services: Logan Express	
Expand Logan Express hours of service.	**Implemented.** Service is offered from Braintree as early as 2:30 AM and as late as 11:00 PM; from Framingham as early as 3:15 AM and as late as 11:00 PM; from Woburn as early as 3:00 AM and as late as 11:00 PM; and from Peabody as early as 3:15 AM and as late as 10:15 PM. Buses leave every hour or half hour. Logan Express buses now depart from Logan Airport as late at 1:15 AM. The Logan Express schedule is available at http://www.massport.com/logan-airport/to-from-logan/transportation-options/logan-express/.
Provide a guaranteed ride home for Logan Express users.	**Implemented and subsequently modified.** From January 1995 until November 2001, Massport provided this service for air passengers and Logan TMA members. Due to financial constraints following September 11, 2001, this program was suspended for those passengers arriving after midnight with pre-purchased round-trip Logan Express tickets. Extended service now provides nearly 24-hour service at several Logan Express locations.

Table 9-1 West Garage Project Status Report (EEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Provide Logan Express price incentives.	**Implemented.** Massport continues to monitor price incentives and implements additional incentives to promote Logan Express ridership, particularly during vacation periods and other periods of peak airport activity. In April 2011, Logan Express sites offered a discounted rate for parking. A survey of Logan Express passengers revealed that drop-off activity at Logan Airport was reduced and the demand for parking at Logan Airport was reduced during the period of the discounted Logan Express parking. To encourage greater ridership, Massport restructured parking rates, which lowered parking rates to $7 per day from $11 per day at Logan Express parking lots. These rates have been in effect since March 1, 2012 (and resulted in increased Logan Express passenger activity at rates greater than the rate of increase in Logan Airport air passengers). Additional seasonal and holiday promotions are also offered.
Develop an additional Logan Express service.	**Implemented.** Massport opened a fourth Logan Express in Peabody, Massachusetts in September 2001, several years before the Section 61 Commitment date of the opening of Phase II of the West Garage Project. While the new service was initially planned to operate on a half-hour schedule like the Braintree, Framingham, and Woburn services, because of the dramatic air passenger reductions after September 11, 2001, (during Peabody's first week of service), to cut costs, Massport operated the Peabody Logan Express on hourly headways. In January 2004, in light of low levels of ridership on the Peabody Logan Express, Massport doubled service by going to a half-hourly schedule in an effort to stimulate ridership growth at Peabody. The service now operates on an hourly weekday schedule. In 2014, Massport initiated the interim Back Bay Logan Express pilot service, which provides travelers with three scheduled trips per hour between the Hynes Convention Center, Copley Square Station, and Logan Airport. The service continues as of the date of this EDR filing.
Enhancement of Existing HOV Services: Water Transportation	
In conjunction with the MBTA, Massport will pursue joint ticketing opportunities for the Hingham Commuter Boat and the Logan Airport Water Shuttle.	**Implemented.** This ticketing program was implemented in mid-1995 and discontinued in 2000 since many of the former users of this program now use the Harbor Express Service direct from Quincy to Logan Airport.
Massport is reviewing the fee schedules and operating requirements of the dock to make it more accessible and convenient to potential water taxi operators.	**Implemented.** In the fall of 1995, Massport made physical improvements to a low-freeboard float at the Logan Airport Dock to create a dock capable of accommodating smaller vessels such as water taxis. In the fall of 2002, Massport completed expansion of the Harborside Dock to accommodate the demand of additional vessels and to comply with handicapped accessibility requirements. The improved dock increases capacity from a two-float system to a seven-float system to accommodate the various water shuttles, taxis, and charter boats that are licensed to use it. Massport continues to provide free on-Airport shuttle service to the water shuttle dock.
Initiate a new Boston Harbor Water shuttle service.	**Implemented.** Harbor Express service, between Logan Airport and the South Shore, began in November 1996, well before the opening of Phase I of the West Garage in September 1998. In 2001, the MBTA took over operations of this service.

Table 9-1 West Garage Project Status Report (EEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Expand docking capacity at Logan Airport for water taxi and other services.	**Implemented.** Massport accommodates water taxi services, enhanced the dock as described above, provides communication links for passengers to call the taxi, and allows taxi passengers to use the free water shuttle buses to access the terminals from the dock. Water taxi information is posted on the Massport website. Details on water taxi services are provided in Chapter 5, *Ground Access to and from Logan Airport.*
Other Measures	
Coordinate with public and private entities to provide more extensive radio, television, and telephone announcements of poor traffic conditions with suggestions for alternative access modes.	**Implemented.** Callers to the Customer Information Line (1-800-23LOGAN) may access the latest traffic information, flight status, parking information, cell phone waiting lot information, or learn about alternative forms of transportation to and from Logan Airport. Starting in August 1999, real-time traffic information and parking became accessible on Massport's website. Massport regularly contacts the media to inform the public about roadway changes, parking shortages, and to encourage travelers to use HOV services. Similar information is disseminated on the Logan Airport e-mail subscriber list, the Massport website, Facebook, and on Twitter at twitter.com/bostonlogan.
HOV Marketing and advertising. Massport will continue the advertising and marketing programs for HOV services with an emphasis on promoting MBTA, Logan Express and water shuttle services to and from the Airport.	**Implemented.** Massport continues to market Logan Express services via Massport's website and other media. Massport continues to promote HOV services including availability, schedules, and fares to consumers through the Customer Information Line at 1-800-23LOGAN and the website that provides up to the minute information. HOV advertising boards, schedules, and maps are placed at all Logan Airport terminals, at the MBTA Blue Line Airport Station and at all shuttle bus drop-off/pick-up locations. Massport has actively promoted passenger water transportation in Boston Harbor for more than 20 years, playing a leadership role in policy development, planning, and promotions. This has included promoting vessel services at Logan Airport in the following ways: ▪ Annual updates and in-terminal distribution of a brochure promoting water transportation at Logan Airport; ▪ Annual updates of a harbor-wide water transportation map showing routes serving Logan Airport along with other routes and landings – Massport provides this map to the MBTA, area non-profits, and others interested in promoting passenger water transportation in Boston Harbor; ▪ Updated information promoting passenger water transportation at Logan Airport on 1-800-23LOGAN and www.massport.com; and ▪ Collecting, tracking, and disseminating passenger water transportation ridership data for Logan Airport passengers to aid in planning and facility development.

Table 9-1 West Garage Project Status Report (EEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Prepare an inventory of private scheduled services including origins/destinations, schedule, and cost.	**Implemented.** Massport continues to update and track information and services by hundreds of privately operated passenger services certified to operate at Logan Airport. Industry changes with such operations make publication of reliable service and schedule information impractical, if not impossible. However, Massport continued to expand and update information on transportation options to Logan Airport using the latest information technologies, including: ▪ Information and links to transportation companies on the Massport website. Some sites accessed through internet links provided passengers with online reservation services; ▪Most scheduled service operators provided placards with current schedules posted in bus stop shelters located on the curb at each terminal. Individual bus schedules were also available at the information booths; and ▪ Transportation information database for online assistance at Logan Airport terminal information booths.
Proceed with environmental review and seek funding for construction of People Mover system.	**Implemented.** Massport completed the Environmental Assessment (EA) and Major Investment Study for the Logan Airport Intermodal Transit Connector (AITC). The AITC evolved out of the People Mover process and evaluated new access routes to both the MBTA Blue Line and the South Station Transportation Center. On February 25, 1997, Massport submitted to the U.S. House Committee on Transportation and Infrastructure an application for the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) funds for the next phase of environmental review, planning, and design of the AITC. Congressman J. Joseph Moakley was the congressional sponsor; the project also had the support from the Secretary of Transportation and the U.S. Environmental Protection Agency (EPA). The Logan AITC was included, for an unspecified funding level, in the 1997 ISTEA reauthorization bill. In 1998, Massport received a Certificate on a Notice of Project Change (NPC) for the People Mover from the Secretary of EEA and a Finding of No Significant Impact (FONSI) on an EA from the Federal Transit Authority. In June 2001, Massport and the MBTA executed an interagency agreement for the purchase of eight Silver Line dual mode buses and the Massport Board approved the expenditure of approximately $13 million for this purchase. In 2004, Massport and the MBTA finalized the 10-year/20 million-dollar Inter-Agency Operating & Maintenance Agreement. Initial Silver Line service to the Airport began in December 2004 and full service began in June 2005 (refer to *Chapter 5, Ground Access to and from Logan Airport* for additional details). Services continue to be adjusted to meet growing demand. In early 2018, Massport began consideration of an Automated People Mover (AMP) concept as a possible alternative for connection between the terminal area and the Massachusetts Bay Transportation Authority (MBTA) Blue Line Station (see Chapter 3, *Airport Planning* for more information).
Alternative Fuels Program. Massport is carrying out an extensive program to convert existing Massport-owned service vehicles to environmentally preferable sources.	**Implemented. Table 9-2** of this *2016 EDR* details Massport's progress in achieving these measures.
Massport will assess progress towards the achievement of HOV goals using on-Airport	**Implemented.** Massport has an ATMS plan that provides daily traffic counts at all gateways and other critical locations. Massport uses technologies that utilize on-Airport traffic signal controllers and loops for traffic counting. The

Table 9-1 West Garage Project Status Report (EEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Automated Traffic Monitoring Systems (ATMS).	Logan Airport ATMS uses technologies that detect vehicle movement (inductive loop lines and microwave sensors). The project is complete and the upgraded ATMS is functioning as planned and designed.
Massport will assess progress towards the achievement of HOV goals by monitoring parked vehicles using systems such as the parking and revenue control (PARC) system.	**Implemented.** Massport monitors all parking activity at Logan Airport and inventories all commercial parking facilities on a daily basis. Updated PARC systems were installed in the Terminal B Garage in 2004, with Central/West Garage following in 2005. Terminal E parking areas and the Economy Garage also have PARC systems.
Measuring, Monitoring, and Evaluating Ground Access Improvements	
Monitor HOV Services (Logan Express, MBTA, water shuttle, limousine/bus, and taxi).	**Implemented.** Massport maintains a "real time" log of dispatcher reports for Logan Express, the taxi pool, and the bus/limousine pool and other ground transportation operations at Logan Airport. Massport coordinates with the MBTA and the operators of all water shuttles serving Logan Airport to track ridership and service schedules. Daily Logan Express ridership and operations data are submitted monthly to Massport. Massport maintains a Passenger Water Transportation Ridership Summary on a monthly basis. Massport maintains a continuing record, the Ground Transportation Unit (GTU) Daily Event Log, of all occurrences impacting the Airport roadways, terminal curbs, and access roads. This log cites such events as accidents, lane closures, bus delays, as well as routine and non-transportation events. Massport's Ground Transportation Operations Center (GTOC) located in the Rental Car Center (RCC) is the 24/7 command center for all transportation information in and around Logan Airport. GTOC staff monitor up to the minute traffic information to ensure Logan Airport bus services are running efficiently.
Monitor passenger activity and employee modes of transportation.	**Implemented.** The 2016 air passenger survey was conducted in the spring of 2016 and is summarized in Chapter 5, *Ground Access to and from Logan Airport*.
Massport supports the use of Automated Vehicle Identification (AVI) to monitor, manage, and facilitate efficient traffic operations at Logan Airport and elsewhere on the regional transportation system.	**Implemented.** An AVI system for Massport's Logan Airport shuttles and Logan Express buses was implemented. All new buses are being procured with AVI/global positioning system (GPS), in anticipation of a planned "next bus" arrival notification system. In addition, the GTOC in the new RCC is outfitted with the required equipment to track the new clean-fuel unified bus fleet.
Track the effectiveness of ground access measures.	**Implemented.** Massport continues to track the effectiveness of its ground access mitigation programs in its annual Massachusetts Environmental Policy Act (MEPA) filings. See Chapter 5, *Ground Access to and from Logan Airport* for 2016 details.

Source: Massport
Note: Text in *italics* detailing the mitigation measures is from Section IV, Mitigation of the West Garage Final EIR, January 31, 1995.

Table 9-2 describes the Alternative Fuels Program, which was part of the West Garage Section 61 commitments.

Table 9-2 Alternative Fuels Program — Details of Ongoing Section 61 Mitigation Measures for the West Garage Project (as of December 31, 2016)

Program Element	Projected Date of Completion/ Acquisition	Status
Purchase four electric passenger utility vehicles	Winter 1995	**Implemented.**
Purchase five electric sedans	Winter and Summer 1995	**Implemented.**
Build compressed natural gas (CNG) quick-fill station	Spring 1995	**Implemented.** The CNG station has been operational since 1995. It is one of New England's largest retail CNG quick fill stations and serves approximately 34 Massport CNG vehicles (21 of which are the Massport-owned 42-foot CNG buses) along with a dozen Airport tenants including nearby hotel CNG shuttle bus fleets. In calendar year 2016, the station pumped approximately 34,345 gallon equivalents per month. Sixty-six percent of the fuel is purchased by Massport and 34 percent by outside vendors.
Purchase five electric buses	Spring and Summer 1995	**Implemented.** Massport purchased two electric buses and leased one. These vehicles operated at Logan Airport between 1996 and 2001. After more than six years of testing and evaluation, Massport determined that electric buses are neither durable nor dependable enough to function effectively in the demanding operating environment at Logan Airport. Massport's new unified bus fleet includes clean diesel/electric hybrid buses. Massport continues to evaluate electric and other alternative fuel vehicles (AFV) as new technologies become available.
Purchase five electric pick-up trucks	Spring 1995	**Implemented.**
Use soy-blend diesel fuel	Spring 1995	**Implemented.** Massport's shuttle fleet operated on soy diesel from 1995 to 1999. In 1999, all the buses were replaced with CNG buses. This fleet was fully replaced in 2012 by CNG and clean-diesel/electric hybrid buses.
Purchase additional AFVs	Spring 1995	**Implemented.** Refer to Chapter 7, *Air Quality/Emission Reductions* for a list of AFVs.
Purchase six CNG buses	Summer 1995	**Implemented.** The initial fleet of 26 CNG shuttle buses was fully replaced in 2012 with 32 60-foot clean diesel/electric hybrid buses and 18 42-foot CNG buses. Three CNG buses were added to the fleet in 2015, increasing the total from 18 to 21; and one additional CNG bus was added in 2016, increasing the total from 21 to 22.
Purchase four electric vans	Summer 1995	**Implemented.**
Install quick-charge kiosks for electric vehicles	Summer 1995	**Implemented but no longer in use.**
Develop slow-charge infrastructure	Ongoing	**Implemented.** The electric charging infrastructure included 15 inductive charging locations but these are not in use since there are no vehicles currently using inductive charging. In 2012, Massport installed 13 Level 2 electric vehicle (EV) charging stations to accommodate a total of 26 vehicles in the Central and Terminal B parking areas. The Framingham Logan Express Garage also has two EV charging stations**.**

Source: Massport

International Gateway Project (Terminal E) – EEA #9791

Permitting History:

- Certificate on the Final EIR issued on December 2, 1996.
- Section 61 Findings submitted to EEA on June 26, 1997.

Project Status

The International Gateway Project (**Figure 9-2**) expanded and upgraded Terminal E to provide better service to international passengers. The original Terminal E was opened in 1974 and over time became outdated and too small to accommodate the growth in international travel. This project is being constructed in phases:

- **Phase 1 – Complete.** This phase of the project included a weather-protected outside airside bus portico with an elevator and escalator linking the ground floor to the second floor to accommodate passengers arriving on remotely parked aircraft (that are unable to park at a gate because it is occupied by another aircraft).
- **Phase 2 – Complete.** This phase of the project enlarged Logan Airport's congested Federal Inspection Services (FIS) Facility, and improved the meeter/greeter lobby and the ticketing area of Terminal E to maximize passenger convenience and reduce processing times in the terminal. The project called for the reconstruction and expansion of Terminal E in and around the existing terminal while keeping it operational and safe. The new departure hall includes high ceilings, wood paneling, built-in artwork, and views of the city skyline. Additionally, to reduce curb and roadway congestion at Terminal E, this project also included a new separated roadway system for arrivals and departures.
- **Future Phase – Transitioned to Terminal E Modernization Project (EEA #15434).** The West Concourse element of the International Gateway Project and its three additional gates were approved but not constructed. These three gates are now included in the upcoming Terminal E Modernization Project.

Construction of Phase 1 and 2 of this project commenced in the summer of 1998. Phase 1 was completed in 2004. The departure level of the terminal, including the new ticketing hall and departure level roadway, opened in May 2003. Enlargement of the FIS Facility and construction of the new arrivals level was completed in July 2007. Phase 2 is now complete. Preliminary work was completed for the West Concourse including planning for three additional contact gates that were not constructed. Additional information on the status of this project is available in Chapter 3, *Airport Planning*.

As part of a separate new project, Massport is advancing plans for the modernization of Terminal E. The Terminal E Modernization Project will accommodate existing and long-range passenger forecasted demand for international service, and will include the three permitted but not built gates from the West Concourse the International Gateway Project, and four additional new aircraft contact gates. An ENF was filed in October 2015. The Draft EIR/EA was filed in July 2016, and the Final EA/EIR was filed in September 2016. FAA issued a FONSI on November 10, 2016, and a ROD on November 14, 2016 for the project (see Chapter 3*, Airport Planning,* for additional information). Final design is underway in anticipation of a 2018 construction start.

Table 9-3 lists each of the continuing mitigation measures for the International Gateway Project in the Section 61 Findings, along with Massport's progress in achieving these measures through the end of 2016. Many of the mitigation measures for this project have long since been implemented, but it is noted in the tables when there have been recent updates. Completed design and construction phase measures are described in previous EDRs.

FIGURE 9-2 International Gateway Project | **2016 Environmental Data Report**

Note: Runway 14-32 construction completed in November 2006

◆ International Gateway Project (Terminal E) - EEA #9791

0 500 1000 2000 Feet

Table 9-3 International Gateway Project Status Report (EEA #9791) Section 61 Mitigation Measures (as of December 31, 2016)

Mitigation Measure	Status
Alternative Fuel Outreach Program	
Massport is working cooperatively with the Environmental Protection Agency (EPA) and regional utility providers in coordinating an ongoing outreach program aimed at promoting the use of clean-burning alternative fuels. This program, which is also supported by fuel providers, vendors, and state and federal agencies, will offer information to airport tenants in the following areas: ▪ *Notification of grant programs or other financial incentives for vehicle conversions.* ▪ *Assistance in cost-benefit analysis for conversion of conventionally fueled vehicles to AFVs.* ▪ *Assistance in placing airport tenants in contact with alternative fuel suppliers and product vendors.*	**Implemented but no longer in use.**
High Occupancy Vehicle (HOV) Promotion	
Massport will reserve terminal space for ground transportation ticket sales, reservations, and information.	**Implemented.** In a joint venture with the Massachusetts Bay Transportation Authority (MBTA) Charlie Card automated fare collection equipment was installed in all Logan Airport terminals in 2006. In mid-2012, in an effort to encourage greater transit ridership, Massport commenced a pilot program for free boarding of the Silver Line at Logan Airport. Free Silver Line boarding continued throughout 2016. Additional ground transportation information is provided om Massport's website at http://www.massport.com/logan-airport/to-from-logan/transportation-options/.
Attractive and distinctive signage and graphics will be utilized inside the terminal and out at the curb to clearly mark access to Logan Express, MBTA, water transportation, and other HOV options.	**Implemented.** Signage is installed in the terminal and at the curbside identifying HOV curb locations. In 2012, Massport installed new digital signage at all terminal Silver Line curb locations to indicate next bus wait times, which has improved passenger convenience.
As HOV services continue to develop and expand at Terminal E, Massport will expand its web page to encompass these new services and initiatives.	**Implemented.** Massport continues to reflect service changes on its website.
Massport and the MBTA will offer, on a trial basis, the sale of MBTA tokens via a vending machine in the baggage claim area of Terminal C.	**Implemented.** The MBTA Charlie Card machines are located at the MBTA's Blue Line Airport Station and in each of the Logan Airport passenger terminals. Massport continues to offer free service to Airport Station and the water shuttle dock with its fleet of compressed natural gas (CNG) and clean diesel/electric hybrid buses. Since the summer of 2012, Massport continues to sponsor a pilot program offering free rides on the Silver Line from Logan Airport to downtown Boston.

Source: Massport
Note: Text in *italics* detailing the mitigation measures is excerpted from the Section 61 Findings submitted to the EEA, June 26, 1997.

Replacement Terminal A Project – EEA #12096

Permitting History

- Certificate on the Final EIR issued on November 16, 2000.
- Section 61 Findings submitted to EEA on August 31, 2001.

Project Status

The Replacement Terminal A Project (**Figure 9-3**) replaced the original Terminal A with a main terminal linked to a satellite concourse. The new Terminal A opened on March 16, 2005.

In the spring of 2006, Delta Air Lines and Massport submitted an application for certification of Terminal A under the U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED®) Green Building Rating System™. LEED certification was awarded in June 2006, making Terminal A the first airport terminal in the world to be awarded LEED certification.

The following sustainable elements were incorporated into the design of Terminal A:

- **Water conservation** — low-flow toilets and drip, rather than spray, irrigation.
- **Atmosphere protection** — zero use of chlorofluorocarbon (CFC)-based, hydrochlorofluorocarbon (HCFC) based, or halon refrigerants.
- **Energy conservation** — special roofing and paving materials that reflect solar radiation. Solar panels were installed on the roof of Terminal A in 2012.
- **Materials and resources conservation** — more than 10 percent of all the building materials used to construct the terminal were from recycled materials.
- **Enhanced indoor environmental air quality** — low and volatile organic compound (VOC) free adhesives, sealants, paints, and carpets were used.
- **Sustainable sites** — bicycle racks were installed.

Table 9-4 lists each mitigation measure in the Section 61 Findings along with Massport's progress in achieving these measures through the end of 2016.

FIGURE 9-3 Replacement Terminal A Project | **2016 Environmental Data Report**

◆ Terminal A Replacement Project - EEA #12096

0 450 900 1800 Feet

Table 9-4 Replacement Terminal A Project Status Report (EEA #12096) Section 61 Mitigation Measures (as of December 31, 2016)

Mitigation Measure	Status
Project Design Mitigation	
Logan Transportation Management Association (TMA) Participation	
Delta Air Lines, Inc. to join Massport's Logan TMA and designate an Employee Transportation Advisor.	**Implemented.** Delta Air Lines joined the Logan TMA and designated an Employee Transportation Advisor.
Additionally, Delta Air Lines will provide the following services as part of their Transportation Demand Management Program through the Logan TMA Transportation subsidy for full-time Delta Air Lines employees at Logan Airport; ride matching/carpooling; vanpooling; guaranteed ride home; preferential parking for HOVs; shuttle to and from employee parking.	**Implemented.** Transportation Demand Management (TDM) services are provided through Delta Air Lines and the Logan TMA.
Recycling Program	
The Replacement Terminal A will be included in Massport's terminal recycling program.	**Implemented.** Paper, plastic, aluminum, glass, and cardboard are recycled at Terminal A. In 2013, Massport converted to single-stream recycling in all terminals. Massport established aggressive recycling goals as part of its 2015 Logan Airport Sustainability Management Plan and is actively working to reduce waste and increase its recycling rate. As part of this effort, Massport installed liquid diversion stations at the security checkpoint for Terminals A, B, C, and E in the spring of 2016. Passengers are now able to empty their bottles before security and re-fill them again on the secure side for the remainder of their journey.
High Occupancy Vehicle (HOV) Promotion	
HOV access can be accommodated on the departures level and will be designated near main entrances to the terminal building to ensure efficient and convenient unloading by air passengers who use these mode-types to access the Airport. *The inner-most curb of [the arrivals level] will be designated exclusively for HOVs and taxis, similar to the departures level.*	**Implemented.** Curbside HOV lanes give HOV modes preferential access to Terminal A for passenger convenience at both the arrival and departure levels. Coinciding with the opening of the Rental Car Center (RCC) (and its new on-Airport shuttle bus operations), in September 2013, Massport made improvements to the terminal curbsides to increase access for HOV/transit/shared-ride modes. The improvements followed several general principles: situate HOV modes to the curb closest to the terminal and locate the Airport's Blue Line/RCC shuttle stop adjacent to the Silver Line stop. Terminals B, C, and E underwent the most significant changes; in fact, the ground level of the Terminal B garage was converted to a taxi and limousine pick-up area, eliminating all commercial parking from that level, and allowing extra curb space to be better allocated among the remaining HOV and other modes. Terminal A, which already had the primary HOV modes pick-up at the terminal curb (and private vehicles pick-up at the second/outer curb), underwent the fewest changes (notably relocating the Silver Line bus stop to be adjacent to the Blue Line/RCC shuttle stop). The curb improvements also included adding electronic "next bus arrival time" displays for the Massport shuttles, MBTA Silver Line, and Logan Express buses.

Table 9-4 Replacement Terminal A Project Status Report (EEA #12096) Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Ground Service Equipment (GSE) Conversion	
In conjunction with the Project, Delta Air Lines will implement a program for conversion of its entire GSE fleet at Terminal A as soon as viable alternative fueled fleet vehicles become available and can be effectively integrated into Delta Air Lines' operations at Terminal A. Delta Air Lines will introduce battery powered baggage tugs and belt loaders with the replacement terminal and convert this portion of the GSE fleet by the end of 2008. This represents over 40 percent of Delta Air Lines' current GSE fleet.	**Implemented.** Terminal A incorporates infrastructure for GSE charging. In September 2009, Massport approved a 3-million-dollar loan to Delta Air Lines for the purchase of battery-powered baggage tugs and battery powered-baggage conveyor belt vehicles. Delta Air Lines purchased 50 electric baggage cart tugs, 25 electric baggage conveyor belt vehicles, and charging stations for each vehicle. Thirty-two GSE charger installations have been completed and are currently serving electric GSE.
Delta Air Lines will also examine the feasibility of locating a Compressed Natural Gas (CNG) fill station at Terminal A. The availability of a CNG fueling station would facilitate conventionally-fueled vehicles to be replaced with CNG-fueled vehicles where this vehicle option is offered. Delta Air Lines will introduce these vehicles into its GSE fleet as soon as they become available and are determined to be feasible and practicable for use at Terminal A.	**Implemented.** Delta Air Lines examined the feasibility of locating the CNG fill station at Terminal A and determined it to be infeasible, given that the GSE conversions are trending toward electric vehicles and electric vehicle infrastructure. A public access CNG fuel facility is available on the Airport at 81 North Service Road.
Where new alternative fuel vehicles (AFVs) are developed and determined to be cost effective and in available supplies, Delta Air Lines will integrate their use into its Terminal A GSE fleet operations.	**Implemented.** As described earlier, Delta Air Lines has purchased electric baggage tugs and belt loaders and will continue to determine the feasibility of integrating other alternative fuel GSE, as available.
Finally, Delta Air Lines will provide Massport with an annual status report/update on the GSE conversion program at Terminal A, for inclusion in Massport's annual Environmental Data Report (EDR).	**Implemented.** Terminal A includes 32 electric charging stations for Delta Air Lines' electric ramp vehicles. Delta Air Lines continues to study which AFVs and infrastructure are best suited for its future GSE operations.
Operational Mitigation Measures	
Minimizing nighttime movement of aircraft to and from hardstand positions.	**Implemented.** In accordance with the Noise Rules, Massport continues to restrict nighttime movement of aircraft under their own power between 10:00 PM and 7:00 AM, and Massport also requires towing during this time period.

**Table 9-4 Replacement Terminal A Project Status Report (EEA #12096)
Section 61 Mitigation Measures (as of December 31, 2016) (Continued)**

Mitigation Measure	Status
Using single engine taxiing and pushback to the extent feasible and practicable, recognizing that such use is always at the discretion of the pilot in charge of the aircraft based upon his or her experience and safety and operational considerations.	**Implemented.** Massport has conducted two surveys of Logan Airport air carriers (2006 and 2009) to understand the extent single engine taxiing is used at Logan Airport. Massport annually issues letters to air carriers in support of single engine taxiing when consistent with safety procedures. Massport is an active member of the Federal Aviation Administration (FAA) Partnership for Air Transportation Noise and Emissions Reduction (PARTNER) program on reducing noise and emissions. In 2009, Massport offered to facilitate the undertaking by the Massachusetts Institute of Technology (MIT) of a more detailed survey of pilots at Logan Airport to better understand the use of single engine taxiing. MIT completed its survey and issued a paper in March 2010 (as provided in the *2010 EDR*). The MIT survey confirms earlier Massport survey findings that single engine taxiing is an important operational measure used by airlines to conserve fuel and is extensively used at Logan Airport. Based on the more detailed survey results, Massport will tailor future communication to airlines to further encourage the use of single engine taxiing, when safe to do so, within the Logan Airport operational context. In 2016, Massport sent letters to the Boston Airline Community and the Logan Airport user community encouraging them to consider the use of single engine taxiing when safe to do so. This is provided in Appendix L, *Reduced/Single Engine Taxiing at Logan Airport Memorandum* of this *2016 EDR*.
Testing alternative de-icing methods to reduce the amount of glycol usage.	**Ongoing.** Delta Air Lines is currently participating in the *Logan Deicer Management Feasibility Study* to evaluate alternatives to reduce discharges to Boston Harbor. The study report was submitted to the U.S. Environmental Protection Agency (EPA) in May 2017.

Source: Massport
Note: Text in *italics* detailing the mitigation measures is excerpted from the Section 61 Findings submitted to the EEA, August 31, 2001.

Logan Airside Improvements Planning Project – EEA #10458

Permitting History

- Certificate on the Final EIR issued on June 15, 2001.
- Section 61 Findings dated June 8, 2001, on the Final EIR.
- In June 2002, FAA filed a Final Environmental Impact Statement (Final EIS) and issued the ROD in August 2002 approving a unidirectional runway and other improvements, but deferred a decision on the centerfield taxiway pending additional review by FAA.
- In November 2003, the Superior Court of the Commonwealth modified a 1976 injunction prohibiting construction of a new runway at Logan Airport, pending further environmental review. The injunction modification allowed construction of the runway in accordance with the Secretary of EEA's Certificate on the Final EIR and FAA's ROD on the Final EIS.
- In accordance with the Secretary of EEA's Certificate on the Final EIR, Massport amended its final Section 61 Findings issued in 2001 to incorporate mitigation measures added or refined through the federal environmental review process. As a result, Massport amended its initial Section 61 Findings on October 21, 2004, to include mitigation measures required of it in FAA's ROD.
- In April 2007, FAA issued a ROD on the centerfield taxiway improvements based on its review of supplemental information.

Project Status

- Project construction commenced in 2004. Runway 14-32 opened on November 23, 2006. The first full year of operation of Runway 14-32 was 2007.
- Realignment of the southwest corner taxiway system was completed in 2007.
- Taxiway D extension was completed in 2010.
- Taxiway N realignment remains under consideration.
- Reduction in approach minimums on Runway 15R and 33L was implemented in 2013 following completion of the 33L Light Pier replacement and FAA testing of new Instrument Landing System (ILS) equipment.

The Logan Airside Improvements Planning Project (**Figure 9-4**) involved the construction of a new unidirectional Runway 14-32 and centerfield taxiway, extension of Taxiway D, realignment of Taxiway N, improvements to the southwest corner taxiway system, and reduction in approach minimums on Runways 22L, 27, 15R, and 33L. Reduction in approach minimums on Runway 15R and 33L were approved in the EIS. However, implementation for approach minimum reductions depended upon realignment of the ILS. The construction impacts of relocating the ILS localizer and new Category III ILS equipment were addressed in the environmental review of the RSA enhancements for Runway 33L (EOEA #14442). The Category III ILS began operations in 2013.

Table 9-5 summarizes the mitigation measures contained in the amended Section 61 Findings issued on October 21, 2004, and reports on the status of implementation. **Table 9-5** addresses only ongoing requirements, and it is noted when there are recent updates. Documentation on design and construction measures is provided in previous EDRs.

FIGURE 9-4 Logan Airside Improvements | **2016 Environmental Data Report**

Note: Runway 14-32 construction completed in November 2006

◆ Improved Taxiways

● Reductions in Approach Minimums

0 500 1000 2000 Feet

Table 9-5 Logan Airside Improvements Planning Project (EEA #10458)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016)

Mitigation Measures	Status
Runway 14-32 Operations and Construction Mitigation	
Operational procedures for unidirectional Runway 14-32 will include over water flight operations only, arrival operations in east-to-west direction from Runway 32 approach end, and departure operations from west-to-east direction from the Runway 14 departure end. Massport will enter into contract with appropriate government body and/or community group(s) to enforce intended unidirectional runway, if requested. Lighting, marking, and instrumental components of Runway 14-32 will be designed for a unidirectional runway. No parallel or other type taxiway facility will be constructed to allow east-to-west direction departures from the Runway 32 end. *The Federal Aviation Administration (FAA) endorsed the unidirectional limitations on Runway 14-32 and has agreed to develop air traffic control procedures to ensure safe and efficient operation of the unidirectional limitation, subject to variances that may be required to accommodate particular aircraft emergencies.*	**Implemented.** Runway 14-32 was constructed for unidirectional operation. All lighting, marking, and navigational instrumentation was constructed and is operated for unidirectional use only. There is no parallel or other type of taxiway facility that would facilitate east-to-west direction departures from the Runway 32 end. The construction mitigation measures were incorporated into the final design specifications and were implemented during construction. Runway 14-32 opened on November 23, 2006.
Wind-Restricted Use of Runway 14-32	
Restrict the use of Runway 14-32 to those times when winds are equal to or greater than 10 knots from the northwest or southeast (between 275 degrees and 005 degrees, or 095 degrees and 185 degrees, respectively).	**Implemented.** Massport provided initial data to support FAA's effort. FAA implements the wind restriction in compliance with the federal Record of Decision (ROD).
Mitigation Policies/Programs	
Regional Transportation Policy	
Engage in promoting increased utilization of regional airports. *Cooperative transportation planning with the various transportation agencies to ensure an integrated regional transportation infrastructure (i.e., improved highways, public transportation, high-speed rail, private transportation services to improve regional airport access).*	**Implemented.** During 2001, Massport, together with FAA and the six New England Regional State Aviation Directors, developed a scope of work and selected a technical team to undertake the New England Regional Aviation System Plan (NERASP) Update Study. In 2002, the Massport Board approved 10 percent funding with a 90-percent federal match toward the $1.6 million study. Please refer to Chapter 4, *Regional Transportation*, for additional information on Massport's ongoing cooperation on regional transportation efforts.
Massport will continue to exercise operational control over Worcester Regional Airport.	**Implemented**. Massport exercised operational control over Worcester Regional Airport as part of its agreement with the City of Worcester, which went into effect on January 15, 2000. In April 2004, Massport and the City of Worcester agreed to a three-year extension of the Operating Agreement, extending Massport's operation of Worcester Regional Airport through June 2007. Subsequently, both parties agreed to a further extension. Legislation was passed in 2009 requiring Massport to assume ownership of Worcester Regional Airport. Massport's ownership of Worcester Regional Airport commenced on July 1, 2010.

Table 9-5 Logan Airside Improvements Planning Project (EEA #10458)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Massport will continue to attract new air service to Worcester Regional Airport	**Implemented.** Massport continues to work with carriers and make other facility improvements to develop and sustain commercial service from Worcester. Massport is investing $100 million over the next 10 years to revitalize and grow commercial operations at Worcester Regional Airport. As a result of this collaboration, JetBlue Airways has already handled over 500,000 passengers at Worcester Regional Airport since commencing operations in late 2013. Starting in May 2018, JetBlue Airways will offer flights to John F. Kennedy International Airport in New York, NY. Additionally, American Airlines will offer flights to Philadelphia International Airport starting October 2018.
Traveler and air service awareness will be provided to Worcester Regional Airport via marketing campaigns.	**Implemented.** Massport continues to aggressively market the Airport to potential commercial air service carriers. Massport worked with JetBlue Airways to begin service out of Worcester Regional Airport in November 2013. JetBlue currently serves two Florida destinations from Worcester. JetBlue recently announced plans to start service between Worcester Regional Airport and John F. Kennedy International Airport in 2018.
Develop and maintain an aviation information database to include: aviation trend tracking reports for distribution to interested parties; statistical summaries of passenger levels, aircraft operations and airline schedule data at major New England regional airports; include a summary of regional airport trends and service developments in an Annual Report.	**Implemented.** Massport collects regional airport data. A summary of individual airport activity is published annually in the Environmental Data Reports (EDRs) and Environmental Status and Planning Reports (ESPRs).
Participate in other regional/state aviation forums.	**Implemented.** The New England Regional Aviation System Plan (NERASP) study was published in October 2006. Massport continues to participate in regional and state aviation forums as they exist. Please refer to Chapter 4, *Regional Transportation*, for additional information on Massport's ongoing cooperation on regional transportation efforts.
Continue to work with FAA/regional airport directors to complete a New England Airports System Study to evaluate regional airports performance. FAA committed to work with other participants in the preparation of the study.	**Implemented.** The New England Regional Aviation System Plan (NERASP) study was published in October 2006.
Encourage transportation initiatives (i.e., commuter rail, rail or other links between regional airports) by relevant agencies or other governmental bodies through Transportation Bond Bill or other legislative initiatives to implement an improved effective regional transportation system.	**Implemented.** Massport continues to provide support for regional transportation legislation and funding for other modes of transportation including the Massachusetts Bay Transportation Authority (MBTA) Silver Line and water transportation. Massport's support was instrumental in the opening of the Anderson Regional Transportation Center (RTC) in Woburn, which provides a station building for ticketing, baggage and passenger services, approximately 2,400 parking spaces for daily and overnight parking, loading platforms for Logan Express and local buses, improved access from Interstate 93 via a new interchange constructed and opened by the Massachusetts Department of Transportation (MassDOT, formerly the Massachusetts Highway

Table 9-5 Logan Airside Improvements Planning Project (EEA #10458)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
	Department), and a new high-level platform commuter rail station.
Continue to support inter-city rail planning through the Boston Metropolitan Planning Organization (MPO).	**Implemented.** Massport continues to actively participate in the Boston MPO and contributes to the policy discussions in all modes of transportation.
Allow Massport's Logan Express satellite parking lots and stations available for third-party bus and park-and-ride connections to other regional airports, including Worcester, Manchester, and Providence.	**Implemented.** Upon request and review, Massport will continue to allow third party bus operators to provide service to regional airports from Logan Express facilities. In 2007, Massport enacted an agreement with Manchester-Boston Regional Airport to allow operation of a shuttle service between Manchester-Boston Regional Airport and the Anderson Regional Transportation Center (RTC) in Woburn. That pilot program was replaced by hourly van service in 2008.
Sound Insulation	
Sound insulation is being provided within the Boston Logan Airside Improvements Planning Project Mitigation Contour including the affected residences of Chelsea, East Boston, Winthrop, and Revere. Through special project mitigations, FAA funding will be provided for residences with building code considerations to allow for the necessary upgrades thereby ensuring eligibility and participation in the sound insulation program. If FAA funding is unavailable to complete sound insulation to residences within the DNL 65 dB contour as a result of project implementation, Massport will provide the funding.	**Implemented.** Sound insulation is being implemented in full compliance with state and federal regulatory requirements and mitigation commitments. Since 1986, Massport has sound insulated nearly 6,000 residential buildings totaling over 11,515 dwelling units. See Chapter 6, *Noise Abatement,* for additional details on sound insulation.
Preferential Runway Advisory System (PRAS)	
Massport will develop and implement a PRAS monitoring system and a new distribution system for reporting that will expand the contents of Massport's Quarterly Noise Reports and will involve the expansion of the distribution list to include the Logan Airport Citizens Advisory Committee (CAC). Runway utilization, dwell, and persistence reports will be included in the ESPR filings with MEPA. Massport will continue to work with FAA to design additional reports to enhance the attainment of PRAS and Massport will begin to work with CAC to update PRAS. The current PRAS system will remain in place until superseded.	**Implemented.** Massport, FAA, and the CAC initiated a noise study of Logan Airport. PRAS review and reporting was incorporated into the noise study. During Phase 2 of the on-going Boston Logan Airport Noise Study (BLANS) the Logan Airport CAC voted to abandon PRAS because it had not achieved the intended noise abatement. Phase 3 of the BLANS focused on the development of an updated Runway Use Program. Operational tests of a new program began in November 2014 and continued through September 2016. The BLANS project ended in 2016 without the Logan Airport CAC agreeing on a new Runway Use Program. A final BLANS project report was issued in April 2017. For additional information, refer to Chapter 6, *Noise Abatement*. Runway utilization, dwell, and persistence reports continue to be included in the annual ESPR and EDR filings.

Table 9-5 Logan Airside Improvements Planning Project (EEA #10458)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Noise Abatement Study	
FAA has committed to undertake a noise abatement study that will include enhancing existing or developing new noise abatement measures applicable to aircraft overflight impacts, which will take into account environmental benefit, operational impact, aviation safety and efficiency, and consistency with applicable legal requirements. The scope of this study has been completed through the joint efforts of FAA, the CAC, and Massport as required by the ROD. Massport will work with the CAC and FAA to assess the existing PRAS at Logan Airport in accordance with Section 10.0 of the Section 61 Findings and will continue to participate in the noise study as contemplated in the ROD.	**Implemented.** FAA, in conjunction with Massport and the Logan Airport CAC, initiated the Boston Overflight Noise Study (BONS). Phase 1 of the study, completed in early 2007, defined and sought to implement changes to flight tracks to minimize impacts from aircraft overflights, which do not require a detailed Environmental Assessment (EA). Federal funding for Phase 2 was requested early to ensure seamless continuation of the study and transition. Phase 2 of the BLANS was completed in 2012. It addressed additional noise abatement alternatives that will require detailed analysis to meet FAA environmental requirements. Massport is working with the Logan Airport CAC and FAA on Phase 3 of the BONS Study to design a runway use plan for the Airport. Logan CAC could not agree on a runway use program and Phase 3 was completed in August 2012.
Peak Period Monitoring and Demand Management Program (DMP)	
Massport will develop and implement a Peak Period Pricing (PPP) program or an alternative DMP. Massport will identify standards to allow airlines to accurately predict scheduling costs and modify accordingly. Massport will establish and maintain a monitoring system. *Massport will comply with its commitments with respect to PPP or alternate DMP. FAA has indicated in the ROD that it stands ready to assist Massport in this endeavor.*	**Implemented.** In July 2004, Massport filed a proposed rule with the Office of the Massachusetts Secretary of State to formally initiate the state rulemaking process and public review to establish a peak period surcharge during designated peak delay periods at Logan Airport. The filing was followed by a public comment period that lasted through November 15, 2004. During the comment period, Massport conducted two public hearings. The Massport Board voted to establish the peak period surcharge program on January 16, 2005, and the program has been in place since then (see 740 CMR 27.00 et. al.). Please refer to Appendix K, *2016 Peak Period Pricing Monitoring Report* for additional details.

Table 9-5 Logan Airside Improvements Planning Project (EEA #10458)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Single Engine Taxi Procedures	
Develop and implement a program designed to maximize the use of single engine procedures by all tenant airlines, consistent with safety requirements, pilot judgment and federal law requirements.	**Implemented.** Massport supports the use of single engine taxiing when it can be done safely, voluntarily, and at the discretion of the pilot. Massport has conducted two surveys of Logan Airport air carriers (2006 and 2009) to understand the extent single engine taxiing is used at Logan Airport. Massport has also issued letters to air carriers in support of single engine taxiing when consistent with safety procedures. Massport is an active member of the FAA Partnership for Air Transportation Noise and Emissions Reduction (PARTNER) program on reducing noise and emissions. In 2009, Massport offered to facilitate the undertaking by the Massachusetts Institute of Technology (MIT) of a more detailed survey of pilots at Logan Airport to better understand the use of single engine taxiing. MIT completed its survey and issued a paper in March 2010 (as provided in the *2010 EDR*). The MIT survey confirms earlier Massport survey findings that single engine taxiing is an important operational measure used by airlines to conserve fuel and is extensively used at Logan Airport. In 2016, Massport issued letters to air carriers in support of single engine taxiing when consistent with safety procedures. A copy of these letters is included in Appendix L, *Reduced/Single Engine Taxiing at Logan Airport Memorandum* of this *2016 EDR*.
Report on Progress of Logan Transportation Management Association (TMA)	**Implemented.** Chapter 5, *Ground Access to and from Logan Airport* discusses the status of the Logan TMA and efforts to increase Logan TMA membership and overall high occupancy vehicle (HOV) access to Logan Airport. The focus is on expanding Logan TMA services, broadening HOV options, and supporting all major Logan Airport tenants to become members and actively participate in the Logan TDM strategies. A local "Sunrise Shuttle" has been operating since 2007. New work includes: convening an interdepartmental working group focused on rideshare/employee commutes; increasing outreach to employees about transportation options; and hosting Employee Commute Fairs in 2017.

Source: Massport
Note: The mitigation measures in *italics* are those that were referenced in FAA's ROD and later incorporated into the Section 61 Findings amended on October 21, 2004.

Southwest Service Area (SWSA) Redevelopment Program, EEA #14137

Permitting History

- Certificate on the Final EIR issued on May 28, 2010.
- Section 61 Findings submitted to EEA on June 29, 2010.

Project Status

Massport continues redevelopment of the SWSA and completed the Rental Car Center (RCC) in 2014. In addition to customer service benefits, consolidation of the rental car operations and their shuttle buses into one coordinated operation has resulted in reduced vehicle miles traveled (VMT) and reduced air emissions. See Chapter 5, *Ground Access to and from Logan Airport*, for additional information on VMT reductions.

Construction of enabling projects commenced in late summer 2010 as final design of the facility continued through 2011. All RCC facilities (the Garage Structure, Customer Service Center, permanent Quick Turnaround Areas (QTAs) 1 and 2, and temporary QTAs 3 and 4) would be constructed first. The first rental car companies moved into the QTA 1 in mid-2013 and the remaining companies by early 2014. By the end of 2015, the project was completed and fully operational. Logan Airport's new bus fleet, comprising 21 Compressed Natural Gas (CNG) buses and 32 clean diesel/electric buses, has fully replaced the entire fleet of diesel rental car shuttle buses now that the RCC is fully operational. An additional CNG bus was put into service in 2016, increasing the total to 22 CNG buses. Additionally, in keeping with its commitment to sustainability, Massport is proud that the RCC was awarded Logan Airport's first LEED Gold certification in 2015.

Table 9-6 outlines Section 61 mitigation commitments of the SWSA Redevelopment Program, which Massport, the construction contractors, and the rental car companies have implemented as part of the design, construction, and operation of the facility. This project is now complete, and there is updated progress for each mitigation measure.

Table 9-6 Southwest Service Area (SWSA) Redevelopment Program (EEA #14137) Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016)

Mitigation Measure	Status
Site Design	
Stormwater Management	
Improve quality of runoff by upgrading stormwater management facilities site-wide, reducing the volume of flow to the Maverick Street Outfall by increasing pervious area site-wide, utilization of Low Impact Design elements, and replacing uncovered parking areas with buildings.	**Implemented.** These stormwater design features were included in the final project design and are part of the project. The stormwater features include 27 Stormceptors that were constructed as part of this project. Stormceptors are prefabricated, underground units that separate oils, grease, and sediment from stormwater runoff when installed as part of a pipe conveyance system.
Design new sanitary and drainage systems to result in an overall reduction in combined sewer overflow volumes at the Porter Street Outfall and eliminate discharge to Maverick Street Outfall and Bird Island Flats/West Outfall.	**Implemented.** The sanitary sewer system adds new connections at Gove Street and Harborside Drive. Sanitary flows to the Maverick Street sewer were significantly reduced once the connection was completed. The stormwater analysis showed an overall reduction in the post-development stormwater flows for the project, as well as reductions in flows to the Porter Street and West Outfalls and elimination of stormwater flow to the Maverick Street Combined Sewer. Both the sanitary sewer system and stormwater drainage system are completed.
Remediation and Underground Fuel Storage Systems	
Remove all existing car rental fueling systems and associated tanks and replace with current, state-of-the-art vehicle fueling and washing facilities.	**Implemented.** This element has been implemented as part of the Quick Turnaround facilities. Massport will be installing state-of-the-art car wash drying equipment in 2018 for seasonal operation to alleviate worker and customer safety issues associated with ice.
Noise Reduction Measures	
Eliminate individual rental car shuttle buses and combine Massport Airport Station buses (routes 22/33/55) through the Unified Bus System; thereby, reducing the overall number of rental car-related buses circulating on-airport and associated noise.	**Implemented.** Massport purchased a new bus fleet which was put into operation in 2012. The new bus fleet, comprising 21 compressed natural gas (CNG) buses and 32 clean diesel/electric buses, has fully replaced the entire fleet of diesel rental car shuttle buses with the Rental Car Center (RCC) opening in 2013. One additional CNG bus was put into service in 2016, increasing the total from 21 to 22 buses.
Incorporate noise reduction strategies into site design, such as solid fences/walls, gateway signs/walls, and landscaped berms.	**Implemented.** All noise reduction measures were constructed. In 2017, at the request of the Rental Car companies, Massport evaluated installation of state-of-the art vehicle drying systems that would eliminate safety issues arising from freezing at the end of the washing cycle. Based on availability of new low noise drying equipment, in fall 2018, Massport plans to install drying equipment in each of the four vehicle Quick Turnaround Areas (QTA). The new equipment will be operated primarily during daytime hours, seasonally when freezing conditions typically occur.

Table 9-6 Southwest Service Area (SWSA) Redevelopment Program (EEA # 14137)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Airport Transportation System Improvements	
Reduce the rental car shuttle bus fleet by approximately 70 percent through the creation of the Unified Bus System when compared to the 2007 Existing Condition and future No-Build/No-Action Conditions.	**Implemented.** Massport purchased a new Unified Bus Fleet of diesel/electric hybrid and CNG buses. The initial buses were put into operation in 2012. Full implementation of the new bus fleet occurred when the RCC opened in the fall of 2013.
Reduce rental car shuttle bus terminal curbside congestion through the creation of the Unified Bus System resulting in reduced emissions.	**Implemented** upon project opening. Massport purchased a new Unified Bus Fleet which was put into initial operation in 2012.
Utilize clean- and low-emission fuel for the Unified Bus System to further reduce emissions.	**Implemented** upon project opening. Massport has purchased a new Unified Bus Fleet. The new fleet is comprised of diesel/electric hybrid and CNG buses.
Install Intelligent Transportation System features, as part of the Unified Bus System to further reduce emissions and improve operational efficiency.	**Implemented** upon project opening. Massport purchased a new Unified Bus Fleet which was put into initial operation in 2012.
Implement new wayfinding signage to increase the efficiency of the circulating vehicles within and around the SWSA.	**Implemented** upon project opening.
Pedestrian and Bicycle Facilities	
Provide new pedestrian and bicycle facilities, including secure and covered bicycle storage at the Customer Service Center (CSC) and QTA buildings for employees, customers, and the general public, as well as shower/changing facilities within the QTA buildings for employees.	**Implemented.**
Provide enhanced pedestrian connections to and from the SWSA, airport terminals, the Logan Office Center, Memorial Stadium Park, Bremen Street Park, the Harborwalk, on-airport buses, public transit (MBTA Airport Station), along Porter Street, and surrounding East Boston neighborhoods.	**Implemented.**
Provide street and pedestrian-level lighting and advanced warning signals and/or systems at crosswalks.	**Implemented.**
Transportation Demand Management (TDM) Plan	
Provide limited SWSA employee parking on-site.	**Implemented.**
Provide new access to public transit through the Unified Bus System (direct connection to MBTA Blue Line at Airport Station) and new/enhanced pedestrian facilities at the station.	**Implemented.**
Require rental car companies to participate in the Logan Transportation Management Association (TMA).	**Implemented.** This requirement is included in new Rental Car Center (RCC) tenant leases.
Alternative-Fuel Vehicles	
The rental car companies would provide fuel-efficient and/or alternative-fueled rental vehicles (quantity to be determined by the rental car companies).	**Implemented.** This requirement is included in new RCC tenant leases.

Table 9-6 Southwest Service Area (SWSA) Redevelopment Program (EEA # 14137)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Off-Airport Improvements/Benefits	
Reconstruct Frankfort Street/Lovell Street intersection to provide a new traffic signal control and pedestrian-related improvements (for temporary impacts of the relocation of the Bus and Limousine Pools to the North Service Area (NSA) during construction).	**Implemented.**
Reduce the amount of off-airport car shuttling to and from off-airport locations, further reducing traffic on Route 1A and local roadways surrounding the airport due to the consolidated and expanded rental car "ready/return" parking spaces and QTA areas at the SWSA.	**Implemented** upon project opening.

Source: Massport.
Note: The mitigation measures in *italics* are those that were referenced in FAA's ROD, and later incorporated into the Section 61 Findings as amended on June 29, 2010.

Logan Airport Runway Safety Area (RSA) Project – EEA #14442

Permitting History

- Certificate on the Final EA/EIR issued on March 18, 2011.
- FAA issued a Finding of No Significant Impact (FONSI) on April 4, 2011, which documents that the proposed Federal action is consistent with the National Environmental Policy Act of 1969 (NEPA) and other applicable environmental requirements and will not significantly affect the quality of the human environment with the mitigation requirements referenced in **Table 9-7**.
- Section 61 Findings were submitted to EEA on May 27, 2011, and published in the *Environmental Monitor* on June 8, 2011.
- Certificate on the Notice of Project Change (NPC) for the replacement of the Runway 33L approach light pier was issued on March 9, 2012.
- On April 12, 2012, FAA found that the replacement of the Runway 33L approach light pier was a Categorical Exclusion and thus exempt from further consideration under NEPA.

Project Status

- The first construction season for the Runway 33L RSA commenced in June 2011 and was completed in November 2011. The second construction season started in June 2012 and was completed in November 2012.
- Replacement of the Runway 33L approach light pier commenced in July 2012 and was completed in November 2012. The upgraded Category III system was put in service in 2013.
- The Runway 22R improvements were completed in 2014.

As described in previous EDRs/ESPRs, Massport has periodically undertaken RSA improvement projects at other Logan Airport runways. Massport has completed safety improvements for Runways 22L, 4L/4R, and 27 under

EEA #5122. In 2005, Massport began undertaking safety improvements at Runway 22R with the construction of an Engineered Materials Arresting System (EMAS) bed at the end of the runway in compliance with FAA directives, although no MEPA review was needed. In 2006, as part of a separate project, Massport installed an EMAS bed at the Runway 33L End. The Logan Airport RSA Project considered further enhancements to the Runway 33L and Runway 22R RSAs. Massport prepared a combined EA in accordance with NEPA and an EIR in accordance with MEPA for the proposed enhancements at the Runway 33L and Runway 22R RSAs. The ENF was filed with MEPA on June 30, 2009, and the Draft EA/EIR was submitted to FAA and EEA on July 15, 2010. The Final EA/EIR was submitted to FAA and EEA on January 30, 2011. **Figure 9-5** shows the location of RSA projects at Logan Airport.

The Runway 33L RSA improvements include a 600-foot long RSA with an EMAS bed, portions of which are on a 460-foot long by 303-foot wide pile-supported deck extending over Boston Harbor. Additional elements of the RSA improvements include two emergency access ramps located on either side of the deck and relocation of the perimeter access road. Construction of the pile-supported deck was completed in November 2012.

The Runway 33L RSA project replaced the inner 500 feet of the light pier. As construction progressed on the Runway 33L RSA improvements, Massport determined that it would be feasible to replace the remaining Runway 33L approach light pier. In the summer of 2012, Massport began replacing approximately 1,900 feet of the existing timber light pier that extends approximately 2,400 feet southeast of Runway End 33L. The existing timber pier was replaced with a new concrete structure along the runway centerline, approximately 10 feet south of the old pier, using concrete pilings. The in-kind replacement reduced the total number of pilings significantly (from over 500 to approximately 150). As part of the reconstruction, the new light pier was also constructed to accommodate upgraded navigational aids. The pier improvements provide the infrastructure necessary to support navigational aids that facilitate implementation of the reduced aircraft approach minimums previously reviewed and approved by FAA in a ROD dated August 2, 2002, for the *Logan Airside Improvements Planning Project (Airside Project)* (EEA #10458). Massport filed a NPC with MEPA for the proposed light pier replacement on January 31, 2012. On March 9, 2012, the EEA Secretary issued an NPC Certificate determining that no further MEPA review was required for the light pier replacement. On April 12, 2012, FAA found that the replacement of the Runway 33L approach light pier was eligible for a Categorical Exclusion and thus exempt from further review under NEPA.

The Runway 22R improvements that were completed in 2014 enhanced the existing RSA at this location by constructing an inclined safety area (ISA) similar to the ISA constructed at the Runway 22L end. Construction of the Runway 22R ISA is completed. **Table 9-7** lists the Section 61 mitigation commitments for the Logan Airport RSA Project and Massport's progress in achieving these measures.

FIGURE 9-5 Runway End Safety Improvements

2016 Environmental Data Report

◆ Runway End Safety Improvements

0 500 1000 2000 Feet

Table 9-7 Logan Airport Runway Safety Area Improvement Program (EEA # 14442) Section 61 Mitigation Commitments to be Implemented (as of December 31, 2016)

Mitigation Measure	Status
Protected Resources	
Eelgrass (Runway-End 33L Only)	
Develop a mitigation program that will replace lost eelgrass area and functions by creation of new eelgrass, at a 3:1 replacement to loss ratio.	**Implemented.** Eelgrass was transplanted in 2011, but did not survive through 2012. In 2013, state and federal agencies agreed that Massport's implementation of a conservation mooring program would be a suitable replacement alternative to the initial eelgrass transplant. In 2015, Massport completed the replacement of nearly 240 traditional moorings, located in eelgrass habitat, with conservation moorings. The moorings are located in Boston and four other Commonwealth harbors. Under contract to Massport, the Massachusetts Division of Marine Fisheries conducted monitoring of the installations in 2014, 2015, 2016, and 2017.
Salt Marsh (Runway-End 22R Only)	
Restore new salt marsh at a 2:1 replacement to loss ratio.	**Implemented** as part of Runway 22R habitat mitigation at Rumney Marsh. Construction was completed in 2016.
Monitor compensatory salt marsh for success and invasive plant species, and implement an invasive species control plan.	**Implemented** upon completion of Runway 22R habitat mitigation at Rumney Marsh in 2017.
Shellfish	
Monitor pilings and substrate at Runway 33L.	**Implemented.** Monitoring conducted summer 2013, 2014, 2015, and 2017.
Restore approximately 1.1 acres of habitat.	**Implemented** as part of habitat mitigation at Rumney Marsh.
Harvest and transplant shellfish from the footprint of the Runway 22R Inclined Safety Area (ISA).	**Not Implemented.** The Massachusetts Division of Marine Fisheries (MassDMF) identified a risk of shellfish disease in the Logan Airport flats, including Runway 22R and determined that the shellfish should not be relocated.
Execute Memorandum of Agreement with the Massachusetts Division of Marine Fisheries for resource enhancement.	**Implemented.** A Memorandum of Agreement (MOA) with MassDMF was executed on July 30, 2012 and all requirements of the MOA have been implemented.
State-Listed Rare Species	
Identify equivalent area of pavement for removal to maintain area of available habitat at Logan Airport for the upland sandpiper if required by the Massachusetts Natural Heritage and Endangered Species Program.	**To be implemented.** The Massachusetts Natural Heritage and Endangered Species Program (NHESP) has determined that construction time of year restrictions will avoid impacts to state-listed species. These seasonal restrictions will be implemented when construction of Taxiway C-1 is initiated in 2018.

Table 9-7 Logan Airport Runway Safety Area Improvement Program (EEA # 14442) Section 61 Mitigation Commitments to be Implemented (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Protected Resources	
Cultural Resources	
Develop an Unanticipated Discovery Plan in accordance with the Board of Underwater Archaeological Resources' Policy Guidance.	**Implemented.** An Unanticipated Discovery Plan was developed in accordance with the Board of Underwater Archaeological (BUA) Resources' Policy Guidance and approved by BUA. No resources were discovered during construction.
Water Quality	
Develop and implement a comprehensive Soil Erosion and Sediment Control Plan in accordance with NPDES and MassDEP standards.	**Implemented.** A comprehensive Soil Erosion and Sediment Control Plan was developed and implemented at the outset of Runway 33L construction in June 2011 and maintained through the end of construction in 2012.

Source: Massport.

Note: The mitigation measures in *italics* are those that were referenced in FAA's ROD and later incorporated into the Section 61 Findings as amended on May 27, 2011.

Terminal E Modernization – EEA #15434

Permitting History

- Certificate on the ENF issued on December 16, 2015
- Certificate on the Draft EIR issued on September 16, 2016.
- Certificate on the Final EIR issued on November 10, 2016
- Section 61 Findings approved on January 19, 2017.
- FAA Finding of No Significant Impact (FONSI)/Record of Decision issued on November 14, 2016.

Project Status

The Terminal E Modernization Project is being planned and designed to be constructed in two phases. At the completion of Phase 2, the project will include the addition of seven new gates to Terminal E (three of which were already approved under the Massachusetts Environmental Policy Act (MEPA) in 1996, but were never constructed). The existing concourse, terminal core, and terminal roadway frontages (collectively, the "Project") will also be extended. Implementation of the Project will better accommodate the current and projected increased demand for international travel that is expected to occur whether or not the Project is implemented.

As of the date of this document filing, Massport has selected a final design engineer and construction management team. Design is advancing with the goal of commencing construction of Phase 1 in 2018. Phase 1 is planned to include four of the seven new gates. To accommodate this initial phase of construction, the existing Logan Gas Station will be located to the Southwest Service Area along Hotel Drive and Jeffries Street. Construction of Phase 1 is expected to be completed in Spring 2019.

Phase 2 is anticipated to commence after 2020.

Figure 9-6 shows the location of the Terminal E Modernization Project. **Table 9-8** lists each of the Section 61 mitigation commitments for the Terminal E Modernization Project and Massport's progress in achieving these measures. Future ESPRs and EDRs will provide updates, as available.

FIGURE 9-6 Terminal E Modernization Project | **2016 Environmental Data Report**

◆ Terminal E Modernization Project - EEA #15434

0 500 1000 2000 Feet

Table 9-8 Terminal E Modernization Project (EEA #15434)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016)

Mitigation Measure	Status
Overall Project Benefits	
Provide pedestrian access between Terminal E and MBTA Airport Blue Line-Station.	Pedestrian access between Terminal E and Airport Station will be implemented as part of Phase 2. The connection could be implemented in the form of a moving sidewalk or an Automated People Mover (APM). Future EDR/ESPRs will provide updates on design status and what concept is being advanced.
Construct roadway and curb improvements to improve vehicle flow, HOV access, and reduce air and GHG emissions.	Final design is being advanced consistent with the commitments in the Final Environmental Assessment (EA)/Environmental Impact Report (EIR).
Site Terminal E additions so as to buffer the adjacent neighborhoods from aircraft noise.	Final design is being advanced consistent with the commitments in the Final EA/EIR.
Overall Project Benefits	
Seek LEED certification at Silver level or better; meet or exceed MA LEED Plus program goals.	Final design is being advanced consistent with the commitments in the Final EA/EIR.
Provide 400 Hz of power and pre-conditioned air at the new aircraft gates.	400 Hz power and preconditioned air will be installed at the new gates when constructed.
Site Planning and Sustainable Design/Greenhouse Gas Reduction	
▪ *Incorporate sustainable design in design, construction, and operations including:*	Final design is being advanced consistent with the commitments in the EA/EIR.
▪ *Improved building envelope*	Final design is being advanced consistent with the commitments in the EA/EIR.
▪ *Improved Air Handling Units;*	Final design is being advanced consistent with the commitments in the EA/EIR.
▪ *Efficient water loops*	Final design is being advanced consistent with the commitments in the EA/EIR.
▪ *Reduced interior lighting power density*	Final design is being advanced consistent with the commitments in the EA/EIR.
▪ *Specify roofing materials with a minimum reflectance rating of 0.70 and emittance value of at least 0.75 for a minimum of 75% of the available roof area. Install non-glare roofing materials.*	Final design is being advanced consistent with the commitments in the EA/EIR.

Table 9-8 Terminal E Modernization Project (EEA #15434)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Site Planning and Sustainable Design/Greenhouse Gas Reduction	
• *Incorporate infrastructure for collection, storage, and handling of recyclable materials.*	Final design is being advanced consistent with the commitments in the EA/EIR.
• *Require contractor to develop a construction waste management plan that requires diversion or reduction of construction waste by at least 75%.*	Final design is being advanced consistent with the commitments in the EA/EIR.
• *Establish a project-specific goal for sourcing materials extracted, harvested, recovered, and or manufactured within New England.*	Final design is being advanced consistent with the commitments in the EA/EIR.
• *Design project to achieve energy efficiencies of a minimum of 20% below the MA Energy Code.*	Final design is being advanced consistent with the commitments in the EA/EIR.
• *Include water conservation devices that reduce water use by 20% below code.*	Final design is being advanced consistent with the commitments in the EA/EIR.
• *Include a minimum of 25,000 square feet of roof top solar photovoltaic system (approximately 300kW). Heat restroom hot water with solar units.*	Final design is being advanced consistent with the commitments in the EA/EIR.
• *Incorporate occupancy sensors in all indoor areas to reduce electrical demand.*	Final design is being advanced consistent with the commitments in the EA/EIR.
Evaluate other energy efficiency/greenhouse gas reduction measures as project design progresses.	Final design is being advanced consistent with the commitments in the EA/EIR.

Table 9-8 Terminal E Modernization Project (EEA #15434)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Air Quality	
Reduce operational-related carbon dioxide (CO2) emissions associated with the Project by a minimum of 30% percent.	Final design is being advanced consistent with the commitments in the Final EA/EIR.
Stormwater Management	
Replace and upgrade stormwater management.	Final design is being advanced consistent with the commitments in the Final EA/EIR.
Construction Period Impacts	
In accordance with DEP's Clean Air Construction Initiative, the Authority will require that construction contractors to install emission control devices such as diesel oxidation catalyst and/or particulate filters on certain equipment types (i.e., front-end loaders, backhoes, excavators, cranes, and air compressors).	These measures will be incorporated during construction.
Retrofitting of certain construction equipment types with emission controls such as diesel oxidation catalyst and/or particulate filters.	These measures will be incorporated during construction.
Selection of high efficiency "temporary" space heating /cooling systems.	These measures will be incorporated during construction.
Remediate subsurface contamination, as necessary, if encountered during tank removals or other excavation activities as part of construction (in compliance with the Massachusetts Contingency Plan).	These measures will be incorporated during construction.
Soil treatment and reuse on site as part of a Soil Management Plan.	These measures will be incorporated during construction.
Voluntary compliance with the requirements of City of Boston noise ordinances, including restrictions on the types of equipment that can be used, and limitations on the hours when certain activities can take place (the City of Boston noise ordinance establishes restrictions during the construction hours between 7:00 PM and 7:00 AM).	These measures will be incorporated during construction.
Construction worker vehicle trip limitation, including requiring contractors to provide off- airport parking and use of high-occupancy vehicle transportation modes for employees.	These measures will be incorporated during construction.
Implement Indoor Air Quality (IAQ) Management Plan during construction.	These measures will be incorporated during construction.

Table 9-8 Terminal E Modernization Project (EEA #15434)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Construction Traffic Operations	
Construction-related traffic will be required to access and egress through the North Gate using only state and federal highways and the Airport roadway network. Construction-related traffic on local East Boston roadways will be prohibited.	These measures will be incorporated during construction.
Construction Traffic Operations	
Construction employee parking spaces will not be permitted on the construction site nor will provisions be made for them elsewhere on-airport with the exception of a small number of spaces for supervisory personnel. The Authority will require contractors on this Project to implement construction worker vehicle trip management measures, including requiring off-Airport parking and HOV transportation modes for contractor employees.	These measures will be incorporated during construction.
Police details will be employed, as needed, to manage traffic and ensure public safety.	These measures will be incorporated during construction.
Construction Air Quality	
Construction emissions will be reduced and controlled by mandatory contractor implementation of the following best practices:	These measures will be incorporated during construction.
Encouragement for construction-worker site access/egress using dedicated buses and vans;	These measures will be incorporated during construction.
Reduction of exposed erodible surface areas to the extent feasible;	These measures will be incorporated during construction.
Covering of exposed surface areas with pavement or vegetation in an expeditious manner and periodic watering;	These measures will be incorporated during construction.
Minimizing equipment idling times;	These measures will be incorporated during construction.
Reduction of on-site vehicle speeds;	These measures will be incorporated during construction.
Ensuring contractor implementation of appropriate fugitive dust and equipment exhaust controls;	These measures will be incorporated during construction.
Use of low- or zero-emissions equipment to the maximum extent feasible; and	These measures will be incorporated during construction.

Table 9-8 Terminal E Modernization Project (EEA #15434)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Use of covered haul trucks during materials transportation.	These measures will be incorporated during construction.
Construction Noise	
Require construction equipment to deploy noise-reduction measures, such as the use of proper mufflers, measures to limit noise from truck traffic. Primarily operate only during daylight hours (7:00 A.M. to 7:00 P.M.).	These measures will be incorporated during construction.

MEPA Appendices

- Appendix A, MEPA Certificates and Responses to Comments
- Appendix B, Comment Letters and Responses
- Appendix C, Proposed Scope for the *2017 ESPR*
- Appendix D, Distribution List

This Page Intentionally Left Blank.

A

MEPA Certificates and Responses to Comments

- Secretary of the Executive Office of Energy and Environmental Affairs Certificate on the *Logan Airport 2015 Environmental Data Report (EDR)* and Massport's Responses to Comments raised in the Certificate.
- Secretary of the Executive Office of Energy and Environmental Affairs Certificate on the *Logan Airport 2016 EDR Notice of Project Change* and Massport's Responses to New Comments raised in the Certificate.
- Copies of the Secretary of the Executive Office of Energy and Environmental Affairs Certificates issued for the reporting years 2011, 2012/2013, and 2014.
- Copy of the Secretary of the Executive Office of Energy and Environmental Affairs Certificate issued for the Terminal E Modernization Project Environmental Notification Form and Responses to Comments.
- Copy of the Secretary of the Executive Office of Energy and Environmental Affairs Certificate issued for the Terminal E Modernization Project Draft Environmental Assessment/Draft Environmental Impact Report and Responses to Comments.
- Copy of the Secretary of the Executive Office of Energy and Environmental Affairs Certificate issued for the Terminal E Modernization Project Final Environmental Assessment/Environmental Impact Report.
- Copy of the Secretary of the Executive Office of Energy and Environmental Affairs Certificate issued for the Logan Airport Parking Project Environmental Notification Form and Responses to Comments.

This Page Intentionally Left Blank.

Secretary of the Executive Office of Energy and Environmental Affairs Certificate on the Logan Airport 2015 Environmental Data Report and Responses to Comments

This Page Intentionally Left Blank.

The Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Charles D. Baker
GOVERNOR

Karyn E. Polito
LIEUTENANT GOVERNOR

Matthew A. Beaton
SECRETARY

Tel: (617) 626-1000
Fax: (617) 626-1181
http://www.mass.gov/envir

February 17, 2017

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
2015 LOGAN AIRPORT ENVIRONMENTAL DATA REPORT

PROJECT NAME	: 2015 Environmental Data Report
PROJECT MUNICIPALITY	: Boston/Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: December 21, 2016

As Secretary of Executive Office of Energy and Environmental Affairs (EEA), I hereby determine that the Environmental Data Report submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (MEPA) (M.G.L. c. 30, ss. 61-62I) and with its implementing regulations (301 CMR 11.00).

The environmental review process for Logan Airport has been structured to occur on two levels: airport-wide and project-specific. The Environmental Status and Planning Report (ESPR) has evolved from a largely retrospective status report on airport operations to a broader analysis that also provides a prospective assessment of long-range plans. It has thus become, consistent with the objectives of the MEPA regulations, part of the Massachusetts Port Authority's (Massport) long-range planning process. The ESPR provides a "big picture" analysis of the environmental impacts of current and anticipated levels of activities, and presents an overall strategy to minimize impacts. The ESPR is supplemented by (and ultimately incorporates) the detailed analyses and mitigation commitments for project-specific Environmental Impact Reports (EIR). The ESPR is generally updated on a five-year basis; the most recent ESPR for the year 2011 was filed in April of 2013. Environmental Data Reports (EDRs) (formerly referred to as Annual Updates) are filed in the years between ESPRs.

Through these reports, Logan Airport is subject to comprehensive and regular MEPA review, including opportunities for public comment on cumulative impacts. This regular updating and reporting on planning and cumulative impacts is unique among State Agencies. It reflects the challenge and complexity of managing and modernizing Logan Airport within a dense, urban area. It recognizes that the proximity of communities to the Airport warrants an enhanced level of public engagement and a concerted, long-term effort to minimize and mitigate impacts.

The 2015 EDR is the subject of this review and includes the Scope for the 2016 ESPR. The 2016 ESPR is an opportunity to update the cumulative impacts of passenger growth and associated ground and aircraft operations based on revised forecasts. The 2016 ESPR will document trends and environmental impacts and will update and revise environmental management plans to address impacts. A-1
The next ESPR will analyze calendar year 2016 and provide projections through 2035. A-2

Subsequent ESPRs and EDRs will also update the cumulative impacts of passenger growth and associated ground and aircraft operations based on revised forecasts and will update and revise environmental management plans to address impacts. Future submittals will continue to document potential impacts and trends and propose measures to implement the broad goal of maintaining or reducing Logan's overall environmental impacts, even as annual passenger volumes rise. I would like to acknowledge Massport's concerted outreach effort over the last year, including the creation of the Logan Airport Impact Advisory Group (IAG) to solicit comment and to identify and prioritize projects and programs of significance to the IAG.

The 2015 EDR provides a comprehensive, cumulative analysis of the effects of all Logan Airport activities based on actual passenger activity and aircraft operational levels, provides updates on projects, environmental management plans and the status of project mitigation. The 2016 ESPR will report on updated passenger activity levels, aircraft operations forecasts, and environmental conditions forecasts. A-3

Review of the 2015 EDR and Scope for the 2016 ESPR

In 2015, Logan Airport served an all-time high of 33.4 million passengers, exceeding the 2014 historic peak. A significant portion of growth in passengers is driven by an increase in demand for international air service. Massport has provided new service to international destinations and expandined service to existing destinations. As passenger levels have increased, aircraft operations remain significantly below the peak of 507,449 operations experienced in 1998 when Logan Airport served 26.5 million passengers.

The long-term trend is towards more efficient operations and reductions or limited increases in overall environmental impacts. Although environmental impacts are significantly lower compared to 1998 when operations were highest, comparison of activity level and environmental impact data to 2014 and more recent EDRs identifies increases in noise exposure and air emissions. These increases were not forecast in the 2011 ESPR. The increases are associated with passenger growth, changes in flight patterns and changes in modeling of noise and air quality. A significant impact since 2011 is the introduction by the Federal Aviation Administration (FAA) of changes to area navigation (RNAV) procedures. The RNAV program has been implemented throughout the country and its primary purpose is to increase safety and operational efficiency. The implementation of several of these procedures have resulted in concentration of flight patterns over certain communities and significant increases in noise exposure.

The impact of the RNAV program on communities and individuals is clearly reflected in the many comment letters received on the EDR and received during review of specific projects, including the Terminal E Modernization Project (EEA# 15434). In addition, the 2015 EDR indicates that noise complaints have grown significantly. I have received comment letters from elected officials including U.S. Senator Elizabeth Warren, the City of Quincy’s Office of Council, and the Milton Office of Selectmen); the Logan Airport Community Advisory Committee; environmental advocacy groups; businesses; and residents. Massport and the FAA recently signed a Memorandum of Understanding (MOU) to frame a process for analyzing opportunities to incrementally reduce noise through changes or amendments to Performance Based Navigation (PBN), including RNAV procedures. I commend Massport and the FAA for establishing this agreement and committing to coordinate to address the A-4
impact of the RNAV program on citizens and communities. Massport has indicated that this process will incorporate community outreach and public input. This effort should be a significant focus of the 2016 ESPR.

In addition to noise impacts and abatement, traffic and air quality are common concerns of commenters. Several commenters express continued concern with the effects of ultrafine particulates (less than 100 nanometers in diameter) which are associated with transportation sources, including aviation. Massport has proposed that the Massachusetts Department of Environmental Protection (MassDEP) amend the Logan Airport Parking Freeze Regulation (310 CMR 7.30) so that Massport may increase on-airport parking. Massport has proposed increasing its parking supply, if the regulations are amended, to reduce trip generation associated with increases in passenger drop-off and pick-up at the airport. Commenters are concerned that the lifting of the Parking Freeze will lead to increases in long-term growth in traffic and congestion. I expect the data provided in the 2015 EDR will inform any A-5
project-specific review which would include review of potential environmental impacts and of project-specific impact avoidance, minimization, and mitigation measures. I note that commenters have requested to review data that supports Massport’s assertion including data from its parking survey. A-6

The EDR includes a significant amount of information and data which can be analyzed to understand historical conditions and trends as well as compare data on an annual basis or to significant milestones or benchmarks. For instance, the EDR identifies and refers to 1998 because it represents the maximum number of operations, references 2000 because that marks the beginning of a concerted effort to identify and track sustainability indicators to guide programs and mitigation, and references 2008-9 because of the economic recession and its associated effect on activity levels. Equally important to monitoring and historical data, are projections to understand how past or existing trends may affect future conditions. The 2011 ESPR projected year was 2030 and the 2016 ESPR projected year will be 2035. Many of the comments received question the relevance of comparison to certain years, assert that too much emphasis has been placed on historical trends rather than recent increases in certain indicators, and/or question the accuracy of data analysis. Massport has responded to comments regarding data in the past by improving the organization, content and presentation of data and analysis of the ESPR and EDR. The 2014 EDR in particular was a significant improvement and the 2015 EDR continues this trend.

The 2015 EDR identifies additional data collection and identifies changes in modeling programs that are designed to more accurately estimate impacts but may produce different results based on same inputs (i.e. a decrease in emissions could result from a change in modeling rather than an actual reduction in emissions). Also Massport has expanded its reporting on greenhouse gas (GHG) emissions to include tenants and ground access passenger vehicles as well as indirect sources.

The FAA Aviation Environmental Design Tool (AEDT) which was introduced in 2015 is a
significant change in modeling of noise and air quality. FAA is requiring airports to use AEDT for
National Environmental Policy Act (NEPA) review projects and soundproofing eligibility. The tool
models aircraft performance in space and time to produce fuel burn, emissions, and noise information.
The EDR indicates that Massport initiated modeling with AEDT but had concerns that it did not
accurately reflect the noise environment at Logan Airport. Massport consulted with FAA and A-7
determined that the AEDT results would not be published in the 2015 EDR. Massport is evaluating the
new model and working with the FAA to develop the types of Logan Airport specific adjustments for
the AEDT model that have been used for many years in the Integrated Noise Model (INM). Massport
has requested that the FAA consider and approve these adjustments and indicates that, if completed in a
timely fashion, AEDT modeling results would be presented in the 2016 ESPR.

Based on significant changes in operations, modeling and data collection, the 2016 EDR
provides an opportunity to reconsider data collection, presentation and analysis. I expect Massport will
consider the many thoughtful comments provided on these issues and will provide a comprehensive A-8
analysis of these significant changes (e.g. RNAV, AEDT) and results and projections may be influenced
by them.

<u>General</u>

The 2016 ESPR should follow the general format of the 2011 ESPR, presenting major policy
discussions and an overview of the role of Logan Airport in the regional planning context. This should A-9
be followed by a status report on Massport's planning initiatives, projects, and mitigation measures. The
ESPR should include an Executive Summary and Introduction, similar to previous ESPRs and EDRs.
Massport must provide necessary background information to allow reviewing agencies and the public to
understand the environmental policies and planning which form the context of the environmental A-10
reporting, technical studies, and environmental mitigation initiatives at Logan Airport. Some
commenters acknowledged Massport's efforts to increase outreach and resources, including providing A-11
translation at meetings and translation of the EDR Executive Summary into Spanish.

The 2016 ESPR should report on updated passenger and operations activity forecasts for Logan A-12
Airport, Hanscom Field and Worcester Regional Airport. The new forecast used should begin with 2016
as the base year and project activity forecasts forward to calendar year 2035. In addition, the 2016 ESPR
will use the results of the 2016 Logan Airport Air Passenger Ground Access Survey and the Long-term A-13
Parking Management Plan to inform transportation planning.

The technical studies in the 2016 ESPR should include reporting on and analysis of key A-14
indicators of airport activity levels, the regional transportation system, ground access, noise, air quality,
environmental management, and project mitigation tracking. The 2016 ESPR must also respond to
issues explicitly noted in this Certificate and the comments received on the 2015 EDR. A-15

A distribution list for the 2016 ESPR (indicating those receiving documents, CDs, or Notices of A-16
Availability) should be provided in the document. This section must also include copies of all ESPR A-17
and EDR Certificates issued since the 2011 Logan ESPR to provide context for reviewers. Supporting
technical appendices should be provided as necessary. A-18

Responses to Comments

To ensure that the issues raised by commenters are addressed, the 2016 ESPR should include
direct responses to comments to the extent that they are within MEPA jurisdiction. This directive is not A-19
intended to, and shall not be construed to, enlarge the scope of the 2016 ESPR beyond what has been
expressly identified in this Certificate. I recommend that Massport continue to use the format from the
EDR; however, it should limit references to a section of the 2016 ESPR unless they are directly A-20
responsive to the comment. Common themes that should be addressed throughout the ESPR and in the A-21
Responses to Comments include noise modeling, contours and abatement. The 2016 ESPR should
include sufficient information to address comments on traffic and air quality. Massport should consult A-22
directly with individual commenters as appropriate.

Activity Levels

This section reports on annual air traffic activity at Logan Airport in 2015, including air passengers, aircraft operations, aircraft fleet mix, and cargo volumes. Air traffic activity levels at Logan Airport are the basis for the evaluation of noise, air quality effects, and ground access conditions. In this section, current activity levels at the Airport are compared to prior-year levels, and historical passenger and operations trends at Logan Airport dating back to 2000 which is the year Massport approved an Environmental Management Policy. The total number of air passengers increased by 5.7 percent to 33.4 million in 2015, compared to 31.6 million in 2014. As noted previously, the 2015 passenger level represents a record high for Logan Airport.

Passenger aircraft operations accounted for 91 percent of total aircraft operations in 2015. The total number of aircraft operations increased from 363,797 in 2014 to 372,930 in 2015, a 2.5-percent increase. This was preceded by a 0.7 percent increase from 2013 to 2014. Operations are increasing compared to previous years; however, aircraft operations at remained below the 487,996 operations in 2000 and the historical peak of 507,449 achieved in 1998. In 1998, Logan Airport served 26.5 million air passengers, compared to 33.4 million in 2015, which saw 134,519 fewer operations.

Air carrier efficiency continued to improve in 2015 as the average number of passengers per aircraft operation at Logan Airport grew from 87.0 in 2014 to 89.7 in 2015. While the number of domestic and international passengers is increasing, international passenger demand is projected to increase at a faster rate than domestic passenger demand. Annual domestic passengers' activity levels increased from 26.5 million in 2014 to 27.8 million in 2015, a 4.8-percent increase. Total international passengers at Logan Airport increased from 5.0 million in 2014 to 5.5 million in 2015, a 10.9-percent increase. International passengers made up approximately 16.1 percent of total Airport passengers in 2015, and this is projected to increase steadily to nearly 20 percent of the total by 2030 or sooner. The strong international passenger growth was driven by the economic attractiveness of the metropolitan

Boston region and the strength of Boston as an O&D market. New international destinations from Logan Airport in 2015 included Mexico City, Hong Kong, Tel Aviv, and Shanghai.

The 2016 ESPR should report on airport activity levels and aircraft operations, including:

- Aircraft operations, including fleet mix and scheduled airline services at Logan Airport;
- Domestic and international passenger activity levels; A-23
- Cargo and mail volumes;
- Compare 2016 aircraft operations, cargo/mail operations, and passenger activity levels to 2015 activity levels; and
- Report on national aviation trends in 2016 and compare to trends at Logan Airport.

It should report on forecasting upon which planning and impact sections will be based for the next five years. Future year analyses should be based on the 2035 forecast. It should update the aircraft operations and passenger activity forecasts, and provide a discussion of analysis methodologies and assumptions, including anticipated fleet mix changes and other trends in the aviation industry. It should also provide: A-24

- A comparison of 2016 operations to historic trends and 2035 forecasts;
- Updated forecasts of Logan Airport's passenger volume, aircraft operations, and fleet mix; and
- A comparison of forecast activity levels to Massport forecasts, FAA forecasts and the U.S. aviation industry.

Sustainability at Logan Airport

The 2015 EDR describes Massport's airport wide sustainability goals as identified in its Environmental Management Policy (EMP) and 2015 Sustainability Management Report (SMR). The SMR identifies efforts to promote, coordinate and integrate sustainability Airport-wide. A baseline data assessment was completed in winter 2014 to assess current sustainability performance at the Airport.

The 2015 EDR reports its progress towards achieving each goal. Massport revised its Sustainable Design Standards and Guidelines (SDSG) in March 2011 which provide a framework for sustainable design and construction for both new construction and rehabilitation projects. Since 2000 Massport has been striving to achieve certification by the U.S. Green Building Council Leadership in Energy and Environmental Design (LEED) for new and substantial rehabilitation of building projects over 20,000 square feet (sf). The Rental Car Center in the Southwest Service Area was certified at the LEED Gold level and the Green Bus Depot was certified at the LEED Silver level.

Progress on the EMP should be incorporated into subsequent EDRs and ESPRs. A-25

Climate Change

Massport assets including Logan Airport are critical elements of the State's infrastructure and economy. As recognized in Governor Baker's recent Executive Order 569 "Establishing an Integrated Climate Change Strategy for the Commonwealth" and a suite of other state and municipal initiatives, the impacts of climate change must be an important consideration for development across the state. The EO indicates that climate change presents a serious threat to the environment and the Commonwealth's residents, communities and economy. It indicates that extreme weather events associated with climate change present a serious threat to public safety and the lives and property of our residences. In addition, it indicates that the transportation sector continues to be a significant contributor to GHG emissions in the Commonwealth and is the only sector in which GHG emissions are increasing.

The 2015 EDR contains a greenhouse gas (GHG) emissions inventory for Logan Airport. Data is presented in units of million metric tons. It indicates that, in 2015, total GHG emissions grew by 6 percent due to aircraft operations and taxi times. Analysis of emissions has been expanded from a focus on direct sources associated with Massport assets and facilities to incorporate emissions associated with tenants and transportation and include indirect emissions for all sources.

Massport has indicated that it will continue to report on GHG emissions in 2016 and will
quantify aircraft, ground service equipment (GSE), motor vehicles and stationary sources using emission
factors and methodologies outlined in the EEA GHG Policy and the Transportation Research Board's A-26
Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories (Airport Cooperative Research
Program (ACRP) Report 11, Project 02-06) and other relevant guidance. The expansion of GHG
reporting is significant and will guide Massport efforts to achieve sustainability goals and GHG
emission reduction goals. The presentation of the data could be improved, for instance, by normalizing
data and/or reporting emissions in several units (e.g. MMT and tpy) to allow comparisons between A-27
various programs, policies and reporting requirements. Massport controlled emissions and tenant
emissions, for instance, could be reported in kBtu/sf-yr by building for benchmarking purposes.
Identification of total GHG emissions associated with buildings and fuel sources would be informative. I A-28
encourage Massport to consider make this a focus for the 2016 ESPR. In addition, I encourage Massport
to consider establishment of aggressive goals for reducing GHG emissions, and in particular A-29
transportation emissions, in the 2016 ESPR. The ESPR should describe analysis methodologies and
assumptions to develop the 2016 ESPR emissions inventory and provide forecasts for 2035. The results A-30
should be compared to 2015.

In recognition of the potential effects of climate change on Massport infrastructure and operations, the Disaster and Infrastructure Resiliency Planning (DIRP) Study was initiated. A particular concern for Massport is the effect of sea level rise and projected increases in the severity and frequency of storms. The Study includes Logan Airport, the Port of Boston, and Massport's waterfront assets in South and East Boston. The DIRP Study includes a hazard analysis; modeling of projected sea-level rise and storm surge; and, temperature and precipitation projections and anticipated increases in extreme weather events. The study is nearing completion. I note that information from the Study has been
incorporated into project-specific reviews. The 2016 ESPR should provide a summary of the DIRP
Study and identify which recommendations Massport will implement in the short term to increase the A-31
resiliency of its facilities to the potential effects of climate change.

Mitigation

The 2015 EDR identifies the status of mitigation commitments for specific Massport and tenant
projects at Logan Airport that have undergone MEPA review. The 2016 ESPR and future EDRs will A-32
continue to be the forum to address cumulative, Airport-wide impacts. The 2016 ESPR should update A-33

the status of Massport's mitigation commitments for the Terminal E Modernization Project and report on projects previously included in the EDRs. A-33 Cont.

Planning

The Airport Planning section describes the status of projects underway or completed at Logan Airport by the end of 2015 and provides updates for projects in progress. Specific topics include terminal area projects, service area projects, buffer/open space projects, Airport parking projects, airside area projects, high occupancy vehicle (HOV) improvements, and Airport-wide projects. It also describes known future planning, construction, and permitting activities.

It includes the following Airport Projects:

- *Terminal E Renovation and Enhancements Project*: This project includes interior and exterior improvements at Terminal E to accommodate regular service by wider and longer Group VI aircraft. The project does not include any new gates, but will reconfigure three existing gates to accommodate Group VI aircraft (including the Airbus A380 and Boeing 747-8 primarily used by international air carriers). An addition to the west side of Terminal E will allow passenger holdrooms to be reconfigured to accommodate the larger passenger loads associated with larger aircraft. The project also includes modifications to the airfield to meet required FAA safety and design standards to accommodate the larger aircraft. Construction commenced in 2015.

- *Terminal E Modernization Project*: This is proposed to accommodate existing and long range forecasted demand for international service. The expansion will add the three contact gates approved in 1996 as part of the International Gateway West Concourse project (EEA #9791), which were never constructed, and an additional two to four additional new gates in an extended concourse. A key feature of this project is the first direct pedestrian connection from the MBTA Blue Line Airport Station to the terminal complex at Logan Airport. It will also include improvements to Airport roadways to facilitate access. The project underwent MEPA review in 2016. Massport intends to commence construction prior to 2018.

- *Terminal C to E Connector:* The Terminal C to E Connector provides a new post-security connection between Terminals C and E on the Departures Level. Approximately 18,900 sf were made to the existing building, and 3,500 sf of new exterior construction. The connector provides improved passenger circulation within the post-security concourses, additional holdroom space at Terminal E, reconfigured office space, concessions and concessions support, and a new consolidated location for escalators and stairs. The project was completed in May 2016.

  Terminal B Airline Optimization Project: Massport is upgrading its facilities on the Pier B side of Terminal B to meet airlines' needs (primarily reflecting the merger of American Airlines and US Airways) and to provide facilities that improve the passenger traveling experience. Similar improvements have been implemented with the recent renovations and improvements at Terminal B, Pier A. Planned improvements include an enlarged ticketing hall, improved outbound bag area, expanded bag claim hall, expanded concession areas, and expanded holdroom capacity at the gate.

The 2016 ESPR should continue to assess planning strategies for improving Logan Airport's operations and services in a safe, secure, more efficient, and environmentally sensitive manner. As owner and operator of Logan Airport, Massport must accommodate and guide tenant development. The ESPR should describe the status of planning initiatives for the following areas: A-34

- Roadways and Airport Parking;
- Terminal Area;
- Airside Area;
- Service and Cargo Areas; and
- Airport Buffers and Landscaping.

The 2016 ESPR should also indicate the status of long-range planning activities, including the status of public works projects implemented by other agencies within the boundaries of Logan Airport. A-35 The ESPR should also indicate the status and effectiveness of ground access changes, including roadway and parking projects, that consolidate and direct airport-related traffic to centralized locations and minimize airport-related traffic on streets in adjacent neighborhoods. A-36

Regional Transportation

The 2015 EDR describes activity levels at New England's regional airports in 2015 and provides an update on regional planning activities, including long-range transportation efforts. The New England region is anchored by Logan Airport and a system of 10 other commercial service, reliever, and general aviation (GA) airports (regional airports). Overall, passenger traffic at the New England airports in 2015 represented the highest passenger traffic level for the region since the economic downturn in 2008 and exceeding the historical peak of 48.0 million in 2005. The increase in the region's passenger traffic was largely driven by continued growth at Logan Airport. In 2015, the total number of air passengers utilizing New England's commercial service airports, including Logan Airport, increased by 4.1 percent from 46.8 million annual air passengers in 2014 to 48.7 million in 2015. Of the 48.7 million passengers using New England's commercial service airports in 2015, 68.6 percent of passengers (33.4 million) used Logan Airport compared to 67.6 percent (31.6 million) in 2014. While passenger activity levels have increased, aircraft operations in the New England region remained flat in 2015, increasing 0.3 percent from 987,652 operations in 2014 to 991,041 operations in 2015. The 2016 ESPR should report on the issues identified below.

Regional Airports

- 2016 regional airport operations, passenger activity levels, and schedule data within an historical context; A-37
- Status of plans and new improvements as provided by the regional airport authorities;
- Role of the Worcester Regional Airport and Hanscom Field in the regional aviation system and Massport's efforts to promote these airports; and
- Ground access improvements at Massachusetts Regional Airport.

Regional Transportation System

- Massport's role in managing the regional transportation facilities within MassDOT;
- Massport's cooperation with other transportation agencies to promote efficient regional highway and transit operations; and A-38

- Report on metropolitan and regional rail initiatives and ridership. A-38 Cont.

Ground Access to and from Logan Airport

The 2015 EDR reports on transit ridership, roadways, traffic volumes, and parking for 2015. Massport continues to be in full compliance with the Logan Airport Parking Freeze regulations (310 Code of Massachusetts Regulations 7.30) which regulates the number of commercial and employee parking spaces allowed at Logan Airport (total limit of 21,088). The Parking Freeze is included in the Massachusetts State Implementation Plan (SIP) to achieve compliance with the Clean Air Act (42 U.S.C. §7401 et seq. [1970]). Massport submits semi-annual compliance filings to MassDEP; March and September reports are provided in the 2015 EDR. As permitted (and encouraged) by the Parking Freeze provisions, Massport has converted employee spaces to commercial spaces, within the overall limits.

The EDR states that Massport has continued to invest in and operate Logan Airport with a goal of increasing the number of passengers arriving by transit or other high occupancy vehicle (HOV) modes. The HOV/transit mode share at Logan Airport continues to rank at the top of U.S. airports. The 2015 EDR identifies improvements to increase HOV/transit mode share including introduction of the Back Bay Logan Express pilot service (since May 2014); free boardings from Logan Airport to the MBTA Silver Line outbound; construction of a 1,100-car parking garage at the Framingham Logan Express; reduced holiday travel parking rates at Logan Express facilities; increased parking rates on the Airport; and support for private coach bus and van operators.

As part of its Long-Term Parking Management Plan, Massport is considering a series of measures to minimize pick-up/drop-off activity. The EDR indicates that the increase in terminal area parking rates since July 1, 2014 described in the 2014 EDR, does not seem to be have influenced parking demand; daily parking demand more frequently approached the Parking Freeze cap in 2015. The 2015 EDR identifies a proposal to build up to 5,000 new on-Airport commercial parking spaces. Massport states that the goal of the project is to reduce the number of drop-off/pick-up mode which generate more traffic than parking. The construction of additional commercial parking spaces is dependent upon amending the Parking Freeze legislation. Massport has initiated a stakeholder process prior to proposing any amendments and Massport anticipates initiating a parallel review process.

The Airport-wide Automated Traffic Monitoring System (ATMS) consists of permanent traffic count stations at the Airport's gateway roadways, including the Route 1A roadway ramps, the Interstate-90 (I-90) Ted Williams Tunnel ramps, and Frankfort Street/Neptune Road. These stations provide data on annual average daily traffic (AADT), annual average weekday daily traffic (AWDT), and annual average weekend daily traffic (AWEDT). The AADT increased by 0.1 percent between 2014 and 2015. The change in average daily traffic can be attributed to: a 5.7-percent increase in air passenger activity in 2015; a 3.0-percent increase in taxi dispatches in 2015; and 1.1-percent decrease in parking activity (exits) in 2015. Historically, the highest AADT recorded at Logan Airport was in 2007, when AADT reached 110,690, AWDT was 119,200, and AWEDT was 91,320 that same year. These gateway traffic volumes corresponded to an annual air passenger level of 28,102,455 passengers.

On-Airport vehicle miles of travel (VMT) is calculated based on the total number of miles traveled by all vehicles within the Logan Airport roadway system and is used to calculate motor vehicle air emissions. Massport upgraded its modeling capabilities in 2011 and began using an on-Airport VISSIM-10 model which is more robust than the previous model. The adjustment factors for the 2015

VMT calculations were determined by using 2011 to 2015 gateway, Airport roadway, and parking volume averages.

Based on the traffic data obtained from Massport's ATMS, the change in on-Airport daily traffic volumes between 2014 and 2015 was negligible. However, 2015 evening peak hour gateway volumes grew by roughly 5 percent when compared to 2014. Additionally, a shift in gateway traffic entering/exiting the Airport from the Ted Williams Tunnel to the Sumner/Callahan Tunnels was noted. Daily traffic volumes in the Ted Williams Tunnel decreased by 8.4 percent (from 49,600 to 45,400 vehicles) while volumes in the Sumner/Callahan Tunnels increased by 19.5 percent (from 29,800 to 35,600 vehicles). Since 2000, the highest average weekday VMT estimated at Logan Airport was in 2007, when weekday VMT was modeled at 184,613. Although VMT was estimated at lower levels in 2015, a direct comparison between values cannot be made because of significant changes in the study area.

The 2016 ESPR should report on 2016 ground access conditions at the airport and provide a comparison of 2016 findings to those of 2015 for the following:

- Detailed description of compliance with Logan Airport Parking Freeze;
- HOV ridership (including Blue Line, Silver Line, Water Transportation, and Logan Express);
- Logan Airport Employee Transportation Management Association (Logan TMA) services;
- Logan Airport gateway volumes;
- On-airport traffic volumes; A-39
- On-airport VMT;
- Parking demand and management (including rates and duration statistics);
- Status of long-range ground access management strategy planning;
- Results of the 2016 Logan Airport Air Passenger Survey; and,
- Status of proposed connector to the Airport Station associated with the planned Terminal E Modernization Project.

The chapter should present a discussion of analytical methodologies and assumptions for the planning horizon year (2035) for traffic volumes, on-airport VMT and parking demand. A-40

The 2016 ESPR should address the following topics:

- Massport's target HOV mode share along with incentives;
- Non-Airport through-traffic;
- Massport's cooperation with other transportation agencies to increase transit ridership to and from Logan Airport via the Blue Line, Silver Line, Water Transportation, and Logan Express; A-41
- Efforts to increase capacity and usage of Logan Express;
- Progress on enhancing water transportation to and from Logan Airport;
- Report on results of ground access study; and
- Strategies for enhancing services and increasing employee membership in the TMA.

Noise

The 2015 EDR updates the status of the noise environment at Logan Airport in 2015, and describes Massport's efforts to mitigate noise exposure and impacts. As noted previously, the implementation of RNAV has resulted in concentration of flight patterns over certain communities and significant increases in noise exposure. Noise complaints have increased from 12,855 calls in 2014 to 17,685 calls in 2015. In addition, the FAA introduced the AEDT, a new model for noise and air quality. Massport did not submit AEDT modeling results and, instead, modeled noise using the FAA's Integrated Noise Model (INM) as in previous years. Massport intends to use the AEDT for noise modeling for the 2016 ESPR if the adjustments are approved by the FAA. Massport should update the MEPA office regarding the status of the requested adjustments and consult with the MEPA office regarding ESPR noise modeling as early as possible if the FAA does not approve use of the requested adjustments or it appears that the FAA review will be delayed. I note comments that indicate data should be provided regardless of FAA's approval or timing. Otherwise, noise contours for 2016 should be developed using AEDT and compared to the most recent version of the Integrated Noise Model (INM) which has been in place for all previous EDRs and ESPRs. Logan Airport-specific model adjustments made to account for over-water sound propagation and the propagation of sound to areas of higher terrain may be reported as an add-on to AEDT, if accepted by the FAA. A-42 A-43

Compared to 2000, the 2015 EDR indicates that total operations were down by 23.6 percent while total passengers were up by 20.6 percent; that the percentage of jet operations increased to 86 percent from 66 percent; and the number of people exposed to Day-Night Average Sound Level (DNL) 65 decibels (dB) has declined by 20.6 percent.

Compared to 2014, the 2015 DNL 65 dB noise contours were larger in most areas around the Airport due to changes in: (1) runway usage, primarily as a result of wind and weather conditions, (2) a 5.7% increase in the number of nighttime operations, and (3) an increase in the number of overall operations. The overall number of people exposed to DNL values greater than or equal to 65 dB increased by 58.0 percent, from 8,922 people in 2014 to 14,097 people in 2015. This increase is a significant concern to residents, as clearly indicated in comment letters, and to Massport.

Runway use changes from 2014 to 2015 were the largest factor in the increase in the number of people exposed to DNL values greater than or equal to 65 dB in 2015 which is a significant issues raised in many comments. The DNL contour increased in East Boston and slightly in South Boston due to an increase in Runway 22R departures. The DNL contour in Winthrop increased because departures from Runway 22L increased. Increased nighttime arrivals to Runways 22L and 27 contributed to increases in Revere and Winthrop. Data from 2015 reflects almost a full year of the head-to-head night noise abatement procedures on Runway 15R-33L. While this reduces overall noise exposure by concentrating operations over water rather than over populated areas, it increases start-of-takeoff-roll noise in East Boston, north and west of the Runway 15R end. Decreased use of Runway 4R for arrivals in 2015 resulted in a reduction in the contour south of the Airport.

Nighttime operations increased from 48,056 to 50,786 in 2015. The increase remains below the peak of 54,038 annual operations at night reached in 1999; however, this growth is significant and a particular concern given the extent and concentration of noise exposure. As airlines have expanded to new destinations, the number of commercial operations, and in turn the number of nighttime operations, has increased. In 2015, there was an increase of 7.5 nighttime operations per day compared to 2014.

The overall increase in operations was smaller than the increase in nighttime operations (2.5 percent overall versus 5.7 percent nighttime), but contributed to the expansion of the noise contours. The DNL and population levels in 2015 remain well below the peak levels reached in 1990 and are less than in the year 2000 when 17,745 people were exposed to DNL levels greater than or equal to DNL 65 dB. The 2015 DNL 65 dB contour is somewhat larger than the 2014 DNL 65 dB contour. Almost all of the residences exposed to levels greater than or equal to DNL 65 dB in 2015 have been eligible in the past to participate in Massport's residential sound insulation program (RSIP). To date, Massport has provided sound insulation for a total of 11,515 residential units, and will continue to seek funding for sound insulation for properties that are eligible and whose owners have chosen to participate.

The 2016 ESPR should provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, and the updates in noise modeling. The chapter should report on 2016 conditions and compare those conditions to those of 2015 for the following:

- Fleet Mix, including Stage II, Recertified Stage III, newly manufactured Stage III, and qualifying Stage IV aircraft;
- Nighttime operations;
- Runway utilization (report on aircraft and airline adherence with runway utilization goals); and
- Flight tracks.

A-44

The 2016 ESPR should report on the following:

- Changes in annual noise contours and noise-impacted population;
- Measured versus modeled noise values, including reasons for differences and any improvements attributable to the models deployed;
- Cumulative Noise Index (CNI);
- Times-Above for 65, 75, and 85 dBA threshold values/Dwell and Persistence of noise levels; and
- Flight track monitoring noise reports.

A-45

The 2016 EDR should also report on consultation between Massport and FAA regarding the impacts of RNAV, noise abatement efforts, results of Boston Logan Airport Noise Study (BLANS) study, and provide an update on the noise and operations monitoring system.

A-46

<u>Air Quality/Emissions Reduction</u>

The 2015 EDR provides an overview of airport-related air quality issues in 2015 and efforts to reduce emissions. The air quality modeling reported in 2015 EDR is based on aircraft operations, fleet mix characteristics, airfield taxiing times, GSE usage, motor vehicle traffic volumes, and stationary source utilization rates. Total air quality emissions from all sources associated with Logan Airport in 2015 are significantly less than they were a decade ago.

In 2015, calculated emissions of volatile organic compounds (VOCs), oxides of nitrogen (NOx), carbon monoxide (CO), and particulate matter (PM) went up slightly compared to 2014. The increase is primarily due to the increase in aircraft landing and take offs (LTOs) and airfield taxi times. Total emissions of VOCs increased by 1 percent in 2015 to 1,188 kilograms (kg)/day compared to 1,177 kg/day in 2014. Total NOx emissions increased by approximately 5 percent in 2015, to 4,262 kg/day compared to 2014 levels of 4,040 kg/day. Massport's voluntary Air Quality Initiative (AQI) has tracked NOx emissions since the benchmark year of 1999. In the final year of this program (2015), total NOx emissions were 632 tons per year (tpy) lower than the 1999 benchmark. This represents an overall decrease of 27 percent in NOx emissions over the past 15 years. Between 1999 and 2015, the greatest reductions of NOx emissions were associated with aircraft, GSE, and on-Airport motor vehicles at 17 percent, 71 percent, and 87 percent reductions, respectively. Total CO emissions increased by about 3.5 percent in 2015 to 7,243 kg/day, from 6,987 kg/day in 2014; emissions in 2015 were still well below 1990 and 2000 levels. Total PM10/PM2.5 emissions also increased by about 3 percent in 2015 to 98 kg/day, from 95 kg/day in 2014.

The ESPR should contain an overview of the environmental regulatory framework affecting A-47
aircraft emissions, changes in aircraft emissions, changes in air quality modeling and air quality studies.
The ESPR should also provide discussion on progress on the national and international levels to
decrease air emissions, including alternative fuel vehicle programs implemented by Massport and/or its A-48
tenants. If the AEDT tool is used for modeling the 2016 ESPR should compare results to the most recent
version of the Emissions Dispersion Modeling System (EDMS) that has been used in recent EDR A-49
filings. The Environmental Protection Agency (EPA) MOVES2014a program will continue to be used to
estimate vehicular emission on airport roadways. The ESPR should include an emissions inventory for
CO, NOx, VOCs, and PMs. A-50

Commenters express concern that the EDR does not provide a substantive response to concerns
expressed regarding ultrafine particulates (UFP). As commenters are aware, UFPs are not regulated by
the US Environmental Protection Agency (EPA) and EPA has not proposed to adopt standards for UFPs. A-51
I encourage Massport to consider how the ESPR might constructively address the concern presented by
commenters. The ESPR should specifically identify any ongoing or new policies or programs that would
reduce diesel emissions.

The ESPR should include an update on its efforts to encourage the use of single engine taxiing
under safe conditions and, as required in the review of the Terminal E Expansion, Massport should A-52
report on progress made in designing the energy systems for the facility and the feasibility of combined A-53
heat and power (CHP).

<u>Water Quality/Environmental Compliance</u>

The 2015 EDR describes Massport's ongoing environmental management activities including National Pollutant Discharge Elimination System (NPDES) compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan (MCP), and tank management. Massport's primary water quality goal is to prevent or minimize pollutant discharges, thus limiting adverse water quality impacts of airport activities. Massport employs several programs to promote awareness of activities that may impact surface and groundwater quality. Programs include implementing best management practices (BMPs) for pollution prevention by Massport, its tenants, and its construction contractors; training of staff and tenants; and a comprehensive stormwater pollution prevention plan. The EDR reports that Massport continues to comply with water quality and other environmental regulations.

The 2016 ESPR should identify any planned stormwater management improvements and report on the status of:

- NPDES Permit and monitoring results for Logan Airport's outfalls and the Fire Training Facility;
- Jet fuel usage and spills;
- MCP activities;
- Tank management;
- Environmental management plan; and
- Fuel spill prevention.

A-54

Conclusion

I have determined that the 2015 EDR for Logan Airport has adequately complied with MEPA. The EDR provides a comprehensive overview of environmental planning, issues and data. Massport may prepare the 2016 ESPR for submission in 2017 consistent with the Scope included in this Certificate.

February 17, 2017
Date

Matthew A. Beaton

Comments received:

01/18/2017 Logan CAC
01/20/2017 Nancy Timmerman
01/20/2017 Stephen Kaiser
01/20/2017 Boston Harbor Now
01/31/2017 Brian Palmucci, Quincy City Council
01/31/2017 Aaron Toffler, Airport Impact Relief, Inc.
01/31/2017 Chris Marchi
01/31/2017 Wig Zamore
02/01/2017 Bill Schmidt
02/01/2017 Cindy L. Christiansen
02/01/2017 James Roberts
02/01/2017 James Linthwaite
02/01/2017 Town of Milton Office of Selectmen
02/02/2017 John Antonellis
02/17/2017 U.S. Senator Elizabeth Warren

MAB/ACC/acc

Commen	Author	Topic	Comment	Response
A-1	Matthew Beaton, Secretary	Content	The 2016 ESPR will document trends and environmental impacts and will update and revise environmental management plans to address impacts.	The Environmental Data Reports (EDRs) and Environmental Status and Planning Reports (ESPRs) continue to provide documentation on environmental conditions for the reporting year compared to the previous year. The EDR also provides historical data because it is critical context information to understand the long term performance trends at Logan Airport. This *2016 EDR* provides 1990, 2000, and 2010-2016 data as available in each chapter. The *2016 EDR* also includes data from 1990 and 2000, and in some cases 1998 (the year of peak operations at Logan Airport), to provide a historical benchmark of progress over the last few decades. The technical appendices contain available historical data. This *2016 EDR* provides information on past, current, and anticipated projects at Logan Airport in Chapter 3, *Airport Planning*, and reports on specific environmental conditions in the following chapters: Chapter 1, *Introduction/Executive Summary* (available in both English and Spanish), Chapter 2, *Activity Levels*, Chapter 3, *Airport Planning*, Chapter 4, *Regional Transportation*, Chapter 5, *Ground Access to and from Logan Airport*, Chapter 6, *Noise Abatement*, Chapter 7, *Air Quality/Emissions Reduction*, Chapter 8, *Water Quality/Environmental Compliance and Management*, and Chapter 9, *Mitigation*. The *2016 EDR* also discusses the status of management plans, including the Long Term Parking Management Plan, Noise Abatement Management Plan, Air Quality Management Program, Energy Master Plan, Environmental Management Policy, Environmental Management System, Sustainability Management Plan, Tank Management Program, and Outfall Sampling Plan. Each chapter provides a detailed discussion of environmental effects and management strategies.
A-2	Matthew Beaton, Secretary	Content	The next ESPR will analyze calendar year 2016 and provide projections through 2035.	While the next annual report was originally scheduled to be a *2016 ESPR*, with approval from the Executive Office of Energy and Environmental Affairs (EEA), Massport has prepared an EDR for 2016. The key difference between the two documents is that the ESPR provides future forecasts for airport activity levels and environmental conditions. In the past few years, passenger demand trends for air travel have been rapidly increasing and the air carrier landscape is changing. Additionally, the ground transportation arena at Logan Airport has also changed rapidly with the introduction of transportation network companies (TNCs), such as Uber and Lyft. Due to these rapid changes, Massport needs additional time to understand these evolving trends and what it means for future activity levels and airport ground access. Massport will prepare a *2017 ESPR* which will include an updated future forecast and a better understanding of future ground transportation options to and from Logan Airport. The scope for this EDR was established by the Secretary's Certificate dated March 9, 2018, which is included in Appendix A, *MEPA Certificates and Responses to Comments*. This *2016 EDR* fulfills all requirements laid out in the Secretary's Certificate. Future year forecasts and impact assessments will be provided in the *2017 ESPR*. See the cover letter and Chapter 1, *Introduction/Executive Summary* of this *2016 EDR* for more information. This *2016 EDR* provides 1990, 2000, and 2010-2016 data as available in each chapter. Each chapter of the document discusses calendar year 2016 findings and compares data to 2015 and historical years. The document includes data from 1990 and 2000, and in some cases 1998 (the year of peak operations at Logan Airport), to provide a historical benchmark of progress over the last few decades. The technical appendices contain all available historical data.
A-3	Matthew Beaton, Secretary	Activity Levels/ Forecast	The 2016 ESPR will report on updated passenger activity levels, aircraft operations forecasts, and environmental conditions forecasts.	In accordance with the March 9, 2018 Notice of Project Change Certificate, the *2016 EDR* reports on current and historical passenger activity levels and aircraft operations in Chapter 2, *Activity Levels*. The *2016 EDR* reports trends in annual passenger and operations activity levels from 1990 through 2016; passenger volumes have trended upward since 1990, from 26.5 million passengers in 1990 to 36.3 million passengers in 2016. Simultaneously, aircraft operations have trended downward since 1990, from a peak of 507,499 operations in 1998 to 391,222 operations in 2016.

Commen	Author	Topic	Comment	Response
A-4	Matthew Beaton, Secretary	Noise	Massport and the FAA recently signed a Memorandum of Understanding (MOU) to frame a process for analyzing opportunities to incrementally reduce noise through changes or amendments to Performance Based Navigation (PBN), including RNAV procedures. I commend Massport and the FAA for establishing this agreement and committing to coordinate to address the impact of the RNAV program on citizens and communities. Massport has indicated that this process will incorporate community outreach and public input. This effort should be a significant focus of the 2016 ESPR.	The *2016 EDR* provides information on the MOU and the RNAV program in Chapter 6, *Noise Abatement* (see the section titled *Massport and FAA RNAV Pilot Program*). The Federal Aviation Administration (FAA) and Massport have committed to: analyzing the feasibility of changes to RNAV procedures; analyzing the benefits and impacts of modifying existing Logan Airport RNAV procedures; and testing and developing an implementation plan, which will include environmental analysis and community/public outreach. Final recommendations will be provided to FAA for its review and implementation. Massport continues to seek public input through the Massport Community Advisory Committee (MCAC), which is a state-legislated body that works with Massport on a range of topics, including environmental issues. Massport provided a set of initial recommendations regarding Block 1 to the FAA in December 2017. Additional analysis continues on more ideas (Block 2).

Commen	Author	Topic	Comment	Response
A-5	Matthew Beaton, Secretary	Ground Access	Commenters are concerned that the lifting of the Parking Freeze will lead to increases in long-term growth in traffic and congestion.	The intent of the Logan Airport Parking Freeze was to reduce emissions by shifting air passengers to travel modes requiring fewer vehicle trips. However, survey data since the 1970s has consistently shown that constrained parking has the unintended consequence of shifting air passengers to travel modes with higher numbers of vehicle trips, despite Massport's extensive efforts to provide and encourage the use of high-occupancy vehicle (HOV) travel modes. According to the 2016 Logan Airport Air Passenger Ground Access Survey, if parking was not an option for passengers who parked on-Airport, 81 percent of survey respondents indicated that they would use drop-off/pick-up modes (i.e., dropped off or picked up by private vehicles, taxi, TNC, or black car/limousine service). Prior surveys of Logan Airport air passengers have consistently shown similar results. As the number of air travelers has increased, the constrained parking supply at Logan Airport may have contributed to an increase in environmentally harmful drop-off/pick-up vehicle activity (which generates up to four vehicle trips per air passenger, compared to two trips for those who drive and park). The potential impact has been mitigated by the successful growth of transit and shared-ride mode ground access, especially Logan Express park-and-ride and private buses. Nonetheless, implementing parking policies and investments to reduce diversion to growing drop-off/pick-up modes remains an Airport priority. On March 31, 2017, Massport filed an Environmental Notification Form (ENF) for the Logan Airport Parking Project, which proposes to build 5,000 new on-Airport commercial parking spaces at Logan Airport in two locations (on top of the existing Economy Garage and in the location of the existing Terminal E surface lot). On May 5, 2017, the Secretary of EEA issued the Certificate on the ENF establishing the Scope for the required Draft Environmental Impact Report (EIR) for the Logan Airport Parking Project. The Draft EIR will further evaluate the environmental impacts of the project in accordance with the Certificate. The construction of additional commercial parking spaces at Logan Airport was predicated on a regulatory change, by the Massachusetts Department of Environmental Protection (MassDEP), whereby MassDEP would need to amend the existing Logan Airport Parking Freeze to allow for some additional commercial parking spaces at Logan Airport. In response to Massport's 2016 request to consider an amendment to the Logan Airport Parking Freeze (to increase the commercial parking freeze limit by 5,000 spaces), MassDEP conducted a stakeholder process, which was followed by a public process to amend the Parking Freeze regulation. MassDEP issued the amended regulation on June 30, 2017 approving the requested parking increase. On March 6, 2018, U.S. Environmental Protection Agency (EPA) formally amended the Massachusetts State Implementation Plan (SIP) to accommodate an increase of 5,000 spaces in the Logan Airport Parking Freeze.

Commen	Author	Topic	Comment	Response
A-6	Matthew Beaton, Secretary	Ground Access	I note that commenters have requested to review data that supports Massport's assertion including data from its parking survey.	The *Logan Airport Air Passenger Ground Access Survey* is the principal means of measuring air passenger ground-access HOV mode share. Chapter 5, *Ground Access to and from Logan Airport* presents the air passenger ground access mode shares from the 2016 survey findings (Table 5-12). Data from the 2016 survey can be found in Chapter 5, *Ground Access to and from Logan Airport* in the section titled *Logan Airport Air Passenger Ground Access Survey*. Findings from the survey are also available online at: http://massport.com/logan-airport/about-logan/air-passenger-survey/. Since the filing of the *2015 EDR*, Massport filed an ENF for the Logan Airport Parking Project on March 31, 2017. The project proposes to build 5,000 new on-Airport commercial parking spaces at Logan Airport in two locations (on top of the existing Economy Garage and in the location of the existing Terminal E surface lot). On May 5, 2017, the Secretary of EEA issued the Certificate on the ENF establishing the Scope for the required Draft EIR for the Logan Airport Parking Project. The Draft EIR will further evaluate the environmental impacts of the project in accordance with the Certificate. The construction of additional commercial parking spaces at Logan Airport was predicated on a regulatory change, by MassDEP, whereby MassDEP would need to amend the existing Logan Airport Parking Freeze to allow for some additional commercial parking spaces at Logan Airport. In response to Massport's 2016 request to consider an amendment to the Logan Airport Parking Freeze (to increase the commercial parking freeze limit by 5,000 spaces), MassDEP conducted a stakeholder process, which was followed by a public process to amend the Parking Freeze regulation. MassDEP issued the amended regulation on June 30, 2017 approving the requested parking increase. On March 6, 2018, U.S. Environmental Protection Agency (EPA) formally amended the Massachusetts State Implementation Plan (SIP) to accommodate an increase of 5,000 spaces in the Logan Airport Parking Freeze.

Commen	Author	Topic	Comment	Response
A-7	Matthew Beaton, Secretary	Noise/Air Quality	The FAA Aviation Environmental Design Tool (AEDT) which was introduced in 2015 is a significant change in modeling of noise and air quality. FAA is requiring airports to use AEDT for National Environmental Policy Act (NEPA) review projects and soundproofing eligibility. The tool models aircraft performance in space and time to produce fuel burn, emissions, and noise information. The EDR indicates that Massport initiated modeling with AEDT but had concerns that it did not accurately reflect the noise environment at Logan Airport. Massport consulted with FAA and determined that the AEDT results would not be published in the 2015 EDR. Massport is evaluating the new model and working with the FAA to develop the types of Logan Airport specific adjustments for the AEDT model that have been used for many years in the Integrated Noise Model (INM). Massport has requested that the FAA consider and approve these adjustments and indicates that, if completed in a timely fashion, AEDT modeling results would be presented in the 2016 ESPR.	For this *2016 EDR*, for assessing the effects of aircraft activities, Massport has transitioned from using the legacy modeling software, the Integrated Noise Model (INM) and Emissions and Dispersion Modeling System (EDMS), to FAA's next-generation software, Airport Environmental Design Tool (AEDT). For past noise studies, Massport implemented a series of FAA-approved adjustments to the INM model. These adjustments were developed to address specific terrain concerns unique to Logan Airport; which included an over-water and hill-effect adjustment (see Chapter 6, *Noise Abatement* for more information). These Logan Airport-specific adjustments were carried over from one version of INM to the next. Massport has been working with the FAA since 2015 to implement equivalent adjustments in AEDT. After their review, the FAA did not approve the two significant adjustments (accounting for over-water noise propagation and hill effects) to the contours. The FAA did concur with the use of 2016 weather data and aircraft stage length adjustments when using the AEDT model. Details of FAA's guidance with respect to Logan Airport specific adjustments when using AEDT can be found in Chapter 6, *Noise Abatement* and Appendix H, *Noise Abatement*. To assist the reviewer, Massport has provided the 2016 INM contours for comparison with the 2016 AEDT contours. For air quality, Massport has provided 2016 results using both the legacy EDMS model and new AEDT model.
A-8	Matthew Beaton, Secretary	Modeling and Data Collection	Based on significant changes in operations, modeling and data collection, the 2016 ESPR provides an opportunity to reconsider data collection, presentation and analysis. I expect Massport will consider the many thoughtful comments provided on these issues and will provide a comprehensive analysis of these significant changes (e.g. RNAV, AEDT) and results and projections may be influenced by them.	Massport continues to update the annual EDRs and ESPRs based on the latest industry-standard models (e.g., AEDT), regulatory requirements, and the scope provided in the Secretary's Certificates on the EDRs/ESPRs. AEDT is the primary model for noise and air quality in the *2016 EDR* and the only model approved by the FAA for airport environmental analysis. Massport will continue to model environmental conditions at the Airport in accordance with FAA standards. The *2016 EDR* compares 2016 AEDT results to 2016 INM and EDMS results to show differences attributable to the models. AEDT results are included in both Chapter 6, *Noise Abatement*, and Chapter 7, *Air Quality/Emissions Reduction*. The FAA-required RNAV was in place for the third full year in 2016. As RNAV implementation has proceeded, the contour lobes have become more concentrated and elongated. However, this type of year-to-year change is no longer apparent with multiple years of full RNAV implementation, and the overall shape of the 2016 contours is very similar to 2015. On October 7, 2016, FAA signed a MOU with Massport to frame the process for analyzing opportunities to reduce noise through changes or amendments to PBN (see the section titled *Massport and FAA RNAV Pilot Program*). FAA and Massport have committed to: analyzing the feasibility of changes to RNAV approaches; measuring and modeling the benefits and impacts of changing some RNAV approaches; and testing and developing an implementation plan, which will include environmental analysis and community/public outreach. Massport will report on the progress of this pilot program in future EDRs and ESPRs. Based on comments received on the *2015 EDR*, Massport has expanded its discussion of Ultrafine Particles (UFPs) and has added a new section on Black Carbon (see Chapter 7, *Air Quality*). Massport will continue to track the regulatory status of each of these pollutants in the EDRs and ESPRs.

Commen	Author	Topic	Comment	Response
A-9	Matthew Beaton, Secretary	Content	The 2016 ESPR should follow the general format of the 2011 ESPR, presenting major policy discussions and an overview of the role of Logan Airport in the regional planning context. This should be followed by a status report on Massport's planning initiatives, projects, and mitigation measures.	The scope for this document was established by the Secretary's Certificate on the NPC dated March 9, 2018, which is included in Appendix A, *MEPA Certificates and Responses to Comments*. The *2016 EDR* follows the specified format. The EDR provides an overview of Logan Airport and a discussion of policy and planning context in Chapter 2, Activity Levels and Chapter 4, Regional Transportation. The EDR reports on Massport's specific planning initiatives and projects in Chapter 3, Airport Planning, and the EDR reports on resource-specific plans and programs in Chapter 5, Ground Access, Chapter 6, Noise Abatement, Chapter 7, Air Quality/Emissions Reduction, and Chapter 8, Water Quality/Environmental Compliance and Management. The EDR tracks and reports on Section 61 mitigation commitments in Chapter 9, Project Mitigation Tracking.
A-10	Matthew Beaton, Secretary	Introduction/ Executive Summary	The ESPR should include an Executive Summary and Introduction, similar to previous ESPRs and EDRs. Massport must provide necessary background information to allow reviewing agencies and the public to understand the environmental policies and planning which form the context of the environmental reporting, technical studies, and environmental mitigation	The *2016 EDR* includes an executive summary and introduction in Chapter 1, *Introduction/Executive Summary*. This chapter includes the critical context information for reviewing agencies and the public to understand the purpose and scope of the elements reported in the EDR, including the environmental conditions, technical studies, and mitigation initiatives. The *2016 EDR* also provides a Spanish translation of Chapter 1, *Introduction/Executive Summary.*
A-11	Matthew Beaton, Secretary	Spanish Translation	Some commenters acknowledged Massport's efforts to increase outreach and resources, including providing translation at meetings and translation of the EDR Executive Summary into Spanish.	Massport is mindful of its neighbors and has prepared summaries of the EDR and other environmental documentation in Spanish, to provide information to the community. Recently completed Spanish language documents can be found on Massport's website at http://www.massport.com/massport/about-massport/project-environmental-filings/logan-airport/. This *2016 EDR* includes a Spanish translation of Chapter 1, *Introduction/Executive Summary*.
A-12	Matthew Beaton, Secretary	Activity Levels	The 2016 ESPR should report on updated passenger and operations activity forecasts for Logan Airport, Hanscom Field and Worcester Regional Airport. The new forecast used should begin with 2016 as the base year and project activity forecasts forward to calendar year 2035.	While the next annual report was originally scheduled to be a *2016 ESPR*, with EEA approval, Massport has prepared an EDR for 2016. Massport will prepare a *2017 ESPR* which will include an updated future forecast and present an update on future ground transportation options to and from Logan Airport. The scope for this document was established by the Secretary's Certificate on the NPC dated March 9, 2018, which is included in Appendix A, *MEPA Certificates and Responses to Comments*. This *2016 EDR* fulfills all requirements laid out in the Secretary's Certificate. Future year forecasts and impact assessments will be provided in the *2017 ESPR*. See the cover letter and Chapter 1, *Introduction/Executive Summary* of this *2016 EDR* for more information.

Commen	Author	Topic	Comment	Response
A-13	Matthew Beaton, Secretary	Ground Access	In addition, the 2016 ESPR will use the results of the 2016 Logan Airport Air Passenger Ground Access Survey and the Long-term Parking Management Plan to inform transportation planning.	The *2016 EDR* includes the results from the *2016 Logan Airport Air Passenger Ground Access Survey* and includes the most recent Long-Term Parking Management Plan in Chapter 5, *Ground Access to and from Logan Airport*. Since the late 1970s, the Logan Airport Air Passenger Ground Access Survey has been Massport's primary tool for understanding the changes in air passenger travel behavior, including ground access mode choices, travel patterns, and market characteristics. The survey is a tool that assists Massport in evaluating the effectiveness of its transportation policies and services, and the impacts on the regional transportation system. The survey also shapes the direction of Massport's planning efforts to encourage Logan Airport travelers to use HOV/shared-ride modes instead of single-occupancy vehicle (SOV) modes. The Final Reports for both the 2013 and 2016 Air Passenger Ground Access Surveys are available on the Massport website at http://massport.com/logan-airport/about-logan/air-passenger-survey/. According to the *2016 Logan Airport Air Passenger Ground Access Survey*, 30.5 percent of passengers use HOV modes to travel to Logan Airport. Based on survey results, if parking was not an option for passengers who parked on-Airport, 81 percent of survey respondents indicated that they would use drop-off/pick-up modes (i.e., dropped off or picked up by private vehicles, taxi, TNC, or black car/limousine service). Prior surveys of Logan Airport air passengers have consistently shown similar results.
A-14	Matthew Beaton, Secretary	Content	The technical studies in the 2016 ESPR should include reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, environmental	The *2016 EDR* provides information and analysis on these indicators in Chapter 2, *Activity Levels*, Chapter 3, Airport *Planning*, Chapter 4, *Regional Transportation*, Chapter 5, *Ground Access to and from Logan Airport*, Chapter 6, *Noise Abatement*, Chapter 7, *Air Quality/Emissions Reduction*, Chapter 8, *Water Quality/Environmental Compliance and Management*, and Chapter 9, *Project Mitigation Tracking*.
A-15	Matthew Beaton, Secretary	Responses to Comments	The 2016 ESPR must also respond to issues explicitly noted in this Certificate and the comments received on the 2015 EDR.	The *2016 EDR* responds to all issues raised in the Certificate on the *2015 EDR*, the NPC, as well as all comments received in Appendix B, *Comment Letters and Responses*. No comments were received on the NPC.
A-16	Matthew Beaton, Secretary	Distribution	A distribution list for the 2016 ESPR (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document.	The *2016 EDR* includes a distribution list in Appendix D, *Distribution*.
A-17	Matthew Beaton, Secretary	Content	This section must also include copies of all ESPR and EDR Certificates issued since the 2011 Logan ESPR to provide context for reviewers.	The *2016 EDR* provides copies of prior ESPR and EDR Certificates issued since 2011 in Appendix A, *MEPA Certificates and Responses to Comments,* including the NPC Certificate dated March 9, 2018. In addition, the appendix includes the Secretary's Certificate on the Terminal E Modernization Project ENF, issued December 16, 2015, and Draft EA/EIR, issued September 16, 2016, which directs certain items to be addressed in the EDRs and ESPRs. The appendix also includes the Secretary's Certificate on the Logan Airport Parking Project ENF.
A-18	Matthew Beaton, Secretary	Content	Supporting technical appendices should be provided as necessary.	The *2016 EDR* includes supporting technical appendices for activity levels, regional transportation, ground access, noise abatement, air quality, water quality, peak period pricing monitoring, and reduced/single engine taxiing. Massport continually seeks to improve the quality of the ESPRs and EDRs by providing clear and concise language in the body of the report, and providing the technical and supporting documentation as appendices.

Commen	Author	Topic	Comment	Response
A-19	Matthew Beaton, Secretary	Responses to Comments	To ensure that the issues raised by commenters are addressed, the 2016 ESPR should include direct responses to comments to the extent that they are within MEPA jurisdiction. This directive is not intended to, and shall not be construed to, enlarge the scope of the 2016 ESPR beyond what has been expressly identified in this Certificate.	The *2016 EDR* includes the specified content in Appendix B, *Comment Letters and Responses*. Twelve comment letters were received on the *2015 EDR*. No comments were received on the NPC. Massport has provided responses to issues within MEPA jurisdiction for each comment letter. Massport has included direct responses and in some cases, refers readers to the technical chapter and/or appendix for additional information.
A-20	Matthew Beaton, Secretary	Responses to Comments	I recommend that Massport continue to use the format from the EDR; however, it should limit references to a section of the 2016 ESPR unless they are directly responsive to the comment.	The *2016 EDR* continues to use the same format to respond to comments as the *2015 EDR*. The responses include references to chapters and/or appendices of the *2016 EDR* in which information relevant to the comment is provided.
A-21	Matthew Beaton, Secretary	Responses to Comments	Common themes that should be addressed throughout the ESPR and in the Responses to Comments include noise modeling, contours and abatement. The 2016 ESPR should include sufficient information to address comments on traffic and air quality.	Massport will continue to prepare the EDRs and ESPRs in accordance with the Secretary's Certificate. Massport will continue to model environmental impacts in accordance with FAA standard methodologies. Massport will continue to work with organizations and communities, through the Massport CAC. The *2016 EDR* provides information on noise modeling, noise contours, noise abatement, traffic, and air quality, and responds to comments on these topics in Appendix B, *Comment Letters and Responses*.
A-22	Matthew Beaton, Secretary	Responses to Comments	Massport should consult directly with individual commenters as appropriate	Massport regularly consults with commenters through project specific filings and the Massport CAC. Massport will continue to consult with individual commenters, as appropriate.
A-23	Matthew Beaton, Secretary	Activity Levels	The 2016 ESPR should report on airport activity levels and aircraft operations, including: • Aircraft operations, including fleet mix and scheduled airline services at Logan Airport; • Domestic and international passenger activity levels; • Cargo and mail volumes; • Compare 2016 aircraft operations, cargo/mail operations, and passenger activity levels to 2015 activity levels; and • Report on national aviation trends in 2016 and compare to trends at Logan Airport.	The *2016 EDR* reports on current and historical aircraft operations, passenger activity levels, cargo and mail volumes, and national aviation trends in Chapter 2, *Activity Levels*. The EDR provides information on Logan Airport in context of the New England region's intermodal transportation systems and reports on the status of the region's airports in Chapter 4, *Regional Transportation*. This EDR reports trends in annual passenger activity levels from 1990 through 2016; passenger volumes have trended upward since 1990, from 26.5 million passengers in 1990 to 36.3 million passengers in 2016. Simultaneously, aircraft operations have trended downward since 1990, from a peak of 507,499 operations in 1998 to 391,222 operations in 2016. Air cargo volumes at Logan Airport totaled 640 million pounds in 2016, compared to 606 million pounds in 2015.

Commen	Author	Topic	Comment	Response
A-24	Matthew Beaton, Secretary	Activity Levels	It should report on forecasting upon which planning and impact sections will be based for the next five years. Future year analyses should be based on the 2035 forecast. It should update the aircraft operations and passenger activity forecasts, and provide a discussion of analysis methodologies and assumptions, including anticipated fleet mix changes and other trends in the aviation industry. It should also provide: • A comparison of 2016 operations to historic trends and 2035 forecasts; • Updated forecasts of Logan Airport's passenger volume, aircraft operations, and fleet mix; and • A comparison of forecast activity levels to Massport forecasts, FAA forecasts and the U.S. aviation industry.	While the next annual report was originally scheduled to be a *2016 ESPR*, with EEA approval, Massport has prepared an EDR for 2016. The key difference between the two documents is that the ESPR provides future forecasts for airport activity levels and environmental conditions. In the past few years, passenger demand trends for air travel have been rapidly increasing and the air carrier landscape is changing. Additionally, the ground transportation arena at Logan Airport has also changed rapidly with the introduction of TNCs, such as Uber and Lyft. Due to these rapid changes, before predicting long-range future conditions, Massport needs additional time to understand these evolving trends and what it means for future activity levels and airport ground access. Massport will prepare a *2017 ESPR* which will include an updated future forecast and a better understanding of future ground transportation options to and from Logan Airport. The scope for this EDR was established by the Secretary's Certificate dated March 9, 2018, which is included in Appendix A, *MEPA Certificates and Responses to Comments*. This *2016 EDR* fulfills all requirements laid out in the Secretary's Certificate. Future year forecasts and impact assessments will be provided in the *2017 ESPR*. See the cover letter and Chapter 1, *Introduction/Executive Summary* of this *2016 EDR* for more information.
A-25	Matthew Beaton, Secretary	Content	Progress on the EMP [EMS] should be incorporated into subsequent EDRs and ESPRs.	Since 2006, Massport has had an ISO 14001 certified Environmental Management System (EMS) in place, a systematic approach which Massport uses to promote continual improvement of environmental management at Logan Airport. The goals of Massport's EMS are to meet regulatory requirements and to improve Massport's environmental performance beyond compliance on an ongoing basis. The EMS consists of policies, procedures, and records that are collectively used by Massport employees to prevent pollution and address potential environmental impacts associated with Airport operations. Responding to environmental regulations and international standards, Logan Airport's EMS provides a structure for regulatory compliance and monitoring of a wide range of activities at the Airport that affect the environment, such as air quality, recycling, stormwater pollution prevention, and energy use. Additional information can be found in Chapter 8, *Water Quality/Environmental Compliance and Management*.
A-26	Matthew Beaton, Secretary	GHG Emissions	Massport has indicated that it will continue to report on GHG emissions in 2016 and will quantify aircraft, ground service equipment (GSE), motor vehicles and stationary sources using emission factors and methodologies outlined in the EEA GHG Policy and the Transportation Research Board's Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories (Airport Cooperative Research Program (ACRP) Report 11, Project 02-06) and other relevant guidance. The expansion of GHG reporting is significant and will guide Massport efforts to achieve sustainability goals and GHG emission reduction goals.	The *2016 EDR* reports on greenhouse gas (GHG) emissions at Logan Airport, and the GHG inventory includes aircraft, GSE, Massport fleet vehicles, and stationary sources. The inventory uses a methodology consistent with the EEA MEPA Greenhouse Gas Emissions Policy and Protocol and the Transportation Research Board (TRB) ACRP GHG methodology guidance. Massport has voluntarily prepared an inventory of GHG emissions both directly and indirectly associated with Logan Airport since the *2007 EDR*. The EDR provides information on the GHG assessment in Chapter 7, *Air Quality/Emissions Reduction*.

Commen	Author	Topic	Comment	Response
A-27	Matthew Beaton, Secretary	GHG Emissions/ Data Reporting	The presentation of the data could be improved, for instance, by normalizing data and/or reporting emissions in several units (e.g. MMT and tpy) to allow comparisons between various programs, policies and reporting requirements. Massport controlled emissions and tenant emissions, for instance, could be reported in kBtu/sf-yr by building for benchmarking purposes.	In response to the March 9, 2018 Secretary's Certificate on the *2016 EDR Notice of Project Change*, Massport has augmented its GHG reporting to show normalized GHG emissions and building energy use data (see Chapter 7, *Air Quality/Emissions Reduction*). Normalizing the data shows that Logan Airport is operating more efficiently over time, serving more passengers in larger building footprints with less energy. GHG emissions per passenger (Scopes 1 and 2) have decreased by over 34 percent from 2007 to 2016. Logan Airport's energy use intensity, which is a measure of building-only energy consumption per square foot, has decreased by over 23 percent from 2007 to 2016. Building GHG emissions per square foot has decreased by over 43 percent from 2007 to 2016.
A-28	Matthew Beaton, Secretary	GHG Emissions	Identification of total GHG emissions associated with buildings and fuel sources would be informative. I encourage Massport to consider make this a focus for the 2016 ESPR.	In response to the March 9, 2018 Secretary's Certificate on the *2016 EDR Notice of Project Change*, Massport has augmented its GHG reporting to show normalized GHG emissions and building energy use data (see Chapter 7, *Air Quality/Emissions Reduction*). Normalizing the data shows that Logan Airport is operating more efficiently over time, serving more passengers in larger building footprints with less energy. GHG emissions per passenger (Scopes 1 and 2) have decreased by over 34 percent from 2007 to 2016. Logan Airport's energy use intensity, which is a measure of building-only energy consumption per square foot, has decreased by over 23 percent from 2007 to 2016. Building GHG emissions per square foot has decreased by over 43 percent from 2007 to 2016.
A-29	Matthew Beaton, Secretary	GHG Emissions	I encourage Massport to consider establishment of aggressive goals for reducing GHG emissions, and in particular transportation emissions, in the 2017 ESPR.	In 2015, Massport prepared the Logan Airport Sustainability Management Plan (SMP); the plan set sustainability goals and targets for ten resource areas, including Energy and Greenhouse Gas Emissions. The SMP sets a GHG emissions reductions target of 40 percent reduction in GHG emissions per passenger by 2020, and 80 percent reduction in GHG emissions per passenger by 2050. Massport produces an annual Sustainability Report that provides an update on Massport's progress; these reports are available on Massport's website at http://www.massport.com/massport/business/capital-improvements/sustainability/. Massport published an Annual Sustainability Report in April 2018 which reported a 46 percent decrease in GHG emissions per passenger from fiscal year 2002 through fiscal year 2018.
A-30	Matthew Beaton, Secretary	GHG Emissions	The ESPR should describe analysis methodologies and assumptions to develop the 2016 ESPR emissions inventory and provide forecasts for 2035. The results should be compared to 2015.	The 2016 EDR describes the assessment methodologies used to develop the emissions inventory in Chapter 7, *Air Quality/Emissions Reduction* and compares 2016 results to 2015. As described in the Introduction/Executive Summary, preparation of an ESPR has been deferred for approximately one year. The *2017 ESPR* will present an updated 2035 forecast and associated environmental analyses.
A-31	Matthew Beaton, Secretary	Airport Planning	The 2016 ESPR should provide a summary of the DIRP Study and identify which recommendations Massport will implement in the short term to increase the resiliency of its facilities to the potential effects of climate change.	The *2016 EDR* provides a summary of the DIRP as well as parallel resiliency planning efforts, including the 2014 Flood Proofing Design Guidelines (updated in 2016), and the development of Flood Operations Plans for Logan Airport in 2015. To date, Massport has floodproofed 10 out of the 20 originally identified Tier 1 recommendations of the DIRP. Massport's continued pursuit of resiliency improvements is discussed in Chapter 1, *Introduction/Executive Summary* and Chapter 3, *Airport Planning*. Massport also reports on the progress of its resiliency efforts in the Annual Sustainability Report published in April 2016, which is available on Massport's website at http://www.massport.com/massport/business/capital-improvements/sustainability/.
A-32	Matthew Beaton, Secretary	Mitigation	The 2015 EDR identifies the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have undergone MEPA review. The 2016 ESPR and future EDRs will continue to be the forum to address cumulative, Airport-wide impacts.	The *2016 EDR* includes the specified content in Chapter 9, *Project Mitigation and Tracking.* The EDR reports on the status of specific Massport and tenant projects at Logan Airport as defined in their respective Section 61 Findings, including the recently approved Terminal E Modernization Project. The EDR continues to report on cumulative, Airport-wide environmental impacts.

Commen	Author	Topic	Comment	Response
A-33	Matthew Beaton, Secretary	Mitigation	The 2016 ESPR should update the status of Massport's mitigation commitments for the Terminal E Modernization Project and report on projects previously included in the EDRs.	The *2016 EDR* includes the specified content in Chapter 9, *Project Mitigation and Tracking.* The EDR reports on the status of specific Massport and tenant projects at Logan Airport as defined in their respective Section 61 Findings, including the recently approved Terminal E Modernization Project.
A-34	Matthew Beaton, Secretary	Airport Planning	The 2016 ESPR should continue to assess planning strategies for improving Logan Airport's operations and services in a safe, secure, more efficient, and environmentally sensitive manner. As owner and operator of Logan Airport, Massport must accommodate and guide tenant development. The ESPR should describe the status of planning initiatives for the following areas: • Roadways and Airport Parking; • Terminal Area; • Airside Area; • Service and Cargo Areas; and • Airport Buffers and Landscaping.	Massport has identified priority planning projects and initiatives to accommodate increased demand in international and domestic travel, enhance ground access to and from Logan Airport, and improve on-airport roadways and parking. The *2016 EDR* provides information on planning strategies for improving Logan Airport's operations and services in a safe, secure, and more efficient and environmentally sensitive manner in Chapter 3, *Airport Planning* . Specifically, the EDR describes short- and long-term planning initiatives for Logan Airport's terminal areas, service areas, buffer and open space areas, parking areas, and airside areas. The EDR also describes Airport-wide projects and planning concepts. The EDR lists all short- and long-term planning initiatives at Logan Airport in Table 3-1.
A-35	Matthew Beaton, Secretary	Airport Planning	The 2016 ESPR should also indicate the status of long-range planning activities, including the status of public works projects implemented by other agencies within the boundaries of Logan Airport.	The *2016 EDR* lists long-term planning projects, including those that have been recently completed, are underway, and are in planning stages, in Chapter 3, *Airport Planning* , Table 3-1.
A-36	Matthew Beaton, Secretary	Ground Access	The ESPR should also indicate the status and effectiveness of ground access changes, including roadway and parking projects, that consolidate and direct airport-related traffic to centralized locations and minimize airport-related traffic on streets in adjacent neighborhoods.	The *2016 EDR* includes the specified content in Chapter 5, *Ground Access to and from Logan Airport.* The EDR reviews the current and historical traffic and ground access trends, and provides information on projects at Logan Airport to minimize airport-related traffic. Massport is committed to increasing HOV mode share and has a comprehensive, multi-pronged strategy to enhance HOV ridership. Ridership on Logan Express and public transportation increased in 2016 (see Table 5-8). Massport will continue its strategy to provide a broad range of HOV, transit, and shared-ride options for travel to and from Logan Airport and to minimize vehicle trips, by providing convenient transit, shuttle, bike, and pedestrian connections to the Airport. The strategy also aims to provide on-Airport parking for passengers choosing to drive or who have limited HOV options. Table 5-9 provides monthly ridership for Back Bay Logan Express in 2016, which totaled 216,329 passengers, or an average of about 600 riders per day. This EDR also provides the results from the *2016 Air Passenger Ground Access Survey.* For more information, see Chapter 5, *Ground Access to and from Logan Airport* .

Commen	Author	Topic	Comment	Response
A-37	Matthew Beaton, Secretary	Regional Transportation	The 2016 ESPR should report on the issues identified below. Regional Airports • 2016 regional airport operations, passenger activity levels, and schedule data within an historical context; • Status of plans and new improvements as provided by the regional airport authorities; • Role of the Worcester Regional Airport and Hanscom Field in the regional aviation system and Massport's efforts to promote these airports; and • Ground access improvements at Massachusetts Regional Airport.	Logan Airport is one of three airports owned and operated by Massport, and is the primary international and domestic airport operating within a larger network of New England Regional Airports. The *2016 EDR* provides information on passenger and aircraft activity levels at New England regional airports, including Worcester Regional Airport and Hanscom Field, in Chapter 4, *Regional Transportation*. Massport recognizes the continued importance of coordinated airport development through the New England region, and the *2016 EDR* identifies significant airport improvements that are planned and under construction at regional airports. Notably, Massport continues to invest in Hanscom Field through projects like the Runway 23 safety area rehabilitation, installation of new entrance signage, and planned replacement of the airfield lighting control system and rehabilitation of facilities and landside roadways. Together, with the City of Worcester, Massport invests $100 million over the next 10 years to revitalize and grow commercial operations at Worcester Regional Airport. Massport, in conjunction with the City of Worcester and other community stakeholders, actively promoted the reintroduction of scheduled airline service at Worcester Regional Airport and successfully secured new service provided by JetBlue Airways. As a result of this collaboration, JetBlue Airways has already served over 430,000 passengers at Worcester Regional Airport since commencing operations in late 2013. Massport is nearing completion of Worcester's Category (CAT) III Instrument Landing System to elevate operational conditions and enhance safety to a level equal to that of all other commercial airports in New England. This project will significantly improve Worcester Regional Airport's all-weather reliability, a long-standing impediment to greater utilization of this airport.
A-38	Matthew Beaton, Secretary	Regional Transportation	Regional Transportation System • Massport's role in managing the regional transportation facilities within MassDOT; • Massport's cooperation with other transportation agencies to promote efficient regional highway and transit operations; and • Report on metropolitan and regional rail initiatives and ridership.	The *2016 EDR* provides an update on Massport's role and joint efforts to improve the efficiency of New England's regional transportation system. Massport coordinates with a broad array of transportation agencies and concerned parties to promote an integrated, multimodal regional transportation network. Massport supports multiple regional planning organizations and stakeholder initiatives. Massport partners with agencies to implement regional plans, including the *Massachusetts Statewide Airport System Plan,* the Boston Region Metropolitan Planning Organization *Charting Progress to 2040*, MassDOT's *weMove Massachusetts*, the MBTA's *Focus40*, the *Massachusetts State Freight Plan*, the *New England Regional Airport System Plan* and *General Aviation Plan*, *Imagine Boston 2030*, and *GoBoston 2030.* The *2016 EDR* provides information on the current status of the regional transportation system in Chapter 4, *Regional Transportation*.

Commen	Author	Topic	Comment	Response
A-39	Matthew Beaton, Secretary	Ground Access	The 2016 ESPR should report on 2016 ground access conditions at the airport and provide a comparison of 2016 findings to those of 2015 for the following: • Detailed description of compliance with Logan Airport Parking Freeze; • HOV ridership (including Blue Line, Silver Line, Water Transportation, and Logan Express); • Logan Airport Employee Transportation Management Association (Logan TMA) services; • Logan Airport gateway volumes; • On-airport traffic volumes; • On-airport VMT; • Parking demand and management (including rates and duration statistics); • Status of long-range ground access management strategy planning; • Results of the 2016 Logan Airport Air Passenger Survey; and, • Status of proposed connector to the Airport Station associated with the planned Terminal E Modernization Project.	This EDR includes the specified content and compares 2016 findings to those of 2015. The *2016 EDR* provides information on current and historical ground access conditions in Chapter 5, *Ground Access to and from Logan Airport*. The EDR discusses critical aspects of ground access conditions at Logan Airport, including HOV modes and ridership, Logan Airport Employee TMA services, traffic volumes and VMT, parking conditions, ground access strategy, and the status of current projects, including the Terminal E Modernization Project. Pedestrian access between Terminal E and the MBTA Blue Line Airport Station will be implemented as part of Phase 2 of the Terminal E Modernization Project; the EDRs and ESPRs will provide updates on the design status as it progresses. The results of the *2016 Logan Airport Air Passenger Ground Access Survey* are included in Chapter 5, *Ground Access to and from Logan Airport* and available online at: http://massport.com/logan-airport/about-logan/air-passenger-survey/.
A-40	Matthew Beaton, Secretary	Ground Access	The chapter should present a discussion of analytical methodologies and assumptions for the planning horizon year (2035) for traffic volumes, on-airport VMT and parking demand.	While the next annual report was originally scheduled to be a *2016 ESPR*, with EEA approval, Massport has prepared an EDR for 2016. The key difference between the two documents is that the ESPR provides future forecasts for airport activity levels and environmental conditions. In the past few years, passenger demand trends for air travel have been rapidly increasing and the air carrier landscape is changing. Additionally, the ground transportation arena at Logan Airport has also changed rapidly with the introduction of TNCs, such as Uber and Lyft. Due to these rapid changes, Massport needs additional time to understand these evolving trends and what it means for future activity levels and airport ground access. Massport will prepare a *2017 ESPR* which will include an updated future forecast and a better understanding of future ground transportation options to and from Logan Airport. The scope for this EDR was established by the Secretary's Certificate dated March 9, 2018, which is included in Appendix A, *MEPA Certificates and Responses to Comments*. This *2016 EDR* fulfills all requirements laid out in the Secretary's Certificate. Future year forecasts and impact assessments will be provided in the *2017 ESPR*. See the cover letter and Chapter 1, *Introduction/Executive Summary* of this *2016 EDR* for more information. This 2016 EDR provides 1990, 2000, and 2010-2016 data as available in each chapter. Each chapter of the document discusses calendar year 2016 findings and compares data to 2015 and historical years. The document includes data from 1990 and 2000, and in some cases 1998 (the year of peak operations at Logan Airport), to provide a historical benchmark of progress over the last few decades. The technical appendices contain all available historical data.

Commen	Author	Topic	Comment	Response
A-41	Matthew Beaton, Secretary	Ground Access	The 2016 ESPR should address the following topics: • Massport's target HOV mode share along with incentives; • Non-Airport through-traffic; • Massport's cooperation with other transportation agencies to increase transit ridership to and from Logan Airport via the Blue Line, Silver Line, Water Transportation, and Logan Express; • Efforts to increase capacity and usage of Logan Express; • Progress on enhancing water transportation to and from Logan Airport; • Report on results of ground access study; and • Strategies for enhancing services and increasing employee membership in the TMA.	The *2016 EDR* discusses efforts to manage and improve traffic conditions and ground access to Logan Airport in Chapter 5, *Ground Access to and from Logan Airport*. Massport is committed to increasing HOV mode share and has a comprehensive, multi-pronged strategy to enhance HOV ridership. Ridership on Logan Express and public transportation increased in 2016 (see Table 5-8). Massport will continue its strategy to provide a broad range of HOV, transit, and shared-ride options for travel to and from Logan Airport and to minimize vehicle trips, by providing convenient transit, shuttle, bike, and pedestrian connections to the Airport. The strategy also aims to provide on-Airport parking for passengers choosing to drive or who have limited HOV options. Table 5-9 provides monthly ridership for Back Bay Logan Express in 2016, which totaled 216,329 passengers, or an average of about 600 riders per day. The results of the *2016 Logan Airport Air Passenger Ground Access Survey* are included in Chapter 5, *Ground Access to and from Logan Airport* and available online at: http://massport.com/logan-airport/about-logan/air-passenger-survey/.
A-42	Matthew Beaton, Secretary	Noise	Massport intends to use the AEDT for noise modeling for the 2016 ESPR if the adjustments are approved by the FAA. Massport should update the MEPA office regarding the status of the requested adjustments and consult with the MEPA office regarding ESPR noise modeling as early as possible if the FAA does not approve use of the requested adjustments or it appears that the FAA review will be delayed. I note comments that indicate data should be provided regardless of FAA's approval or timing.	For this *2016 EDR*, for assessing the effects of aircraft activities, Massport has transitioned from using the legacy modeling software, INM for noise and EDMS for air quality, to FAA's next-generation software, AEDT. For past noise studies, Massport implemented a series of FAA-approved adjustments to the INM model. These adjustments were developed to address specific terrain concerns unique to Logan Airport; which included an over-water and hill-effect adjustment (see Chapter 6, *Noise Abatement* for more information). These Logan Airport-specific adjustments were carried over from one version of INM to the next. Massport has been working with the FAA since 2015 to implement adjustments in AEDT. After their review, the FAA did not approve the two significant adjustments (accounting for over-water noise propagation and hill effects) to the contours. The FAA did concur with the use of 2016 weather data and aircraft stage length adjustments when using the AEDT model. Details of FAA's guidance with respect to Logan Airport specific adjustments when using AEDT can be found in Chapter 6, *Noise Abatement* and Appendix H, *Noise Abatement*. To assist the reviewer, Massport has provided the 2016 INM contours for comparison with the 2016 AEDT contours. For air quality, Massport has provided 2016 results using both the legacy EDMS model and new AEDT model.
A-43	Matthew Beaton, Secretary	Noise	Otherwise, noise contours for 2016 should be developed using AEDT and compared to the most recent version of the Integrated Noise Model (INM) which has been in place for all previous EDRs and ESPRs. Logan Airport-specific model adjustments made to account for over-water sound propagation and the propagation of sound to areas of higher terrain may be reported as an add-on to AEDT, if accepted by the FAA.	For this *2016 EDR*, for assessing the effects of aircraft activities, Massport has transitioned from using the legacy modeling software, INM for noise and EDMS for air quality, to FAA's next-generation software, AEDT. For past noise studies, Massport implemented a series of FAA-approved adjustments to the INM model. These adjustments were developed to address specific terrain concerns unique to Logan Airport; which included an over-water and hill-effect adjustment (see Chapter 6, *Noise Abatement* for more information). These Logan Airport-specific adjustments were carried over from one version of INM to the next. Massport has been working with the FAA since 2015 to implement adjustments in AEDT. After their review, the FAA did not approve the two significant adjustments (accounting for over-water noise propagation and hill effects) to the contours. The FAA did concur with the use of 2016 weather data and aircraft stage length adjustments when using the AEDT model. Details of FAA's guidance with respect to Logan Airport specific adjustments when using AEDT can be found in Chapter 6, *Noise Abatement* and Appendix H, *Noise Abatement*. To assist the reviewer, Massport has provided the 2016 INM contours for comparison with the 2016 AEDT contours. For air quality, Massport has provided 2016 results using both the legacy EDMS model and new AEDT model.

Commen	Author	Topic	Comment	Response
A-44	Matthew Beaton, Secretary	Noise	The 2016 ESPR should provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, and the updates in noise modeling. The chapter should report on 2016 conditions and compare those conditions to those of 2015 for the following: • Fleet Mix, including Stage II, Recertified Stage III, newly manufactured Stage III, and qualifying Stage IV aircraft; • Nighttime operations; • Runway utilization (report on aircraft and airline adherence with runway utilization goals); and • Flight tracks.	The *2016 EDR* provides an overview of the regulatory framework for aircraft noise, the noise modeling methodology, and the resulting changes in modeled aircraft noise in Chapter 6, *Noise Abatement*. All jet aircraft currently operating at Logan Airport are categorized by FAA as Stage 3 or Stage 4. Stage 5 aircraft certification will begin in 2017, however 18 percent of the current jet fleet already meets Stage 5 standards. Nighttime operations increased from 50,786 operations in 2015 to 55,499 operations in 2016. Runway utilization remained relatively stable between 2015 and 2016. The EDR shows RNAV flight tracks for Air Carrier, Regional Jet, and Non-Jet arrivals and departures throughout 2016.
A-45	Matthew Beaton, Secretary	Noise	The 2016 ESPR should report on the following: • Changes in annual noise contours and noise-impacted population; • Measured versus modeled noise values, including reasons for differences and any improvements attributable to the models deployed; • Cumulative Noise Index (CNI); • Times-Above for 65, 75, and 85 dBA threshold values/Dwell and Persistence of noise levels; and • Flight track monitoring noise reports.	The *2016 EDR* includes the specified content in Chapter 6, *Noise Abatement*. Massport has modeled 2016 noise conditions using both INM and AEDT. Chapter 6, *Noise Abatement* compares 2015 INM to 2016 INM, 2016 INM to 2016 AEDT, and 2015 INM to 2016 AEDT. The EDR describes changes attributable to both operations and modeling. The EDR reports on CNI, Time Above, and Dwell and Persistence in Chapter 6, *Noise Abatement.* Appendix H, *Noise Abatement* includes the flight track monitoring reports for 2016. Future EDRs and ESPRs will use AEDT only to model noise.
A-46	Matthew Beaton, Secretary	Noise	The 2016 EDR should also report on consultation between Massport and FAA regarding the impacts of RNAV, noise abatement efforts, results of Boston Logan Airport Noise Study (BLANS) study, and provide an update on the noise and operations monitoring system.	The *2016 EDR* includes the specified content in Chapter 6, *Noise Abatement*. The Boston Logan Airport Noise Study, or BLANS, has been ongoing since 2008. Detailed information from the study can be found at: http://www.bostonoverflightnoisestudy.com. This study has been an open forum for noise discussions. The FAA-sponsored BLANS program recently concluded and a final report was published in 2017. The *2016 EDR* reviews the past and current coordination between Massport and the FAA regarding RNAV procedures. On October 7, 2016, FAA signed a MOU with Massport to frame the process for analyzing opportunities to reduce noise through changes or amendments to PBN. The EDR includes an update on noise abatement efforts and Massport's noise and operations monitoring system.
A-47	Matthew Beaton, Secretary	Air Quality/ Emissions Reduction	The ESPR should contain an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, changes in air quality modeling and air quality studies.	Chapter 7, *Air Quality/Emissions Reduction* provides an overview of the regulatory framework for aircraft emissions, the emissions modeling methodology, and the resulting changes in modeled aircraft emissions. The chapter includes information on the Clean Air Act, the National Ambient Air Quality Standards, and Massachusetts state laws governing air quality. The EDR includes an expanded section on UFPs and a new section on Black Carbon. Massport will continue to track the regulatory status of these pollutants.

Commen	Author	Topic	Comment	Response
A-48	Matthew Beaton, Secretary	Air Quality/ Emissions Reduction	The ESPR should also provide discussion on progress on the national and international levels to decrease air emissions, including alternative fuel vehicle programs implemented by Massport and/or its tenants.	The *2016 EDR* includes the specified content in Chapter 7, *Air Quality/Emissions Reduction*. Massport now operates 99 vehicles powered by compressed natural gas (CNG), propane, E85 flex fuel, or operates hybrids powered by gasoline or diesel. Massport also operates 125 electric ground service equipment (eGSE) vehicles at Logan Airport and is working to replace all of its GSE with electric alternatives. The EDR reports on Massport's air quality emissions reduction goals and their status in 2016.
A-49	Matthew Beaton, Secretary	Air Quality/ Emissions Reduction	If the AEDT tool is used for modeling the 2016 ESPR should compare results to the most recent version of the Emissions Dispersion Modeling System (EDMS) that has been used in recent EDR filings. The Environmental Protection Agency (EPA) MOVES2014a program will continue to be used to estimate vehicular emission on airport roadways.	For this *2016 EDR,* Massport has transitioned from using the legacy modeling software, INM for noise and EDMS for air quality, to FAA's next-generation software, AEDT. AEDT was used to determine aircraft emissions in 2016. MOVES2014a was used to estimate vehicle emissions. Massport has included 2016 results using both the legacy EDMS model and new AEDT model. These results are reported on and discussed in Chapter 7, *Air Quality/Emissions Reduction.*
A-50	Matthew Beaton, Secretary	Air Quality/ Emissions Reduction	The ESPR should include an emissions inventory for CO, NOx, VOCs, and PMs.	The *2016 EDR* includes an emissions inventory for carbon monoxide (CO), oxides of nitrogen (NOx), volatile organic compounds (VOCs), and particulate matter (PM_{10}/$PM_{2.5}$) in Chapter 7, *Air Quality/Emissions Reduction*. The 2016 data (using AEDT) show an increase in CO (1.5 percent increase since 2015), NOx (24.4 percent increase since 2015), VOCs (7.7 percent increase since 2015), and PM (2.0 percent decrease since 2015). The increase in VOC emissions is primarily influenced by the increase in emissions from other sources, which include stationary and fueling sources; the increase in VOC emissions is also attributable to modeling differences between EDMS and AEDT. The increase in NOx emissions was partially due to the increase in aircraft operations and partially due to modeling differences between EDMS and AEDT. The increase in CO emissions was primarily influenced by the increase in aircraft operations. The decrease in PM emissions was primarily due to model differences between EDMS and AEDT. All emissions levels continue to remain below those reported in 2000. For a detailed discussion, please see Chapter 7, *Air Quality/Emissions Reduction.*
A-51	Matthew Beaton, Secretary	Air Quality/ Emissions Reduction	Commenters express concern that the EDR does not provide a substantive response to concerns expressed regarding ultrafine particulates (UFP). As commenters are aware, UFPs are not regulated by the US Environmental Protection Agency (EPA) and EPA has not proposed to adopt standards for UFPs. I encourage Massport to consider how the ESPR might constructively address the concern presented by commenters. The ESPR should specifically identify any ongoing or new policies or programs that would reduce diesel emissions.	As noted by the Secretary, at this time, there are no state or federal air quality standards for outdoor levels of UFPs. Massport is actively tracking the research and regulatory status of this pollutant and will comply with future UFP standards if promulgated by EPA. The EDR provides information on initiatives to reduce diesel and other GHG emissions, and provides an expanded section on UFPs in Chapter 7, *Air Quality/Emissions Reduction*. Massport has also added a section that discusses Black Carbon to address concerns voiced by the community. Massport will also track the research and regulatory status of this pollutant.

Commen	Author	Topic	Comment	Response
A-52	Matthew Beaton, Secretary	Air Quality/ Emissions Reduction	The ESPR should include an update on its efforts to encourage the use of single engine taxiing under safe conditions	The *2016 EDR* includes the specified content in Chapter 7, *Air Quality/Emissions Reduction.* The document also includes the 2016 and 2017 memoranda sent to the Logan Airport Airline Committee on reduced/single engine taxiing at Logan Airport in Appendix L, *Reduced/Single Engine Taxiing at Logan Airport Memorandum.*
A-53	Matthew Beaton, Secretary	Airport Planning	As required in the review of the Terminal E Expansion, Massport should report on progress made in designing the energy systems for the facility and the feasibility of combined heat and power (CHP).	Final program definition and schematic design for the project is currently being advanced consistent with the commitments in the EA/EIR. Massport will report on the progress of the Terminal E Modernization Project energy systems when information is available.
A-54	Matthew Beaton, Secretary	Water Quality	The 2016 ESPR should identify any planned stormwater management improvements and report on the status of: • NPDES Permit and monitoring results for Logan Airport's outfalls and the Fire Training Facility; • Jet fuel usage and spills; • MCP activities; • Tank management; • Environmental management plan; and • Fuel spill prevention.	The *2016 EDR* includes the specified content. The EDR provides an overview of the regulatory framework for stormwater management at Logan Airport, the National Pollution Discharge Elimination System Permit (NPDES) Permit and monitoring results, and records of hazardous material spills, tank management activities, and implementation of the EMS in Chapter 8, *Water Quality/Environmental Compliance and Management* and Appendix J, *Water Quality/Environmental Compliance and Management*. Massport continues to sample outfalls and implement a Stormwater Pollution Prevention Plan (SWPPP) in accordance with the current NPDES Permit. In 2016, 98.6 percent of stormwater samples were in compliance with standards. Massport complies with the Massachusetts Contingency Plan (MCP) by monitoring fuel spills and tracking the status of spill response actions, and implements the ISO 14001-certified EMS to control, monitor, and improve environmental compliance for underground and aboveground storage tanks, materials management, and other environmental compliance activities.

Secretary of the Executive Office of Energy and Environmental Affairs Certificate on the Logan Airport 2016 Environmental Data Report Notice of Project Change and Responses to Comments

This Page Intentionally Left Blank.

The Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Charles D. Baker
GOVERNOR

Karyn E. Polito
LIEUTENANT GOVERNOR

Matthew A. Beaton
SECRETARY

Tel: (617) 626-1000
Fax: (617) 626-1181
http://www.mass.gov/envir

March 9, 2018

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
NOTICE OF PROJECT CHANGE

PROJECT NAME	: 2016 Environmental Status and Planning Report (ESPR)/ Environmental Data Report (EDR)
PROJECT MUNICIPALITY	: Boston/Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: February 7, 2018

Pursuant to the Massachusetts Environmental Policy Act (MEPA; M.G.L. c. 30, ss. 61-62I) and Section 11.10 of the MEPA regulations (301 CMR 11.00), I have reviewed the Notice of Project Change (NPC) and **hereby determine** that a Supplemental Environmental Impact Report (EIR) is not required.

The NPC consists of a request by the Massachusetts Port Authority (Massport) to shift the timing and sequence of the 2016 Environmental Status and Planning Report (ESPR) and 2017 Environmental Data Report (EDR). Massport has proposed this change because it is concerned that 2016 is not an appropriate baseline year from which to forecast long-term operational and environmental conditions. The NPC indicates that the concern is based changes associated with: (1) rapidly growing domestic and international passenger demand; (2) the formal introduction to Logan Airport of transportation network companies (TNC), such as Uber and Lyft, in early 2017; and (3) use of the Federal Aviation Administration's (FAA) Aviation Environmental Design Tool (AEDT) for noise and air quality modeling for 2016 reporting.

I am granting this request based on the following:

- Massport will submit a 2016 EDR in lieu of the ESPR.
- The 2016 EDR will supplement typical EDR data reporting with discussion of future passenger and activity levels, planning to address growth and strategies to minimize environmental impacts.
- The 2016 EDR will include a draft Scope for the 2017 ESPR and identify when the ESPR will be filed.

NPC-1

Logan Airport Environmental Review and Planning

The environmental review process for Logan Airport has been structured to occur on two levels: airport-wide and project-specific. The ESPR has evolved from a largely retrospective status report on airport operations to a broader analysis that also provides a prospective assessment of long-range plans. It has thus become, consistent with the objectives of the MEPA regulations, part of the long-range planning process for Massport. The ESPR provides a "big picture" analysis of the environmental impacts associated with current and projected activity levels, and presents a comprehensive strategy to minimize impacts.

The ESPR is generally updated on a five-year basis. EDRs (formerly referred to as Annual Updates) are filed annually in the years between ESPRs. EDRs consist of a status report and annual reporting on activity levels and associated environmental impacts at Logan Airport. ESPR's are also supplemented by (and ultimately incorporate) project-specific Environmental Impact Reports (EIR) that provide detailed analyses and mitigation commitments for proposed projects. The sequence and timing for submitting ESPRs and EDRs has been adjusted previously based on consultation between Massport and the Executive Office of Energy and Environmental Affairs (EEA). Most recently, with EEA approval, Massport deferred submittal of the 2011 ESPR by two years based on the regional and national economic downturn experienced in the mid- to late-2000s.

Through these reports, Logan Airport is subject to comprehensive and regular MEPA review, including opportunities for public comment on cumulative impacts. This regular updating and reporting on planning and cumulative impacts is unique among State Agencies. It reflects the challenge and complexity of managing and modernizing Logan Airport within a dense, urban area. It recognizes that the proximity of communities to the Airport warrants an enhanced level of public engagement and a concerted, long-term effort to minimize and mitigate impacts.

On February 17, 2017, I issued a Certificate on the 2015 EDR which contained a review of the 2015 EDR and Scope for the 2016 ESPR. This Certificate on the NPC is informed by and includes references to the 2015 EDR, data and conclusions. This Certificate supplements, but does not replace, the 2015 EDR Certificate. The Scope for the 2017 EDR will be revised based on the review of the 2016 EDR.

In 2015, Logan Airport served an all-time high of 33.4 million passengers, exceeding the 2014 historic peak. A significant portion of growth in passengers is driven by an increase in demand for international air service. Massport has responded to this demand by providing new service to international destinations and expanding service to existing destinations. As passenger levels have increased, aircraft operations remain significantly below the peak of 507,449 operations experienced in 1998 when Logan Airport served 26.5 million passengers. The reduction of over 130,000 annual flight operations combined with transition towards newer and larger aircraft with improved environmental performance and operational efficiencies, have supported passenger growth while limiting environmental impacts.

The long-term trend is towards more efficient operations and significant reductions in overall environmental impacts. Although environmental impacts are significantly lower compared to 1998 when operations were highest, comparison of activity level and environmental impact data to 2014 and more recent EDRs identifies increases in noise exposure, air emissions and traffic. These increases were not forecast in the 2011 ESPR. The increases are associated with passenger growth, changes in flight patterns and changes in modeling of noise and air quality.

The most significant change since 2011 is the introduction by the FAA of changes to area navigation (RNAV) procedures. The RNAV program has been implemented throughout the country and its primary purpose is to increase safety and operational efficiency. The implementation of several of these procedures has resulted in concentrations of flight patterns over certain communities and significant increases in noise exposure.

The impact of the RNAV program was reflected in the many comment letters received during review of specific projects, including the Terminal E Modernization Project (EEA# 15434). Massport and the FAA signed a Memorandum of Understanding (MOU) in 2017 to frame a new process for analyzing opportunities to incrementally reduce noise through changes or amendments to Performance Based Navigation, including RNAV procedures.

Another significant change identified in the 2015 EDR was the introduction of AEDT for emissions and noise modeling. Based on its evaluation of the model, Massport requested that FAA approve development of specific adjustments to the AEDT model consistent with those developed for the Integrated Noise Model (INM). Based on this consultation, Massport deferred use of the AEDT. Projections in the 2016 EDR will be based on AEDT and will provide an opportunity to review and comment on the model and results prior to its use in the 2017 ESPR.

In addition, Logan Airport passenger ground access is changing rapidly with the use of TNCs for departures and arrivals at the Airport. Massport has been collecting TNC data since February 2017 when TNCs began picking up, in addition to dropping off, at Logan. The 2017 ESPR will include limited data from 2016 and a year of data for 2017. NPC-2

The Scope for the 2016 EDR will include description and analysis of these changes which will influence results and projections and provide context for the 2017 ESPR. The deferment of the ESPR until 2019 will provide more meaningful data and will be employed to develop a more reliable baseline from which activity and impacts can be projected.

Scope for the 2016 EDR

General

The 2016 EDR should follow the general format of the 2015 EDR to provide an update on conditions at Logan Airport, including passenger and aircraft operation activity levels. It should include an Executive Summary and Introduction, similar to previous ESPRs and EDRs.

The 2016 EDR must include information on the environmental policies and planning that form the context of environmental reporting, technical studies, and environmental mitigation initiatives against which projects at Logan Airport can be evaluated. This should include identification of the cumulative effects of Logan Airport operations and activities, compared to previous years, as appropriate. It should report on status of Massport's proposed planning initiatives, projects, and mitigation measures. The results of the 2016 Logan Airport Air Passenger Ground Access Survey and the Long-term Parking Management Plan should be used in the 2016 EDR to inform transportation planning.

The technical studies should include reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. The 2016 EDR must also respond to those issues explicitly noted in this Certificate and the comments received on the 2015 EDR and noted in the February 17, 2017 Certificate. NPC-3

A distribution list for the 2016 EDR (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document. This section must also include copies of all ESPR and EDR Certificates. Supporting technical appendices should be provided as necessary.

Response to Comments

The Response to Comments section should address all of the substantive comments on the 2015 EDR, and other Certificates for Logan Airport that reference EDR/ESPR documentation (e.g. Logan Airport Parking Project, Terminal E). NPC-4 To ensure that the issues raised by commenters are addressed, the 2016 EDR should include direct responses to comments to the extent that they are within MEPA jurisdiction. This directive is not intended to, and shall not be construed to, enlarge the scope of the 2016 EDR beyond what has been expressly identified in this Certificate. I recommend that the Massport continue to use the format from the 2015 EDR. The Responses to Comments should not reference a section of the 2016 EDR unless they are directly responsive to the comment. Common themes that should be addressed throughout the EDR and in the Responses to Comments include noise (modeling of noise contours and noise abatement) and emissions reduction issues. The 2016 EDR should include sufficient information to address comments on traffic, air quality and public health which are common concerns of commenters. NPC-5

Activity Levels

Air traffic activity levels at Logan Airport are the basis for the evaluation of noise, air quality, and ground access conditions associated with the Airport. In this section, current activity levels at the Airport are compared to prior-year levels, and historical passenger and operations trends at Logan Airport dating back to 2000 which is the year Massport approved an Environmental Management Policy. The total number of air passengers increased by 5.7 percent to 33.4 million in 2015, compared to 31.6 million in 2014. As noted previously, the 2015 passenger level represents a record high for Logan Airport.

Passenger aircraft operations accounted for 91 percent of total aircraft operations in 2015. The total number of aircraft operations increased from 363,797 in 2014 to 372,930 in 2015, a 2.5-percent increase. This was preceded by a 0.7 percent increase from 2013 to 2014. Although operations are increasing compared to previous years, aircraft operations at Logan Airport remained well below the 487,996 operations in 2000 and the historical peak of 507,449 achieved in 1998. In 1998, Logan Airport served 26.5 million air passengers, compared to 33.4 million in 2015, which saw 134,519 fewer operations.

Air carrier efficiency continued to improve in 2015 as the average number of passengers per aircraft operation at Logan Airport grew from 87.0 in 2014 to 89.7 in 2015. This positive trend is indicative of the industry-wide shift toward higher aircraft load factors and an increase in the number of domestic and international destinations. Annual domestic passengers' activity levels increased from 26.5 million in 2014 to 27.8 million in 2015, a 4.8-percent increase. While the numbers of both domestic and international passengers have increased, international passenger demand continues to increase at a faster rate than domestic passenger demand. Total international passengers at Logan Airport increased from 5.0 million in 2014 to 5.5 million in 2015, a 10.9-percent increase. International passengers made up approximately 16.1 percent of total Airport passengers in 2015, and this is projected to increase steadily to nearly 20 percent of the total by 2030 or sooner. The 2015 EDR indicates that strong international passenger growth was driven by the economic attractiveness of the metropolitan Boston region and the strength of Boston as an origin and destination market. New international destinations from Logan Airport in 2015 included Mexico City, Hong Kong, Tel Aviv, and Shanghai.

The NPC indicates that passenger activity has continued to grow faster than forecasts provided in the 2015 EDR and that it is outpacing growth in aircraft operations. The 2016 EDR should describe how this trend will support Massport's long-standing goals to reduce overall operating and environmental impacts at the airport. 2016 The EDR should include more discussion of future passenger and activity levels and planning/mitigation to address impacts of growth than that which is typically provided in an EDR. NPC-6

The 2016 EDR should report on airport activity levels and aircraft operations, including:

- Aircraft operations, including fleet mix and scheduled airline services at Logan Airport;
- Domestic and international passenger activity levels;
- Cargo and mail volumes;

- Compare 2016 aircraft operations, cargo/mail operations, and passenger activity levels to 2015 activity levels; and
- National aviation trends compared to Logan Airport trends.

Sustainability at Logan Airport

The 2015 EDR described Massport's airport wide sustainability goals as identified in its Environmental Management Policy (EMP) and 2015 Sustainability Management Report (SMR). The SMR identifies efforts to promote, coordinate and integrate sustainability Airport-wide. Progress towards achieving these goals was addressed in the 2015 EDR. Massport revised its Sustainable Design Standards and Guidelines (SDSG) in March 2011 which provide a framework for sustainable design and construction for both new construction and rehabilitation projects. Since 2000 Massport has been striving to achieve certification by the U.S. Green Building Council Leadership in Energy and Environmental Design (LEED) for new and substantial rehabilitation of building projects over 20,000 square feet (sf).

The 2016 EDR should report on progress on achieving EMP goals.

Climate Change

Massport assets and Logan Airport, in particular, are critical infrastructure and play an important role in the economy. As recognized in Governor Baker's recent Executive Order 569 "Establishing an Integrated Climate Change Strategy for the Commonwealth" and a suite of other state and municipal initiatives, the impacts of climate change must be an important consideration for development across the state. Climate change presents a serious threat to the environment and the Commonwealth's residents, communities and economy. The EO indicates that extreme weather events associated with climate change present a serious threat to public safety and the lives and property of our residences. The recent flooding and storm damage caused by two storms in early March underscore these risks and the importance of adaptation and resiliency planning.

The EO also identifies the transportation sector as a significant contributor to GHG emissions in the Commonwealth and the only sector in which GHG emissions are increasing. In 2017, EEA and the Massachusetts Department of Transportation (MassDOT) conducted a number of transportation listening sessions throughout the Commonwealth to inform development of strategies and programs to reverse the growth in this sector.

Massport has begun reporting on GHG emissions and, in recognition of the potential effects of climate change on Massport infrastructure and operations, Massport initiated a Disaster and Infrastructure Resiliency Planning (DIRP) Study. A particular concern for Massport is the effect of sea level rise and projected increases in the severity and frequency of storms. The Study includes Logan Airport, the Port of Boston, and Massport's waterfront assets in South and East Boston. The DIRP Study includes a hazard analysis; modeling of projected sea-level rise and storm surge; temperature and precipitation projections; and anticipated increases in extreme weather events.

The 2016 EDR should provide a summary of the DIRP Study and identify which recommendations Massport will implement in the short term to increase the resiliency of its facilities to the potential effects of climate change.

Mitigation

The 2015 EDR identifies the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have undergone MEPA review. The 2016 EDR will continue to be the forum to address cumulative, Airport-wide impacts. The 2016 EDR should update the status of mitigation commitments for recent projects such as the Terminal E Modernization Project and the Logan Airport Parking Project as well as projects previously included in the 2015 EDR.

Planning

The Airport Planning section of the 2016 EDR should describe the status of projects underway or completed at Logan Airport by the end of 2016 and provide updates for projects in progress. It should address planning, construction, and permitting activities. Specific topics include terminal area projects, service area projects, buffer/open space projects, Airport parking projects, airside area projects, high occupancy vehicle (HOV) improvements, and Airport-wide projects. Project updates include:

- *Terminal E Renovation and Enhancements Project*: This project includes interior and exterior improvements at Terminal E to accommodate regular service by wider and longer Group VI aircraft. The project will reconfigure three gates to accommodate Group VI aircraft (including the Airbus A380 and Boeing 747-8 primarily used by international air carriers) and will reconfigure passenger holdrooms to accommodate larger passenger loads associated with these aircraft. Construction commenced in 2015.

- *Terminal E Modernization Project*: This project will accommodate existing and long range forecasted demand for international service. The expansion will add the three gates approved in 1996 (International Gateway West Concourse project, EEA #9791), which were never constructed, and an additional two to four additional new gates in an extended concourse. A key feature of this project is the first direct pedestrian connection from the MBTA Blue Line Airport Station to the terminal complex at Logan Airport. It will also include improvements to Airport roadways to facilitate access. The project completed MEPA review in 2016. Phase 1 has been permitted and is in the final design stage.

- *Terminal C to E Connector:* This project provides a new post-security connection between Terminals C and E on the Departures Level and provides improved passenger circulation within the post-security concourses, additional holdroom space at Terminal E, reconfigured office space, concessions and concessions support, and a new consolidated location for escalators and stairs. The project was completed in May 2016.

- *Terminal B Airline Optimization Project:* Massport is upgrading its facilities on the Pier B side of Terminal B to meet airlines' needs (primarily reflecting the merger of American Airlines and US Airways) and to provide facilities that improve the passenger traveling experience. Similar improvements have been implemented with the recent renovations and improvements at Terminal B, Pier A. Planned improvements include an enlarged ticketing hall, improved outbound bag area, expanded bag claim hall, expanded concession areas, and expanded holdroom capacity at the gate.

Logan Airport Parking Project: This project includes the construction of up to 5,000 new commercial parking spaces to reduce trip generation associated with increases in passenger drop-off and pick-up at the airport. The Certificate on the ENF was issued on May 5, 2017 and included a Scope for the Draft Environmental Impact Report (DEIR). This project required an amendment to the Logan Airport Parking Freeze Regulations (310 CMR 7.30). MassDEP proposed amendments to the regulations on March 24, 2017 and amendments were promulgated last year.

In the absence of a 2016 ESPR and the significant public interest in passenger growth, ground access, noise and air quality, the 2016 EDR should provide a broader context for long range planning than would normally be included in an EDR. It should address planning strategies for improving Logan Airport's operations and services in a safe, secure, more efficient, and environmentally sensitive manner. The 2016 EDR should describe the status of planning initiatives for the following areas: NPC-7

- Roadways and Airport Parking;
- Terminal Area;
- Airside Area;
- Service and Cargo Areas; and
- Airport Buffers and Landscaping.

The 2016 EDR should describe the status and effectiveness of ground access changes, including roadway and parking projects, that consolidate and direct airport-related traffic to centralized locations and minimize airport-related traffic on streets in adjacent neighborhoods.

Regional Transportation

The 2015 EDR describes activity levels at New England's regional airports in 2015 and provides an update on regional planning activities, including long-range transportation efforts. The New England region is anchored by Logan Airport and a system of 10 other commercial service, reliever, and general aviation (GA) airports (regional airports). In 2015, passenger traffic at the New England airports represented the highest passenger traffic level for the region since the economic downturn in 2008 and exceeded the historical peak of 48.0 million in 2005. The increase in the region's passenger traffic was largely driven by continued growth at Logan Airport. In 2015, the total number of air passengers utilizing New England's commercial service airports, including Logan Airport, increased by 4.1 percent from 46.8 million annual air passengers in 2014 to 48.7 million in 2015. Of the 48.7 million passengers, 68.6 percent of passengers (33.4 million) used Logan Airport compared to 67.6 percent (31.6 million) in 2014. Aircraft operations in the region remained flat in 2015, increasing 0.3 percent from 987,652 operations in 2014 to 991,041 operations in 2015.

Regional Airports

- 2016 regional airport operations, passenger activity levels, and schedule data within an historical context;
- Status of plans and new improvements as provided by the regional airport authorities;
- Role of the Worcester Regional Airport and Hanscom Field in the regional aviation system and Massport's efforts to promote these airports; and
- Ground access improvements at Massachusetts Regional Airport.

Regional Transportation System

- Massport's role in managing the regional transportation facilities within MassDOT;
- Massport's cooperation with other transportation agencies to promote efficient regional highway and transit operations; and
- Report on metropolitan and regional rail initiatives and ridership.

<u>Ground Access to and from Logan Airport</u>

The 2015 EDR reports on transit ridership, roadways, traffic volumes, and parking for 2015. Specifically, the EDR states that Massport has continued to invest in and operate Logan Airport with a goal of increasing the number of passengers arriving by transit or other high occupancy vehicle (HOV) modes.

Massport remains in compliance with the Parking Freeze regulations which regulates the number of commercial and employee parking spaces allowed at Logan Airport (total limit of 21,088). Massport submits semi-annual compliance filings to MassDEP; March and September reports are provided in the 2015 EDR. As permitted (and encouraged) by the regulations, Massport has converted employee spaces to commercial spaces, within the overall limits.

The HOV/transit mode share at Logan Airport continues to rank at the top of U.S. airports. At the same time, private passenger vehicle trips continue to increase as air travel grows. Massport has indicated that as passenger levels have increased, the constrained parking supply at Logan Airport has resulted in an increase in pick-up and drop-off vehicle trips. Despite an increase in terminal area parking rates on July 1, 2014, daily parking demand more frequently approached the Parking Freeze cap in 2015. As described previously, Massport is proposing to construct additional parking to reverse this trend.

The Airport's gateway roadways are equipped with permanent traffic count stations, as part of the Airport-wide Automated Traffic Monitoring System (ATMS). These stations provide data on annual average daily traffic (AADT), annual average weekday daily traffic (AWDT), and annual average weekend daily traffic (AWEDT). The AADT (entering and departing Logan Airport via its gateway roadways) increased by 0.1 percent between 2014 and 2015. The change in average daily traffic can be attributed to: a 5.7-percent increase in air passenger activity in 2015; a 3.0-percent increase in taxi dispatches in 2015; and 1.1-percent decrease in parking activity (exits) in 2015. Historically, the highest AADT recorded at Logan Airport was in 2007, when AADT reached 110,690, AWDT was 119,200, and AWEDT was 91,320 that same year. These gateway traffic volumes corresponded to an annual air passenger level of 28,102,455 passengers. Current AADT and AWDT values are 2 and 5 percent (respectively) lower than current on-Airport traffic volumes despite a 19.0-percent increase in air passenger levels from 2007 to 2015.

On-Airport VMT is calculated based on the total number of miles traveled by all vehicles within the Logan Airport roadway system. In 2011 as detailed in the 2011 ESPR, Massport upgraded its modeling capabilities and began using an on-Airport VISSIM-10 model to estimate VMT. Based on the ATMS data, the change in on-Airport daily traffic volumes between 2014 and 2015 was negligible. However, 2015 evening peak hour gateway volumes grew by roughly 5 percent when compared to 2014. Additionally, a shift in gateway traffic entering/exiting the Airport from the Ted Williams Tunnel to the Sumner/Callahan Tunnels was noted. Daily traffic volumes in the Ted Williams Tunnel decreased by 8.4 percent (from 49,600 to 45,400 vehicles) while volumes in the Sumner/Callahan Tunnels increased by 19.5 percent (from 29,800 to 35,600 vehicles). Since 2000, the highest average weekday VMT estimated at Logan Airport was in 2007, when weekday VMT was modeled at 184,613.

The 2015 EDR describes improvements to support HOV access which include: Back Bay Logan Express pilot service (since May 2014); free MBTA Silver Line outbound (from Logan Airport) boardings; a 1,100-car parking garage at the Framingham Logan Express; reduced holiday travel parking rates at Logan Express facilities; increased parking rates on the Airport; and support for private coach bus and van operators.

As noted previously, TNCs such as Lyft and Uber that did not exist just a few years ago are becoming prominent providers of Logan Airport passenger ground access/egress. According to the NPC, this new mode is already beginning to have a dramatic impact on how passengers arrive and depart Logan Airport. Using TNC data collected since February 2017 when TNCs began picking up at Logan will provide a better indication of future ground access mode share than using limited 2016 information. The 2016 EDR should describe how this TNC data collection and analysis will be incorporated into the 2017 ESPR. NPC-8

The 2016 EDR should report on 2016 ground access conditions at the airport and provide a comparison of 2016 findings to those of 2015 for the following:

- Detailed description of compliance with Logan Airport Parking Freeze;
- High-occupancy vehicle (HOV) ridership (including Blue Line, Silver Line, Water Transportation, and Logan Express);
- Logan Airport Employee Transportation Management Association (Logan TMA) services;
- Logan Airport gateway volumes;
- On-airport traffic volumes;
- On-airport vehicle miles traveled (VMT);
- Parking demand and management (including rates and duration statistics);
- Status of long-range ground access management strategy planning;
- Results of the 2016 Logan Airport Air Passenger Survey; and,
- Status of proposed connector to the Airport Station associated with the planned Terminal E Modernization Project.

The 2016 ESPR should address the following topics:

- Massport's target HOV mode share along with incentives;
- Non-Airport through-traffic;
- Massport's cooperation with other transportation agencies to increase transit ridership to and from Logan Airport via the Blue Line, Silver Line, Water Transportation, and Logan Express;
- Report on Logan Express usage and efforts to increase capacity and usage;
- Progress on enhancing water transportation to and from Logan Airport;
- Report on results of ground access study; and
- Strategies for enhancing services and increasing employee membership in the Logan Airport TMA.

Noise

The 2015 EDR updated the status of the noise environment at Logan Airport in 2015, and described Massport's efforts to mitigate noise exposure and impacts. As noted previously, the implementation of RNAV has resulted in concentration of flight patterns over certain communities and significant increases in noise exposure. At the same time, the FAA introduced the AEDT for modeling noise and air quality. Massport did not submit AEDT modeling results for 2015. Noise was modeled using the FAA INM. Massport will use the AEDT for noise modeling for the 2016 EDR. NPC-9

Compared to 2000, overall operations were down by 23.6 percent while overall passengers were up by 20.6 percent; jet operations made up 86 percent of operations compared to 66 percent; and the number of people exposed to Day-Night Average Sound Level (DNL) 65 decibels (dB) has declined by 20.6 percent.

Compared to 2014, the 2015 DNL 65 dB noise contours were larger in most areas around the Airport due to changes in: (1) runway usage, primarily as a result of wind and weather conditions, (2) an increase in the number of nighttime operations, and (3) an increase in the number of overall operations. The overall number of people exposed to DNL values greater than or equal to 65 dB increased by 58.0 percent, from 8,922 people in 2014 to 14,097 people in 2015.

Runway use changes from 2014 to 2015 were the largest factor in the increase in the number of people exposed to DNL values greater than or equal to 65 dB. The DNL contour increased in East Boston and slightly in South Boston due to an increase in Runway 22R departures. Increased departures from Runway 22L also resulted in increases in Winthrop. Increased arrivals to Runways 22L and 27 at night contributed to increases in Revere and Winthrop. Unlike 2014, 2015 reflects almost a full year of the head-to-head night noise abatement procedures on Runway 15R-33L. While this reduces overall noise exposure by concentrating operations over water rather than over populated areas, it increases start-of-takeoff-roll noise in East Boston, north and west of the Runway 15R end. Lower use of Runway 4R for arrivals in 2015 resulted in a reduction in the contour south of the Airport.

An additional factor influencing noise contour changes in 2015 was a 5.7-percent increase in nighttime operations (from 48,056 nighttime operations in 2014 to 50,786 nighttime operations in 2015). This increase in overall operations and nighttime operations is still well below the peak of 54,038 annual operations at night reached in 1999. As airlines have expanded to new destinations, the number of commercial operations, and in turn the number of nighttime operations, has increased. In 2015, there was an increase of 7.5 nighttime operations per day compared to 2014.

The overall increase in operations was smaller than the increase in nighttime operations (2.5 percent overall versus 5.7 percent nighttime), but contributed to the expansion of the noise contours. The DNL and population levels in 2015 remain well below the peak levels reached in 1990 and are less than in the year 2000 when 17,745 people were exposed to DNL levels greater than or equal to DNL 65 dB. The 2015 DNL 65 dB contour is somewhat larger than the 2014 DNL 65 dB contour. Almost all of the residences exposed to levels greater than or equal to DNL 65 dB in 2015 have been eligible to participate in Massport's residential sound insulation program (RSIP).

To date, Massport has provided sound insulation for a total of 11,515 residential units, and will continue to seek funding for sound insulation for properties that are eligible and whose owners have chosen to participate. The 2016 EDR should provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, and the updates in noise modeling. The chapter should report on 2016 conditions and provide a comparison to 2015 for the following:

- Fleet Mix, including Stage II, Recertified Stage III, newly manufactured Stage III, and qualifying Stage IV aircraft;
- Nighttime operations;
- Runway utilization (report on aircraft and airline adherence with runway utilization goals);
- Preferential runway advisory system (PRAS) tracking; and
- Flight tracks.

The 2016 EDR will be based on AEDT for the first time. The initial analysis will provide a baseline from which to project noise conditions in the future.

Noise contours for 2016 should be developed using AEDT and compared to the most recent version of the INM which has been in place for all previous EDRs and ESPRs. The 2016 EDR should report on the following:

- Changes in annual noise contours and noise-impacted population;
- Measured versus modeled noise values, including reasons for differences and any improvements attributable to the models deployed;
- Cumulative Noise Index (CNI);
- Times-Above for 65, 75, and 85 dBA threshold values/Dwell and Persistence of noise levels; and
- Flight track monitoring noise reports.

The 2016 EDR should also report on noise abatement efforts, results from Boston Logan Airport Noise Study (BLANS) study, and provide an update on the noise and operations monitoring system.

Air Quality/Emissions Reduction

The 2015 EDR provided an overview of airport-related air quality issues in 2015 and efforts to reduce emissions. The air quality modeling is based on aircraft operations, fleet mix characteristics, and airfield taxiing times combined with ground support equipment (GSE) usage, motor vehicle traffic volumes, and stationary source utilization rates. Total air quality emissions from all sources associated with Logan Airport are significantly lower than a decade ago.

In 2015, calculated emissions of volatile organic compounds (VOCs), oxides of nitrogen (NOx), carbon monoxide (CO), and particulate matter (PM) went up slightly compared to 2014. The increase is primarily due to the corresponding increase in aircraft landing and take offs (LTOs) and airfield taxi times. Total emissions of VOCs increased by 1 percent in 2015 to 1,188 kilograms (kg)/day compared to1,177 kg/day in 2014, which is still well below 1990 and 2000 levels. Total NOx emissions increased by approximately 5 percent in 2015, to 4,262 kg/day compared to 2014 levels of 4,040 kg/day. Massport's voluntary Air Quality Initiative (AQI) has tracked NOx emissions since the benchmark year of 1999. In the final year of this program (2015), total NOx emissions were 632 tons per year (tpy) lower than the 1999 benchmark. This represents a decrease of 27 percent in NOx emissions over the past 15 years. Between 1999 and 2015, the greatest reductions of NOx emissions were associated with aircraft, ground service equipment (GSE), and on-Airport motor vehicles at 17 percent, 71 percent, and 87 percent reductions, respectively. Massport has committed to continue to report on NOx emissions as part of the Logan Airport emissions inventory in future EDRs/ESPRs. Total CO emissions increased by about 3.5 percent in 2015 to 7,243 kg/day, from 6,987 kg/day in 2014; emissions in 2015 were still well below 1990 and 2000 levels. Total PM10/PM2.5 emissions also increased by about 3 percent in 2015 to 98 kg/day, from 95 kg/day in 2014.

The increases are associated with transportation and a significant portion is due to changes in modeling from MOBILE 6.2.03 to MOVES 2014a. Use of this program provides consistency with the State Implementation Plan (SIP) and MassDEP's methodologies.

The 2015 EDR contains a greenhouse gas (GHG) emissions inventory for the Logan Airport EDR. In 2015, total GHG emissions grew by 6 percent. As reported in past year EDRs, Logan Airport-related GHG emissions in 2015 comprised less than 1 percent of statewide totals.

The 2016 EDR should contain an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, and the changes in air quality modeling. The 2016 EDR should also provide discussion on progress on the national and international levels to decrease air emissions. Massport has committed to use the FAA's AEDT model for air emissions modeling. The 2016 EDR should compare results to the most recent version of the Emissions Dispersion Modeling System (EDMS) that has been used in recent EDR filings. NPC-10

The EPA Motor Vehicle Emission Simulator (MOVES) tool will continue to be used to assess vehicular emissions on airport roadways. The 2016 EDR should include an emissions inventory for CO, NOx, VOCs, and PMs. It should also report on Massport and tenant alternative fuel vehicle programs and the status of Logan Airport air quality studies undertaken by Massport or others, as available.

The 2016 EDR should incorporate GHG emissions reporting. The 2015 EDR provided extensive data on GHG emissions. As required in the Certificate on the 2015 EDR, Massport should consider changes to the presentation of this data and normalizing it to support effective review and analysis. Massport should consult with the MEPA Office and DOER regarding presentation of GHG data in the 2016 EDR and subsequent ESPR. NPC-11

The 2016 EDR GHG emissions should continue to be quantified for aircraft, GSE, motor vehicles and stationary sources using emission factors and methodologies outlined in the *Greenhouse Gas Emissions Policy and Protocol* issued by EEA and the Transportation Research Board's *Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories* (Airport Cooperative Research Program (ACRP) Report 11, Project 02-06). The results of the 2016 GHG emissions inventory should be compared to the 2015 results.

Massport should also provide an update on its efforts to encourage the use of single engine taxiing under safe conditions. In addition, the 2016 EDR should provide an update on the feasibility of combined heat and power (CHP) use for Terminal E and updates to progress made in designing the energy systems for the facility.

<u>Water Quality/Environmental Compliance</u>

The 2015 EDR describes Massport's ongoing environmental management activities including National Pollutant Discharge Elimination System (NPDES) compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan (MCP), and tank management. Massport's primary water quality goal is to prevent or minimize pollutant discharges, thus limiting adverse water quality impacts of airport activities. Massport employs several programs to promote awareness of activities that may impact surface and groundwater quality. Programs include implementing best management practices (BMPs) for pollution prevention by Massport, its tenants, and its construction contractors; training of staff and tenants; and a comprehensive stormwater pollution prevention plan.

The 2016 EDR should identify any planned stormwater management improvements and report on the status of:

- NPDES Permit and monitoring results for Logan outfalls and the Fire Training Facility;
- Jet fuel usage and spills;
- MCP activities;
- Tank management;
- Update on the environmental management plan; and
- Fuel spill prevention.

Conclusion

Massport may prepare a 2016 EDR for submission in 2018 consistent with the Scope included in this Certificate. Massport has indicated that the 2016 EDR will be filed within the next few months. The 2016 EDR should include a draft Scope for the 2017 ESPR and identify a date by which the 2017 ESPR will be filed. I encourage Massport to target early 2019 for filing of the 2017 ESPR. NPC-12

March 9, 2018
Date

Matthew A. Beaton

No comments received.

MAB/ACC/acc

Comment #	Author	Topic	Comment	Response
NPC-1	Matthew Beaton, Secretary	2016 EDR Scope	• Massport will submit a 2016 EDR in lieu of the ESPR. • The 2016 EDR will supplement typical EDR data reporting with discussion of future passenger and activity levels, planning to address growth and strategies to minimize environmental impacts. • The 2016 EDR will include a draft Scope for the 2017 ESPR and identify when the ESPR will be filed.	Massport has prepared the *2016 Logan Airport Environmental Data Report (EDR)* in lieu of a *2016 Environmental Status and Planning Report (ESPR)*. The *2016 EDR* continues to provide documentation on environmental conditions for the reporting year compared to the previous year. This *2016 EDR* provides information on past, current, and anticipated projects at Logan Airport in Chapter 3, *Airport Planning.* Chapter 1, *Introduction/Executive Summary* and Chapter 2, *Activity Levels* describes why 2016 does not serve as a reasonable baseline for prediction of longer-range impact assessments. In the past few years, passenger demand trends for air travel have been rapidly increasing and the air carrier landscape is changing. Additionally, the ground transportation arena at Logan Airport has also changed rapidly with the introduction of transportation network companies (TNCs) such as Uber and Lyft. The *2017 ESPR* will include updated long-range forecasts and will assess future impacts for noise, air quality, and ground access. The *2016 EDR* discusses the status of management plans, including the Long Term Parking Management Plan, Noise Abatement Management Plan, Air Quality Management Program, Energy Master Plan, Environmental Management Policy, Environmental Management System, Sustainability Management Plan, Tank Management Program, and Outfall Sampling Plan. Each chapter provides a detailed discussion of environmental effects and management strategies. The *2016 EDR* also includes the Scope for the *2017 ESPR* in Appendix C, *Proposed Scope for the 2017 ESPR*.
NPC-2	Matthew Beaton, Secretary	Ground Access	Massport has been collecting TNC data since February 2017 when TNCs began picking up, in addition to dropping off, at Logan. The 2017 ESPR will include limited data from 2016 and a year of data for 2017.	The *2017 ESPR* will report on Transportation Network Companies (TNC) data collected at Logan Airport for 2017, Chapter 5, *Ground Access to and from Logan Airport*. TNCs, such as Uber and Lyft, are increasingly becoming a mode of choice for ground-access at airports throughout the country. Data from the 2016 Logan Airport Air Passenger Ground Access Survey show a number of departing air passengers choosing TNCs. Beginning in February 2017, Massport began allowing TNCs to pick-up arriving air passengers via a TNC pool lot and collecting that activity data. This is a service that is being tracked for reporting in 2017. TNC information for 2017 will be included in the 2017 ESPR and also used to inform future ground-access/HOV mode shares.
NPC-3	Matthew Beaton, Secretary	Responses to Comments	The 2016 EDR must also respond to those issues explicitly noted in this Certificate and the comments received on the 2015 EDR and noted in the February 17, 2017 Certificate.	The *2016 EDR* responds to all issues raised in the Certificate on the *2015 EDR* and the 2016 EDR Notice of Project Change in Appendix A, *MEPA Certificates and Responses to Comments*. The *2016 EDR* also responds to all comments received on the *2015 EDR* in Appendix B, *Comment Letters and Responses*. No comments were received on the 2016 Notice of Project Change.
NPC-4	Matthew Beaton, Secretary	Responses to Comments	The Response to Comments section should address all of the substantive comments on the 2015 EDR, and other Certificates for Logan Airport that reference EDR/ESPR documentation (e.g. Logan Airport Parking Project, Terminal E).	The *2016 EDR* responds to all issues raised in the Certificate on the *2015 EDR,* and in the *2016 EDR Notice of Project Change Certificate*, the *Terminal E Modernization Environmental Notification Form (ENF) and Draft Environmental Assessment/Draft Environmental Impact Report* (Draft EA/EIR), and the Certificate on the *Logan Airport Parking Project Environmental Notification Form* (ENF) in Appendix A, *MEPA Certificates and Responses to Comments*. The *2016 EDR* also responds to all comments received in Appendix B, *Comment Letters and Responses*.

Comment #	Author	Topic	Comment	Response
NPC-5	Matthew Beaton, Secretary	Ground Access, Air Quality, Public Health	The 2016 EDR should include sufficient information to address comments on traffic, air quality and public health which are common concerns of commenters.	The *2016 EDR* includes information pertaining to traffic in Chapter 5, *Ground Access to and from Logan Airport* and information pertaining to air quality and public health in Chapter 7, *Air Quality/Emissions Reduction*. Massport has carefully reviewed comment letters received on the *2015 EDR* and has responded to comments in Appendix B, *Comment Letters and Responses.*
NPC-6	Matthew Beaton, Secretary	Activity Levels, Planning	The NPC indicates that passenger activity has continued to grow faster than forecasts provided in the 2015 EDR and that it is outpacing growth in aircraft operations. The 2016 EDR should describe how this trend will support Massport's long-standing goals to reduce overall operating and environmental impacts at the airport. 2016 The EDR should include more discussion of future passenger and activity levels and planning/mitigation to address impacts of growth than that which is typically provided in an EDR.	The *2016 EDR* reports on current and historical passenger activity levels and aircraft operations in Chapter 2, *Activity Levels*. The *2016 EDR* reports trends in annual passenger and operations activity levels from 1990 through 2016; passenger volumes have trended upward since 1990, from 26.5 million passengers in 1990 to 36.3 million passengers in 2016. Simultaneously, the long-range trend for aircraft operations is downward since 1990, from a peak of 507,499 operations in 1998 to 391,222 operations in 2016. Chapter 2, *Activity Levels* describes why 2016 does not serve as a reasonable baseline for prediction of longer-range impact assessments. In the past few years, passenger demand trends for air travel have been rapidly increasing and the air carrier landscape is changing. Additionally, the ground transportation arena at Logan Airport has also changed rapidly with the introduction of TNCs such as Uber and Lyft. The *2017 ESPR* will include updated long-range forecasts and will assess future impacts for noise, air quality, and ground access.
NPC-7	Matthew Beaton, Secretary	Planning	In the absence of a 2016 ESPR and the significant public interest in passenger growth, ground access, noise and air quality, the 2016 EDR should provide a broader context for long range planning than would normally be included in an EDR. It should address planning strategies for improving Logan Airport's operations and services in a safe, secure, more efficient, and environmentally sensitive manner.	Chapter 2, *Activity Levels* and Chapter 3, *Airport Planning* provide updates on current and future activity levels, and updates on planning efforts through the date of filing.
NPC-8	Matthew Beaton, Secretary	Ground Access	Using TNC data collected since February 2017 when TNCs began picking up at Logan will provide a better indication of future ground access mode share than using limited 2016 information. The 2016 EDR should describe how this TNC data collection and analysis will be incorporated into the 2017 ESPR.	Transportation Network Companies (TNC), such as Uber and Lyft, are increasingly becoming a mode of choice for ground-access at airports throughout the country. Data from the *2016 Logan Airport Air Passenger Ground Access Survey* show a number of departing air passengers choosing TNCs. Beginning in February 2017, Massport began allowing TNCs to pick-up arriving air passengers via a TNC pool lot and collecting that activity data. This is a service that is being tracked for reporting in 2017. TNC information for 2017 will be included in the 2017 ESPR and also used to inform future ground-access/HOV mode shares.
NPC-9	Matthew Beaton, Secretary	Noise Abatement	Massport will use the AEDT for noise modeling for the 2016 EDR.	For this *2016 EDR,* Massport has transitioned from using the legacy modeling software, the Integrated Noise Model (INM), to FAA's next-generation software, Airport Environmental Design Tool (AEDT). To assist the reviewer, Massport has provided the 2016 INM noise contours for comparison with the 2016 AEDT noise contours. In future EDRs and ESPRs, Massport will only use AEDT for modeling noise.

Comment #	Author	Topic	Comment	Response
NPC-10	Matthew Beaton, Secretary	Air Quality	Massport has committed to use the FAA's AEDT model for air emissions modeling. The 2016 EDR should compare results to the most recent version of the Emissions Dispersion Modeling System (EDMS) that has been used in recent EDR filings.	For this *2016 EDR*, Massport has transitioned from using the legacy modeling software, the Emissions Dispersion Modeling System (EDMS), to FAA's next-generation software, AEDT. To assist the reviewer, Massport has provided 2016 results using both the legacy EDMS model and new AEDT model. In future EDRs and ESPRs, Massport will only use AEDT for modeling emissions.
NPC-11	Matthew Beaton, Secretary	Air Quality	As required in the Certificate on the 2015 EDR, Massport should consider changes to the presentation of this data and normalizing it to support effective review and analysis. Massport should consult with the MEPA Office and DOER regarding presentation of GHG data in the 2016 EDR and subsequent ESPR.	In response to the March 9, 2018 Secretary's Certificate on the 2016 EDR Notice of Project Change, Massport has augmented its GHG reporting to show normalized GHG emissions and building energy use data (see Chapter 7, Air Quality/Emissions Reduction). Normalizing the data shows that Logan Airport is operating more efficiently over time, serving more passengers in larger building footprints with less energy. GHG emissions per passenger (Scopes 1 and 2) have decreased by over 34 percent from 2007 to 2016. Logan Airport's energy use intensity, which is a measure of building-only energy consumption per square foot, has decreased by over 23 percent from 2007 to 2016. Building GHG emissions per square foot has decreased by over 43 percent from 2007 to 2016.
NPC-12	Matthew Beaton, Secretary	2017 ESPR Scope	The 2016 EDR should include a draft Scope for the 2017 ESPR and identify a date by which the 2017 ESPR will be filed. I encourage Massport to target early 2019 for filing of the 2017 ESPR.	The *2016 EDR* includes a draft Scope for the *2017 ESPR* in Appendix C, *Proposed Scope for the 2017 ESPR*. Massport will target spring 2019 for the *2017 ESPR* filing.

Copies of Secretary of the Executive Office of Energy and Environmental Affairs Certificates issued for the Reporting Years 2011, 2012/2013, and 2014

This Page Intentionally Left Blank.

The Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Deval L. Patrick
GOVERNOR

Timothy P. Murray
LIEUTENANT GOVERNOR

Richard K. Sullivan Jr.
SECRETARY

Tel: (617) 626-1000
Fax: (617) 626-1181
http://www.mass.gov/envir

June 14, 2013

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
2011 LOGAN AIRPORT ENVIRONMENTAL STATUS AND PLANNING REPORT

PROJECT NAME	: 2011 Environmental Status and Planning Report
PROJECT MUNICIPALITY	: Boston and Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority (Massport)
DATE NOTICED IN MONITOR	: April 24, 2013

As Secretary of Environmental Affairs, I hereby determine that the Environmental Status and Planning Report submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (G. L. c. 30, ss. 61-62H) and with its implementing regulations (301 CMR 11.00).

The environmental review process for Logan Airport has been structured to occur on two levels: airport-wide and project-specific. The Environmental Status and Planning Report (ESPR) has evolved from a largely retrospective status report on airport operations to a broader analysis that also provides a prospective assessment of long-range plans. It has thus become, consistent with the objectives of the MEPA regulations, part of Massport's long range planning. The ESPR provides a "big picture" analysis of environmental impacts associated with current and anticipated levels of activities, and presents an overall mitigation strategy aimed at avoiding increases in such impacts. The ESPR analysis is supplemented by (and ultimately incorporates) the detailed analyses and mitigation commitments of project-specific Environmental Impact Reports (EIR). The ESPR is generally updated on a five year basis, with much less detailed Environmental Data Reports (EDR) (formerly Annual Updates) filed in the years between ESPRs. The 2011 ESPR is the subject of this review. In addition, Massport has requested to combine the 2012-2013 EDRs into one document. I have considered and granted this request. This Certificate also contains a Scope for the 2012-2013 EDR.

In general, the ESPR has responded to the scope. In particular, the 2011 ESPR contains a wealth of useful data on activity levels and impacts, and lays out a forecast for trends in the future years. The technical studies in the 2011 ESPR include reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. The 2011 ESPR updates and compares the data presented in the 2010 EDR, and presents activity levels (including aircraft operations and passenger activity) and environmental conditions at Logan Airport for calendar year 2011. In addition to the annual report on 2011 conditions, two other primary functions of this 2011 ESPR are to provide a discussion of future activity levels at Logan Airport through the year 2030 based on an updated forecast, and to predict the associated potential environmental conditions at the Airport in 2030. The 2011 ESPR also presents historical data on the environmental conditions at Logan Airport dating back to 1990 in instances where historical information is available. Historical data are included in the technical appendices. Overall the 2011 ESPR provides a comprehensive, cumulative analysis of the effects of all Logan Airport activities based on actual and predicted passenger activity and aircraft operation levels in 2011 and 2030 and presents environmental management plans for addressing areas of environmental concern.

The majority of comments received on the 2011 ESPR focused on noise issues, including measurement of noise, modeling of noise contours, and noise abatement. In addition to responding to these comments, the 2012-2013 EDR should also report on the progress and other refinements for tracking noise and abatement efforts, as further described in the Scope below.

Background

In 1979, the Secretary of the Executive Office of Environmental Affairs issued a Certificate requiring Massport to define, evaluate, and disclose, every three years, the impact of long-term growth at the airport through a Generic Environmental Impact Report (GEIR). The Certificate also required the submission of interim Annual Updates to provide data on conditions for the years between the GEIRs. The GEIR provided projections of environmental conditions where the cumulative effects of individual projects could be understood. The Secretary's Certificate on the *1997 Annual Update* proposed a revised environmental review process for Logan Airport. As a result, Massport evaluates the cumulative impacts associated with airport activities through preparation of an ESPR every five years and provides data updates annually through the EDRs.

Review of the 2011 ESPR and Scope for the 2012-2013 EDR

Framework for the 2011 ESPR

Massport has adopted a new, long-term forecast for the long-range planning horizon,

2030. Previous forecasts for the 1999 ESPR and the 2004 ESPR forecasts anticipated that Logan Airport would be handling 37.5 million annual passengers in 2015 and 42.8 million passengers in 2020, respectively. The 2011 ESPR revisits previous forecasts and revises them based on current and predicted conditions, and to consider a more distant time horizon.

For this 2011 ESPR, Massport updated the Logan Airport long-range forecast with 2015, 2020, and 2030 as the forecast years. Three scenarios were also developed (Low, Moderate, and High). Massport views the Moderate forecast scenario as the most likely forecast of future activity levels at Logan Airport. Massport's forecast under the Moderate scenario predicts that there will be 39.8 million passengers using Logan Airport in 2030. The updated forecast takes into account slower-than-anticipated passenger growth (compared to previous forecasts), the increasing efficiency of aircraft (higher passenger load factors), and fleet mix trends, including a growing prevalence of larger capacity jet aircraft. This 2011 ESPR examines both airside and landside activities, including planned Massport projects, and projects being carried out by others that affect the Airport, such as the FAA's Boston Logan Airport Noise Study (BLANS). Future year projections incorporate available information about projects that have undergone or are currently under MEPA review.

Cumulative analysis of airport activities are based on actual and projected passenger activity levels, aircraft operations, and the facilities and services needed to serve them. Analysis conditions for current and future years are used to assess environmental conditions and to develop, evaluate, and adjust environmental management actions.

General

The 2012-2013 EDR should follow the general format of the 2010 EDR status report on Massport's planning initiatives, projects, and mitigation measures. The 2012-2013 EDR should include an Executive Summary and Introduction, similar to previous ESPRs and EDRs. Massport must provide necessary background information to allow reviewing agencies and the public to understand the environmental policies and planning which form the context of the environmental reporting, technical studies, and environmental mitigation initiatives at Logan Airport.

Specifically, the 2012-2013 EDR should provide an update on conditions at Logan Airport for calendar year 2012 and 2013. The EDR should continue to serve as a background/context against which projects at Logan Airport can be evaluated. It should also report on the cumulative effects of Logan Airport operations and activities, compared to previous years, as appropriate.

The 2012-2013 EDR should report on 2012 and 2013 passenger and aircraft operation activity levels. This will be followed by a status report on Massport's proposed planning initiatives and projects and mitigation. In this way, Massport should provide the necessary background information to allow the reviewer to understand the environmental policies and

planning which form the context of the environmental reporting, technical studies, and environmental mitigation initiatives at Logan Airport.

The technical studies in the 2012-2013 EDR should include reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. The 2012-2013 EDR must also respond to those issues explicitly noted in this Certificate and the comments received on the 2011 ESPR.

A distribution list for the 2012-2013 EDR (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document. This section must also include copies of all ESPR and EDR Certificates issued since the 2004 Logan Environmental Status and Planning Report (issued on August 16, 2006) to provide context for reviewers. Supporting technical appendices should be provided as necessary.

Responses to Comments

The 2012-2013 EDR must include responses to comments that address all of the substantive comments from the letters listed at the end of this Certificate. The responses to comments included in the 2011 ESPR is well-constructed and cross-referenced. Massport may follow the same format in addressing comments in the 2012-2013 EDR.

The majority of comments received on the 2011 ESPR focus on noise related issues, including measurement of noise, modeling of noise contours, and noise abatement, and emission reduction issues. In addition to responding to these comments, the 2012-2013 EDR should continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commenters where appropriate.

Activity Levels

The Activity Levels chapter provides a solid analysis of major activity issues and the technical appendix contains useful and detailed information. This section in the 2011 ESPR specifically presents aviation activity statistics for Logan Airport in 2011 and compares activity levels to the prior year. The specific activity measures discussed include air passengers, aircraft operations, fleet mix, and cargo/mail volumes. This chapters also provides Massport's long-range 2030 aviation forecast for Logan Airport.

The 2012-2013 EDR must report on airport activity levels, including information on aircraft operations, including fleet mix, passenger activity levels, and cargo and mail operations. A primary purpose of this section of the 2012-2013 EDR will be to report on airport activity levels for 2012 and 2013, including:

- Aircraft operations, including fleet mix and scheduled airline services at Logan Airport;

- Passenger activity levels;
- Cargo and mail activities;
- Compare 2012 and 2013 aircraft operations, cargo/mail operations, and passenger activity levels to 2011 activity levels; and
- Report on national aviation trends in 2012/2013 and compare to trends at Logan Airport.

It should also report on Massport's activity level forecasts that will become the basis for the planning and impact sections that follow and for Massport's strategic planning initiatives over the next few years. In addition to reporting the analysis of major activity issues, I advise Massport to consider and attempt to address all comments related to activity levels in the 2010 EDR.

Planning

The Airport Planning chapter in the 2011 ESPR provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2011. It also describes known future planning, construction, and permitting activities and initiatives.

The 2012-2013 EDR should continue to assess planning strategies for improving Logan Airport's operations and services in a safe, secure, more efficient, and environmentally sensitive manner. As owner and operator of Logan Airport, Massport also must accommodate and guide tenant development. Therefore, the 2012-2013 EDR should describe the status of planning initiatives for the following areas:

- Roadway Corridor Project;
- Airport Parking;
- Terminal Area;
- Airside Area;
- Service and Cargo Areas; and
- Airport Buffers and Landscaping.

The 2012-2013 EDR should continue to assess the status of long-range planning activities. The chapter should report on the status of public works projects implemented by other agencies within the boundaries of Logan Airport. The chapter will also report on the status and effectiveness of the ground access related changes including roadway and parking projects, which consolidate and direct airport-related traffic to centralized locations and minimize airport-related traffic on external streets in adjacent neighborhoods.

Regional Transportation

In general, the 2011 ESPR has met the requirements with respect to regional transportation issues. It describes activity levels at New England's regional airports in 2011 and updates recent regional planning activities.

Overall, aviation activity at New England's regional airports increased in 2011, because the regional airports experienced a modest recovery after the 2008/2009 Economic Recession. Highlights for the regional airports and the status of long-range regional transportation planning efforts in the region which are relevant to Massport's three airports as well as the regional transportation network are provided in the 2011 ESPR.

The 2012-2013 EDR should describe Logan Airport's role in the region's intermodal transportation system by reporting on the following:

Regional Airports

- 2012 and 2013 regional airport operations, passenger activity levels, and schedule data within an historical context;
- Status of plans and new improvements as provided by the regional airport authorities;
- Ground access improvements to the regional airports; and
- The role that Worcester Regional Airport and Hanscom Field play in the regional aviation system and Massport's efforts to promote these airports.

Regional Transportation System

- Massport's role in managing the regional transportation facilities within the restructured Massachusetts Department of Transportation (MassDOT);
- Massport's cooperation with other transportation agencies to promote efficient regional highway and transit operations; and
- Report on metropolitan and regional rail initiatives and ridership.

Ground Transportation

The 2011 ESPR reported on transit ridership, roadways, traffic volumes and parking for 2011. It also provides forecasts for traffic volumes, parking, and VMT for the year 2030.

The 2012-2013 EDR should report on 2012 and 2013 conditions and provide a comparison of 2012 and 2013 findings to those of 2011 for the following:

- Detailed description of compliance with Logan Airport Parking Freeze;
- High occupancy vehicle (HOV) ridership (including Blue Line, Silver Line, Scheduled, Unscheduled, Water Transportation, and Logan Express);
- Logan Airport Employee Transportation Management Association (Logan TMA) services;
- Logan Airport gateway volumes;
- On-airport traffic volumes;
- On-airport vehicle miles traveled (VMT);
- Parking demand and management (including rates and duration statistics);
- Status of long-range ground access management strategy planning; and

- Results of the 2013 Logan Airport Passenger Survey.

The 2012-2013 EDR should also present a discussion of the following topics:

- Definition of HOV;
- Massport's target HOV mode share along with incentives;
- Non-Airport through-traffic;
- Massport's cooperation with other transportation agencies to increase transit ridership to and from Logan Airport via the Blue Line and Silver Line;
- Report on Logan Express usage and efforts to increase capacity and usage;
- Progress on enhancing water transportation to and from Logan Airport;
- Progress on rental car consolidation;
- Report on results of ground access study; and
- Strategies for enhancing services and increasing employee membership in the Logan Airport TMA.

Noise

The 2011 ESPR updates the status of the noise environment at Logan Airport in 2011, and describes Massport's efforts to reduce noise levels. It also provides noise contour population counts for 2030. The technical appendix contains useful and detailed information, while the main document provides a solid analysis of major noise issues. Many of the issues raised in the noise analysis are ongoing and require continuous monitoring. The future 2012-2013 EDR represents an appropriate forum to serve this updating function and to address the noise issues raised by numerous commenters on the 2011 ESPR.

In 2011 the following changes occurred in the Airport noise environment:

- Compared to 2010, the 2011 DNL decibel (dB) contours were smaller in East Boston and over Boston Harbor toward Hull. The DNL 65 dB contour was slightly larger in Revere, South Boston, and in most of Winthrop for 2011.
- The overall number of people exposed to DNL values greater than 65 dB increased to 3,947 people in 2011 from 3,830 people in 2010 (an increase of 117 people). The number of people residing within the DNL 70 dB contour remained at 130 people. These levels are well below the numbers of people exposed in the year 2000 when 17,745 people were exposed to DNL noise levels greater than 65 dB and 1,551 people were exposed to DNL levels greater than 70 dB.
- In 2011, Massport provided sound insulation to 114 homes, 84 percent of which were in Chelsea. The focus of the program in Chelsea was to fulfill federal and state mitigation commitments related to the opening of Runway 14-32. Since the inception of Massport's residential sound insulation program (RSIP), 11,333 homes have received sound insulation treatment in East Boston, South Boston, Winthrop, Revere, and Chelsea.

Based on the 2030 forecast of aircraft operations and expected aircraft fleet mix, the following conditions are expected in 2030:

- There is forecast to be a larger number of operations and a higher percent of jet fleet activity than in 2011. The higher level of operations is not a capacity challenge as the Airport has operated in the past with over 1,300 operations per day.
- The 2030 fleet mix consists of 81 percent commercial jets whereas the 2011 fleet mix consists of 78 percent commercial jets. The 2000 fleet mix had a lower proportion of commercial jets at 62 percent of the fleet.
- Total operations are expected to increase by 29 percent or 290 operations per day from 2011 to 2030, from 1,011 operations per day in 2011 to 1,301 operations per day in 2030. Compared to 2000, which is the last year that Logan Airport had over 1,300 daily operations, 2030 is forecasted to have 54 fewer daily operations (1,355 in 2000 and 1,301 in 2030). Daytime commercial operations are projected to increase by 254 operations per day from 819 in 2011 to 1,073 in 2030, however this is still fewer than the 1,142 daytime operations in 2000. Nighttime commercial operations are projected to increase from 114 in 2011 to 154 in 2030. This is an increase compared to 2000 when 126 daily operations occurred at night.
- The 2030 operations forecast produced a larger set of DNL noise contours with the number of people exposed to noise levels greater than DNL 65 dB increasing from 3,947 in 2011 to 12,211 people in 2030. This is still significantly fewer than the number of people exposed in 2000 (17,745 people). The number of people within the DNL 70 dB is also projected to increase from 130 in 2011 to 352 people in 2030 but still remaining well below the 1,551 people within the DNL 70 dB in 2000. All of the residences within the forecasted 2030 DNL 65 dB contour are in areas where Massport has implemented its sound insulation program.

The information in this chapter is very informative and I encourage Massport to continue with detailed analysis in the 2012-2013 EDR. I strongly advise Massport to consider and address the comments on noise and noise related issues.

The 2012-2013 EDR should provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, and the updates in noise modeling. The chapter should report on 2012 and 2013 conditions and compare those conditions to those of 2011 for the following:

- Fleet Mix, including Stage II, Recertified (Hushkitted) Stage III, newly manufactured Stage III, and qualifying Stage IV aircraft;
- Nighttime operations;
- Runway utilization (report on aircraft and airline adherence with runway utilization goals);
- Preferential runway advisory system (PRAS) tracking; and
- Flight tracks.

The 2012-2013 EDR should also report on 2012 and 2013 conditions and compare those to 2011 conditions for the following noise indicators:

- Using the Federal Aviation Administration's (FAA) most current version of the Integrated Noise Model (INM), and RealContoursTM and RealProfilesTM, produce an accurate set of Day-Night Sound Level (DNL) noise contours. Adjustments made to account for over-water sound propagation and the propagation of sound to areas of higher terrain will be reported;
- Noise-impacted population;
- Measured versus modeled noise values, including reasons for differences and any improvements attributable to the use of RealContoursTM and RealProfilesTM;
- Cumulative Noise Index (CNI);
- Times-Above for 65, 75, and 85 dBA threshold values/Dwell and Persistence of noise levels;
- Installation and benefits of the new noise monitoring system; and
- Flight track monitoring noise quarterly reports.

The 2012-2013 EDR should also report on noise abatement efforts, results from Boston Logan Airport Noise Study (BLANS) study, and provide a status update on the new noise and operations monitoring system.

Air Quality

The 2011 ESPR provides an overview of airport-related air quality issues in 2011 and efforts to reduce emissions. It also predicts emission levels for 2030. Overall total volatile organic compounds (VOC) emissions were 1,109 kilograms per day (kg/day), or 9 percent higher than 2010 levels, but still follow a long-range (i.e., a period of over 20 years) downward trend decreasing by almost 76 percent since 1990. This one-year increase is primarily due to the increase in landing and takeoff operations (LTOs) when compared to 2010 (176,322 LTOs in 2010 and 184,494 LTOs in 2011). Total emissions of oxides of nitrogen (NOX) were 4,077 kg/day, or 2 percent higher than 2010 levels. In 2011, total NOx emissions at Logan Airport were approximately 29 percent lower than 2000 levels. Also, total NOx emissions in 2011 were 707 tons per year (tpy) lower than Massport's 1999 Air Quality Initiative (AQI) benchmark. This represents an overall decrease of 30 percent in NOx emissions since 1999. Total emissions of carbon monoxide (CO) were 6,919 kg/day, or 3 percent lower than 2010 levels and 53 percent lower than 2000 levels; following the same long-range downward trend as VOCs and NOx. Total emissions of particulate matter (PM10/PM2.5) associated with Logan Airport increased in 2011 by approximately 5 percent to 67 kg/day compared to 2010 levels, but still following a long-range downward trend decreasing by 19 percent since 2005 (2005 is the first year that PM10/PM2.5 emissions were reported). This one-year increase is mostly attributable to the corresponding increase in stationary source use, particularly snow melters in conjunction with the unusually heavy snowfall in early 2011.

Since 1999, there has been a continuing trend of decreasing nitrogen dioxide (NO2) concentrations at both the Massport and Massachusetts Department of Environmental Protection (MassDEP) monitoring sites located in the vicinity of Logan Airport. In addition, the annual NO2 concentrations at all monitoring locations in 2011 continued to be well within the National Ambient Air Quality Standards (NAAQS) for NO2. The NO2 monitoring program was discontinued in 2012. Massport's Air Quality Monitoring Study is now complete, having collected data on a variety of ambient air pollutants over a two-year period as a means of assessing any air quality changes attributable to the operation of the Centerfield Taxiway which was completed in 2009. The findings from this Study will be submitted to MassDEP in 2013, and reported in the next Logan Airport EDR.

2011 marks the fifth consecutive year in which Massport has voluntarily prepared a greenhouse gas (GHG) emissions inventory for the EDR/ESPR. The 2011 GHG emission inventory was prepared following methodological guidance by the Transportation Research Board's (TRB) Airport Cooperative Research Program (ACRP). The 2011 inventory assigns GHG emissions based on ownership or control (whether it is controlled by Massport, the airlines or other airport tenants, or the general public). Total Logan Airport GHG emissions in 2011 were 5 percent higher than 2010 levels primarily due to the increase in aircraft operations and passenger vehicles accessing the Airport. Massport-related emissions represent only 12 percent of total GHG emissions at the Airport, tenant-based emissions represent approximately 68 percent, electrical consumption represents 14 percent; and passenger vehicle emissions represent 6 percent. This inventory is one of the three GHG emissions inventories Massport prepares annually; however, the other two only comprise stationary sources of GHGs and are filed with MassDEP and the U.S. Environmental Protection Agency (EPA) respectively.

The 2012-2013 EDR should include an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, and the changes in air quality modeling. The chapter should provide discussion on progress on the national and international levels to decrease air emissions to provide context for this chapter. The chapter will also discuss analysis methodologies and assumptions and report on 2012 and 2013 conditions using the most recent versions of the Emissions Dispersion Modeling System (EDMS) and MOBILE motor vehicle emissions. The 2012-2013 EDR should include:

- Emissions inventory for carbon monoxide (CO)
- Emissions inventory for oxides of nitrogen (NOx)
- Emissions inventory for volatile organic compounds (VOCs)
- Emissions inventory for particulate matter (PM)
- Nitrogen dioxide (NO2) monitoring
- NOx emissions by airline

The 2012-2013 EDR should also report on the following air quality initiatives (AQI) for 2012 and 2013:

- Air Quality Initiative Tracking;

- Massport's and Tenant's Alternative Fuel Vehicle Programs; and
- The status of Logan Airport air quality studies undertaken by Massport or others, as available.

Massport has also committed to include an inventory of greenhouse gas (GHG) emissions from Logan Airport in 2012 and 2013. GHG emissions should be quantified for aircraft, ground service equipment (GSE), motor vehicles and stationary sources using emission factors and methodologies outlined in the MEPA Greenhouse Gas Emissions Policy and Protocol. The results of the 2012 and 2013 GHG emissions inventory should be compared to the 2011 results. This chapter should also include an update on Massport's efforts to encourage the use of single engine taxiing under safe conditions.

Water Quality/Environmental Compliance

The 2011 ESPR describes Massport's ongoing environmental management activities including National Pollutant Discharge Elimination System (NPDES) compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan (MCP), and tank management.

The 2012-2013 EDR should report on the 2012/2013 status of:

- National Pollutant Discharge Elimination System (NPDES) Permit and monitoring results for Logan Airport's outfalls and the Fire Training Facility;
- Jet fuel usage and spills;
- Massachusetts Contingency Plan (MCP) Activities;
- Tank management;
- Update on the environmental management plan; and
- Fuel spill prevention.

The chapter should also present a discussion of the following topics:

- Future stormwater management improvements (if any); and
- Future MCP and tank management activities.

Sustainability at Logan Airport

This chapter describes Massport's airport-wide sustainability goals. In October 2000, the Massport Board approved an Authority-wide Environmental Management Policy that articulates Massport's commitment to protect the environment and to implement sustainable design principles. In October 2004, the Massport Sustainability Team produced the *Massachusetts Port Authority Sustainability Plan* (Sustainability Plan). The Environmental Management Policy is incorporated in the Sustainability Plan as Massport's long-term sustainability goal or vision. It also identifies the actions necessary to achieve the goals, the staff members responsible for each sustainability goal, and the timeline for achieving the goals.

The 2012-2013 EDR should report on the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have undergone MEPA review and other commitments and have commenced construction. The status of mitigation commitments made in the Section 61 Findings for the following projects should also be reported:

- West Garage/Central Garage
- International Gateway
- Runway Ends 22R and 33L Runway Safety Area Improvements
- Replacement Terminal A
- Logan Airside Improvements Planning
- Southwest Service Area Redevelopment Program

This chapter should also update the status of Massport's mitigation commitments and also will identify projects for which mitigation is complete.

Distribution of the 2012-2013 EDR

Massport should explore opportunities to advance the reporting of information through Massport's website. Massport should strive to collect and analyze the information required for the 2012-2013 EDR and report this information in a timely manner. For several recent projects, including the 2011 ESPR, Massport has published bi-lingual meeting and project notices and made the services of an interpreter available upon request. Massport should consider continuing these services for the 2012-2013 EDR submittal.

Conclusion

I have determined that the 2011 ESPR for Logan Airport has adequately complied with MEPA and that Massport must submit a 2012-2013 EDR that responds to the issues raised in comments received. The 2012-2013 EDR must include a copy of this Certificate and a copy of each comment letter received on the 2011 ESPR. In particular, Massport should provide a thorough examination of issues raised regarding individual noise monitoring locations, noise measurement and modeling, noise abatement, and air quality issues.

June 14, 2013
Date

Richard K. Sullivan Jr.

Comments Received:

06/06/2013	Philip Johenning
06/07/2013	Nancy Timmerman
06/07/2013	Stephen Kaiser, PhD
06/07/2013	Darryl Pomicter
06/07/2013	Town of Milton
06/14/2013	The Boston Harbor Association

RKS/ACC/acc

The Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Charles D. Baker
GOVERNOR

Karyn E. Polito
LIEUTENANT GOVERNOR

Matthew A. Beaton
SECRETARY

Tel: (617) 626-1000
Fax: (617) 626-1181
http://www.mass.gov/envir

February 6, 2015

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
2012-2013 LOGAN AIRPORT ENVIRONMENTAL DATA REPORT

PROJECT NAME	: 2012-2013 Environmental Data Report
PROJECT MUNICIPALITY	: Boston / Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: December 10, 2014

As Secretary of Executive Office of Energy and Environmental Affairs (EEA), I hereby determine that the Environmental Data Report submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (MEPA) (M.G.L. c. 30, ss. 61-62I) and with its implementing regulations (301 CMR 11.00).

Background

The environmental review process for Logan Airport has been structured to occur on two levels: airport-wide and project-specific. The Environmental Status and Planning Report (ESPR) has evolved from a largely retrospective status report on airport operations to a broader analysis that also provides a prospective assessment of long-range plans. It has thus become, consistent with the objectives of the MEPA regulations, part of the Massachusetts Port Authority's (Massport) long-range planning process. The ESPR provides a "big picture" analysis of the environmental impacts of current and anticipated levels of activities, and presents an overall strategy to minimize impacts. The ESPR is supplemented by (and ultimately incorporates) the detailed analyses and mitigation commitments associated with project-specific Environmental

Impact Reports (EIR). The ESPR is generally updated on a five-year basis; the most recent ESPR for the year 2011 was filed in April of 2013. Environmental Data Reports (EDRs) (formerly referred to as Annual Updates) are filed in the years between ESPRs. During the review of the 2011 ESPR, Massport requested that the 2012 and 2013 EDRs be combined into one document. The 2012-2013 EDR is the subject of this review. Additionally, this Certificate contains a Scope for the 2014 EDR.

The 2012-2013 EDR provides a comprehensive, cumulative analysis of the effects of all Logan Airport activities based on actual and predicted passenger activity and aircraft operation levels in 2012 and 2013, and presents environmental management plans for addressing areas of concern. The technical studies in the 2012-2013 EDR include reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality and environmental management. The 2012-2013 EDR updates and compares the data presented in the 2011 ESPR, and presents activity levels (including aircraft operations and passenger activity) and environmental conditions at Logan Airport for the calendar years 2012 and 2013. It also reports on the status of project mitigation.

Passenger levels at Logan Airport reached a new peak in 2013, exceeding the 2007 historic peak, while aircraft operations at Logan Airport remained well below the historic peak reached in 1998. The 2012-2013 EDR examines the effects of airlines operating much more efficiently with quieter fleets and flying more passengers per aircraft operation. As discussed in the 2011 ESPR, the 2012-2013 EDR anticipates further increases in activity levels and some increases in environmental impacts compared to recent years.

Scope for the 2014 EDR

General

The 2014 EDR should follow the general format of the 2012-2013 EDR status report. The 2014 EDR should include an Executive Summary and Introduction, similar to previous ESPRs and EDRs. Massport must provide background information on the environmental policies and planning that form the context of the environmental reporting, technical studies, and environmental mitigation initiatives at Logan Airport to provide context for reviewing agencies and the public. A1

The 2014 EDR should provide an update on conditions at Logan Airport for calendar year 2014, including passenger and aircraft operation activity levels. It should continue to serve as a background/context against which projects at Logan Airport can be evaluated. It should also report on the cumulative effects of Logan Airport operations and activities, compared to previous years, as appropriate. It should provide a status report on Massport's proposed planning initiatives, projects, and mitigation measures. A2

The technical studies in the 2014 EDR should include reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. The 2014 EDR must also A3 respond to those issues explicitly noted in this Certificate and the comments received on the 2012-2013 EDR.

A distribution list for the 2014 EDR (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document. This section must also include copies of all ESPR and EDR Certificates issued since the 2004 Logan ESPR (issued on August 16, 2006) to provide context for reviewers. Supporting technical appendices should be provided as necessary. A4

Response to Comments

The 2014 EDR Responses to Comments section should address all of the substantive comments from the letters listed at the end of this Certificate. The Response to Comments chapter included in the 2012-2013 EDR is well-constructed and cross-referenced. I encourage Massport to use the same format in the 2014 EDR. A5

The majority of comments received on the 2012-2013 EDR focus on noise related issues, including measurement of noise, modeling of noise contours, and noise abatement, and emission reduction issues. In addition to responding to these comments, the 2014 EDR should continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commenters where appropriate. A6

Activity Levels

The Activity Levels chapter provides a solid analysis of major activity issues and the technical appendix contains useful and detailed information. This chapter presents aviation activity statistics for Logan Airport in 2012 and 2013. Logan Airport is New England's primary domestic and international airport, operating as an origin-destination airport, rather than a connecting hub for major airlines. In 2012, Logan Airport was the 23rd busiest commercial aviation facility in North America ranked by aircraft operations, and the 20th busiest in North America ranked by number of passengers. In 2013, Logan Airport was the 21st busiest commercial aviation facility in North America ranked by aircraft operations, and remained the 20th busiest in North America ranked by number of passengers.

The total number of air passengers at Logan Airport increased by 1.1 percent to 29.2 million in 2012 and by 3.4 percent to 30.2 million in 2013, compared to 28.9 million in 2011. The 2013 passenger level represents a new record high for Logan Airport. At the same time, the total number of aircraft operations fell from approximately 368,987 in 2011 to 354,869 in 2012, a decrease of 3.8 percent. In 2013, aircraft operations increased by 1.8 percent to 361,339. Despite the increase in airport operations from 2012 to 2013, aircraft operations at Logan Airport remained well below the 487,996 operations accommodated in 2000 and the historic peak of 507,449 operations reached in 1998. Passenger aircraft operations, which accounted for 91 percent of total aircraft operations, increased by 2.4 percent in 2013 after decreasing by 3.9 percent in 2012, compared to 2011 levels.

General aviation (GA) operations which is defined as aviation activity other than commercial airline activity, accounted for seven percent of total operations in 2013. GA decreased by 0.4 percent in 2012 and decreased by 5.1 percent in 2013. The 26,682 GA operations in 2013 remain below the 35,233 GA operations that Logan Airport handled in 2000.

Airline efficiency continued to increase as the average total number of passengers per aircraft operation increased from 78.3 percent in 2011 to 82.4 percent in 2012 and 83.6 percent in 2013. The average number of passengers per aircraft operation in 2012 and 2013 represented approximately 74 percent of average aircraft seat capacity. At Logan Airport, the increasing number of passengers per flight reflects a shift away from smaller aircraft and rising load factors because airlines have reduced or restricted capacity growth after several airline mergers.

Air cargo volumes, including shipments transported in the belly compartments of passenger aircraft, decreased from 562 million pounds in 2011 to 553 million pounds in 2012, a decline of 1.4 percent compared to 2011. Over the same period, all-cargo aircraft operations fell by 16.5 percent to 5,237 million pounds. All-cargo aircraft operations fell at a faster rate than cargo volumes, because all-cargo airlines introduced larger capacity aircraft into service at Logan Airport. In 2013 air cargo volumes increased by 0.8 percent to 558 million pounds and all-cargo operations increased by 3.2 percent to 5,403 million pounds, compared to 2012.

The 2014 EDR should report on airport activity levels and aircraft operations, including:

- Aircraft operations, including fleet mix and scheduled airline services at Logan Airport;
- Passenger activity levels;
- Cargo and mail activities; A7
- Compare 2014 aircraft operations, cargo/mail operations, and passenger activity levels to 2013 activity levels; and
- Report on national aviation trends in 2014 and compare to trends at Logan Airport.

It should also report on Massport's activity level forecasts that will become the basis for the planning and impact sections that follow and for Massport's strategic planning initiatives for the future ESPR. Massport should address comments related to activity levels in the 2014 EDR. A8

Sustainability at Logan Airport

The 2012-2013 EDR describes Massport's airport wide sustainability goals. In October 2000, the Massport Board approved an Authority-wide Environmental Management Policy, which articulates Massport's commitment to protect the environment and to implement sustainable design principles. In October 2004, the Massport Sustainability Team produced the *Massachusetts Port Authority Sustainability Plan* (Sustainability Plan). The Environmental Management Policy is incorporated in the Sustainability Plan as Massport's long-term sustainability goal or vision.

The 2012-2013 EDR describes Massport's continued efforts including Massport-wide sustainability. In 2013, Massport was awarded a grant by the Federal Aviation Administration (FAA) to prepare a Sustainability Management Plan (SMP) for Logan Airport. The Logan

Airport SMP planning effort began in May 2013, and is expected to be completed in 2015. The 2012-2013 EDR indicates that the Logan Airport SMP is intended to promote and integrate sustainability, formulate a list of priority initiatives, and engage employees and tenants in the process. The 2012-2013 EDR provides an excellent overview of Massport's commitment to incorporate sustainability into all aspects of Massport's activities: Planning and Design; Construction; Operations, Maintenance and Management; and Monitoring of Environmental Performance. It also identifies specific practices to reduce impacts associated with construction and efforts to address energy intensity, percentage of renewable energy, and GHG reductions.

A specific example includes compliance with the Leading by Example Executive Order which requires state agencies to procure 15 percent of their electricity from renewable resources by 2012. The Leading by Example program has influenced Massport's own operations including its offices, heating plants, and garages resulting in Massport receiving the Leading by Example award in 2008. As part of the Leading by Example program, all new construction and major renovations over 20,000 square feet constructed by Commonwealth agencies must meet the Massachusetts LEED Plus green building standard established by the Massachusetts Sustainable Design Roundtable.

I commend Massport for its commitment and expect progress on the SMP will be incorporated into subsequent EDRs and ESPRs. The focus in the 2014 EDR should include reporting on data, identifying goals and priorities for specific Massport and tenant projects at Logan Airport that have undergone MEPA review to include energy efficiency/greenhouse gas reduction, water conservation, and waste management and recycling. A9

The 2014 EDR should report on the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have undergone MEPA review, including whether they are under construction or completed. The status of mitigation commitments made in the Section 61 Findings for the following projects should also be reported: A10

- West Garage/Central Garage (EEA #9790)
- International Gateway (EEA #9791)
- Logan Airside Improvements Planning Project (EEA #10458)
- Terminal A Replacement Project (EEA #12096)
- Southwest Service Area Redevelopment Program/Rental Car Center (EEA #14137)
- Logan Runway Safety Area Improvements Project (EEA #14442)

Planning

The Airport Planning chapter in the 2012-2013 EDR provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2012 and 2013. It also describes future planning, construction, and permitting activities and initiatives. It includes the following Airport Projects:

- Southwest Service Area (SWSA) Redevelopment Program (EEA #14137);
- Logan Airport Runway Safety Area (RSA) Improvements Project at Runway Ends 33L and 22R (EEA #14442);

- Logan Airport Runway 33L Light Pier Replacement Project (EEA #14442);
- Green Bus Depot (EEA #14629);
- Martin A. Coughlin (East Boston-Chelsea) Bypass Project (EEA #14661);
- Renovations and Improvements at Terminal B;
- Terminal B Garage Improvement Project;
- North Service Area Roadway Corridor Project;
- Greenway Connector Project a pedestrian/bicycle path connecting the Bremen Street Park path to the future City of Boston pedestrian/bicycle path; and
- Hangar Upgrade Projects.

At the end of 2013, Massport initiated the Disaster and Infrastructure Resiliency Planning (DIRP) Study for Logan Airport, the Port of Boston, and Massport's waterfront assets in South and East Boston according to the 2012-2013 EDR. The DIRP Study includes a hazard analysis, modeling projected sea-level rise and storm surge, and projections of temperature and precipitation and anticipated increases in extreme weather events. The study is nearing completion. The 2014 EDR should address the DIRP Study and identify which recommendations Massport will implement in the short term to increase the resiliency of its facilities to the potential effects of climate change. A11

Massport is in the process of developing a long-term parking management plan for Logan Airport. The Long-Term Parking Management Plan will lay out a multi-part strategy for efficiently managing parking supply, pricing, and operations – both at Logan Airport and at off-Airport locations controlled by Massport – to maximize access for transit and shared-ride vehicles while minimizing both drive-and-park and pick-up/drop-off modes. The 2014 EDR should provide updates on this plan. A12

The 2014 EDR should also continue to assess planning strategies for improving Logan Airport's operations and services in a safe, secure, more efficient, and environmentally sensitive manner. As owner and operator of Logan Airport, Massport also must accommodate and guide tenant development. Therefore, the 2014 EDR should also describe the status of planning initiatives for the following areas: A13

- Roadway Corridor Project;
- Airport Parking;
- Terminal Area;
- Airside Area;
- Service and Cargo Areas; and
- Airport Buffers and Landscaping.

The 2014 EDR should provide a status report on long-range planning activities. This chapter should include the status and effectiveness of the ground access changes, including roadway and parking projects, that will consolidate and direct airport-related traffic to centralized locations and minimize airport-related traffic on external streets in adjacent neighborhoods. A14

Regional Transportation

The 2012-2013 EDR describes activity levels at New England's regional airports in 2012 and 2013 and provides an update on regional planning activities, including long-range transportation efforts.

Overall, aviation activity at New England's regional airports decreased in 2012 and 2013. In 2012, the total number of air passengers utilizing New England's commercial service airports, including Logan Airport, decreased by 1.3 percent from 44.7 million in 2011 to 44.1 million annual air passengers. The decline in the region's passenger traffic largely reflects airline service reductions at many of the regional airports in 2012. Airlines have attempted to maintain tighter capacity control, which has resulted in ongoing service cuts at various secondary and tertiary airports across the nation. While passenger traffic at Logan Airport increased slightly in 2012, reduced passenger levels at regional airports resulted in an overall decline for the region. In 2013, however, overall passenger traffic at New England commercial airports recovered somewhat, increasing 2.8 percent from 44.1 million to 45.4 million passengers. Passenger traffic at New England airports in 2013 was the highest since the economic downturn in 2008. In 2013, total passenger traffic at the regional airports increased 1.6 percent from the previous year, while passenger traffic at Logan Airport increased by 3.4 percent.

A15

The 2014 EDR should describe Logan Airport's role in the region's intermodal transportation system by reporting on the following:

Regional Airports

- 2014 regional airport operations, passenger activity levels, and schedule data within an historical context;
- Status of plans and new improvements as provided by the regional airport authorities;
- Ground access improvements; and
- Role of the Worcester Regional Airport and Hanscom Field in the regional aviation system and Massport's efforts to promote these airports.

Regional Transportation System

- Massport's role in managing the regional transportation facilities within the restructured Massachusetts Department of Transportation (MassDOT);
- Massport's cooperation with other transportation agencies to promote efficient regional highway and transit operations; and
- Report on metropolitan and regional rail initiatives and ridership.

Ground Access to and from Logan Airport

The 2012-2013 EDR reports on transit ridership, roadways, traffic volumes, and parking for both 2012 and 2013. Specifically, the average daily vehicular traffic on Airport roadways decreased by 0.2 percent from 99,449 in 2011 to 99,281 in 2012, and then increased by 3.5 percent to 102,771 between 2012 and 2013. The 2012-2013 EDR also updates information on the Logan Parking Freeze limit which is set at 21,088, of which 18,415 are dedicated to commercial

parking spaces and 2,673 are dedicated to employee parking spaces. The EDR indicates that Massport continued to be in full compliance with the Parking Freeze throughout 2012 and 2013.

The 2012-2013 EDR includes key findings for ground access activity to and from the Airport which include:

- Massachusetts Bay Transportation Authority (MBTA) Silver Line bus boardings at the Airport continued to grow, based on ridership estimates.
- In 2012, Blue Line transit boardings at Airport Station increased about seven percent over 2011 levels. In 2013, MBTA Blue Line ridership increased six percent over 2012 levels.
- In 2012, ridership levels on all types of water transportation to the Airport remained flat in comparison to the previous year. Ridership on the MBTA ferry continues to decline, while private water taxi use has grown slightly since 2007. In 2013, ridership on private water taxis increased by three percent.
- In 2012, air passengers using Logan Express bus service increased 10 percent compared to 2011 levels; employee use of Logan Express increased by 16 percent and non-employee passengers increased nearly five percent. In 2013, non-employee passenger ridership increased nearly eight percent over 2012 levels, and employee passenger activity increased almost two percent.
- In September 2013, Massport solicited an operator for a Back Bay express shuttle bus service, which commenced in April 2014. The Back Bay Logan Express, provides improved service to those transit riders who are affected by the two-year Government Center MBTA Station closure and increases high occupancy vehicle (HOV) use from the inner Boston area.

A16

The 2014 EDR should report on the following conditions and provide a discussion of analysis in 2014 and compare them to 2013:

- Detailed description of compliance with Logan Airport Parking Freeze;
- High occupancy vehicle (HOV) ridership (including Blue Line, Silver Line, Water Transportation, and Logan Express);
- Massport's cooperation with other transportation agencies to increase transit ridership to and from Logan Airport via the Blue Line and Silver Line;
- Logan Airport Employee Transportation Management Association (Logan TMA) services;
- Logan Airport gateway volumes;
- On-airport traffic volumes;
- On-airport vehicle miles traveled (VMT);
- Parking demand and management (including rates and duration statistics);
- Status of long-range ground access management strategy planning; and
- Results of the 2013 Logan Airport Passenger Survey.
- Massport's target HOV mode share along with incentives; and,
- Non-Airport through-traffic;

Noise Abatement

The 2012-2013 EDR updates the status of the noise environment at Logan Airport in 2012 and 2013, and describes Massport's efforts to reduce noise levels. Many of the issues raised in the noise analysis are ongoing and require continuous monitoring. The 2014 EDR should address the noise issues raised by numerous commenters on the 2012-2013 EDR

Compared to 2011, the 2012 Day-Night Average Sound Level (DNL) 65-decibel (dB) contours were slightly larger in East Boston, Revere, South Boston, and Winthrop and smaller over Boston Harbor towards Long Island and south towards Columbia Point. The 2012 contours remained substantially smaller than the 2000 contours. There are several factors that influenced the contour changes, including: Runway 15R-33L, the nighttime noise abatement runway, was temporarily closed from June 16, 2012 through October 2, 2012 to allow for the second and final period of construction of the enhanced Runway 33L RSA. There were also partial construction closures of the runway before and after this period. Typically, this runway is used during these periods for head-to-head operations (arrivals to Runway 33L and departures from Runway 15R) at night, which keeps air traffic over Boston Harbor, and away from the community. The 2012 RSA construction closure was extended for longer period than in 2011, which also extended the use of other runways for nighttime operations during 2012. During this period, night operations primarily used Runway 22R and Runway 9 for departures and Runway 4R, 27, and 22L for arrivals.

Compared to 2012, the 2013 DNL 65 dB contours were slightly larger in East Boston and slightly smaller in Revere, South Boston, and Winthrop. The 2013 contours remained substantially smaller than the 2000 contours. There are several factors that influenced the contour changes, including:

- Runway use in 2013 was reflective of a typical year (return to pre-construction conditions), with an increased use (compared to 2012) of Runway 15R-33L and Runway 27;
- The availability of all runway configurations in 2013, resulted in lower levels of arrivals to Runways 22L, 27, and 4R;
- Due to the runway closure, the overall number of people exposed to DNL values greater than 65 dB increased to 4,736 people in 2012 from 3,947 people in 2011 (an increase of 789 people); and
- In 2013 with runway use back to pre-construction patterns, the overall number of people exposed to DNL values greater than 65 dB decreased to 4,307 people in 2013 from 4,736 people in 2012 (a decrease of 429 people).

The number of people residing within the DNL 70 dB contour increased from 130 people in 2011 to 200 people in 2012 and returned to 130 people in 2013. These levels are still well below the number of people exposed in the year 2000 when 17,745 people were exposed to DNL noise levels greater than 65 dB and 1,551 people were exposed to DNL levels greater than 70 dB. All of the residences exposed to levels greater than DNL 65 dB in 2012 and 2013 have been eligible to participate in Massport's residential sound insulation program (RSIP). Participation in the program is voluntary and Massport has provided sound insulation to all of homeowners who

have chosen to participate. An additional 76 residential units received sound insulation treatment in 2013 bringing the program total to 11,409 residential units. Massport will continue to seek funding for this program.

Massport is participating in a FAA aircraft noise study as part of the Airside Improvement Project mitigation. The primary focus of the Boston Logan Airport Noise Study (BLANS) is to determine viable ways to reduce noise from aircraft operations to and from Logan Airport without diminishing airport safety and efficiency. The Runway Navigation (RNAV) departure portions of Phase 1 of the project, first implemented in 2010, continued to be utilized in 2012 and 2013. The 2012-2013 EDR detailed the Flight Track Monitoring reports in Appendix of Noise Abatement.

The information in the Noise Abatement chapter is very informative and I encourage Massport to continue with detailed analysis in the 2014 EDR. I strongly advise Massport to consider and address the comments on noise and noise related issues.

The 2014 EDR should provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, and the updates in noise modeling. The chapter should report on 2014 conditions and compare those conditions to those of 2013 for the following:

- Fleet Mix, including Stage II, Recertified (Hushkitted) Stage III, newly manufactured Stage III, and qualifying Stage IV aircraft; A17
- Nighttime operations;
- Runway utilization (report on aircraft and airline adherence with runway utilization goals);
- Preferential runway advisory system (PRAS) tracking; and
- Flight tracks.

The 2014 EDR should also report on 2014 conditions and compare those to 2013 conditions for the following noise indicators:

- Using the FAA's most current version of the Integrated Noise Model (INM), and RealContoursTM and RealProfilesTM, produce an accurate set of Day-Night Sound Level (DNL) noise contours.
- Update on FAA's combined air quality and noise modeling tool (Aviation Environmental Design Tool - AEDT)
- Noise-impacted population; A18
- Measured versus modeled noise values, including reasons for differences and any improvements attributable to the use of RealContoursTM and RealProfilesTM;
- Cumulative Noise Index (CNI);
- Times-Above for 65, 75, and 85 dBA threshold values/Dwell and Persistence of noise levels;
- Installation and benefits of the new noise monitoring system; and
- Flight track monitoring noise quarterly reports.

The 2014 EDR should also report on noise abatement efforts, results from Boston Logan Airport Noise Study (BLANS) study, and provide a status update on the new noise and operations monitoring system. A19

Air Quality/Emissions Reduction

The 2012-2013 EDR provides an overview of airport-related air quality issues in 2012 and 2013 and also efforts to reduce emissions. The air quality modeling reported in 2012-2013 EDR is based on aircraft operations, fleet mix characteristics, and airfield taxiing times combined with ground support equipment (GSE) usage, motor vehicle traffic volumes, and stationary source utilization rates. Motor vehicle emissions for the 2012 analysis were obtained from the United States Environmental Protection Agency's (EPA's) MOBILE model (MOBILE6.2.03) combined with MassDEP-recommended motor vehicle fleet mix data, operating conditions, and other Massachusetts-specific input parameters. The most up-to-date EPA mobile model, Motor Vehicle Emission Simulator (MOVES), was used to develop 2013 motor vehicle emission factors. For comparative purposes, both MOBILE and MOVES were used to generate the 2013 motor vehicle emission factors.

The following is a summary of modeled air quality conditions for Logan Airport in the 2012 to 2013 time-period:

- Total volatile organic compound (VOC) emissions in 2012 were 1,080 kilograms per day (kg/day), or approximately three percent lower than 2011 levels. By comparison, total VOC emissions in 2013 were 1,138 kg/day, or 5 percent higher than 2012 levels. For comparison, total VOC emissions were 1,777 kg/day in 2000.
- Total emissions of oxides of nitrogen (NO_x) in 2012 were 4,099 kg/day, or less than one percent higher than 2011 levels. However, total emissions of NO_x in 2013 were 4,020 kg/day, or two percent lower than 2012 levels. For comparison, total NO_x emissions were 5,707 kg/day in 2000.
- Total emissions of carbon monoxide (CO) in 2012 were 6,739 kg/day, or three percent lower than 2011 levels. However, total emissions of CO in 2013 were 7,340 kg/day, or nine percent higher than 2012 levels. For comparison, total CO emissions were 13,111 kg/day in 2000.
- Total emissions of particulate matter $(PM)_{10}/PM_{2.5}$ increased in 2012 by approximately seven percent to 72 kg/day compared to 2011 levels. This particular increase is unique and is mostly attributable to a change the MOBILE6.2.03 model. Total modeled emissions of $PM_{10}/PM_{2.5}$ again increased in 2013 by approximately 28 percent to 92 kg/day compared to 2012 levels. This increase is primarily attributable to the updated computer modeling (i.e., Emissions and Dispersion Modeling System [EDMS] and MassDEP-preferred model –MOVES) used to calculate aircraft and motor vehicle emissions.
- With respect to Massport's Air Quality Initiative (AQI) 1999 benchmark, total NO_x emissions in 2012 were 698 tons per year (tpy) lower than the benchmark and in 2013 emissions were 730 tpy lower than the benchmark. This represents an overall decrease of 31 percent in NO_x emissions since 1999. For comparison, total NO_x emissions in 2000 were 51 tpy lower than the benchmark or a decrease of 2 percent since 1999.

The year 2013 marks the seventh consecutive year in which Massport has voluntarily prepared a greenhouse gas (GHG) emissions inventory for the EDR/ESPR. The 2012 and 2013 GHG emission inventory was again prepared following methodological guidance by the Transportation Research Board's (TRB) Airport Cooperative Research Program (ACRP). Total Logan Airport GHG emissions in 2012 were approximately three percent lower than 2011 levels primarily due to lower fuel consumption by stationary sources. Total Logan Airport GHG emissions in 2013 were approximately six percent higher than 2012 levels primarily due to the increase in usage of passenger ground access vehicles on off-airport roadways. In 2012, Massport-related emissions represented 10 percent of total GHG emissions at the Airport; tenant-based emissions represented approximately 69 percent; electrical consumption represented 14 percent; and passenger vehicle emissions represented six percent. Similarly, in 2013, Massport-related emissions represented 13 percent of total GHG emissions at the Airport, tenant-based emissions represented approximately 66 percent, electrical consumption represented 10 percent, and passenger vehicle emissions represented 10 percent.

The 2014 EDR should include an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, and the changes in air quality modeling. The 2014 EDR should provide discussion on progress on the national and international levels to decrease air emissions. It should also include analysis methodologies and assumptions and report on 2014 conditions using the most recent versions of the EDMS and MOVES models. The 2014 EDR should include an emissions inventory for CO, NO_x, VOCs, and PM. It should include NO_2 monitoring and identify NO_x emissions by airline. A20

The 2014 EDR should also report on the following AQI for 2014: A21

- AQI Emissions Monitoring and Tracking;
- Massport's and Tenant's Alternative Fuel Vehicle Programs; and
- The status of Logan Airport air quality studies undertaken by Massport or others, as available.

Massport has also committed to include an inventory of GHG emissions from Logan Airport in 2014. GHG emissions should be quantified for aircraft, GSE, motor vehicles and stationary sources using emission factors and methodologies outlined in the MEPA Greenhouse Gas Emissions Policy and Protocol. The results of the 2014 GHG emissions inventory should be compared to the 2013 results. This chapter should also include an update on Massport's efforts to encourage the use of single engine taxiing under safe conditions. A22

Water Quality/Environmental Compliance

The 2012-2013 EDR describes Massport's ongoing environmental management activities including National Pollutant Discharge Elimination System (NPDES) compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan (MCP), and tank management.

The 2014 EDR should report on the 2014 status of:

- NPDES Permit and monitoring results for Logan Airport's outfalls and the Fire Training Facility;
- Jet fuel usage and spills;
- MCP activities;
- Tank management;
- Update on the environmental management plan; and
- Fuel spill prevention.

It should also identify any planned stormwater management improvements.

A23

Conclusion

I have determined that the 2012-2013 EDR for Logan Airport has adequately compiled with MEPA. Massport may prepare a 2014 EDR for submission in 2015 consistent with the scope included in this Certificate.

February 6, 2015
Date

Matthew A. Beaton

Comments received:

01/14/2015	Frank J. Ciano
01/26/2015	Cindy L. Christiansen
01/26/2015	City of Somerville, Mayor Joseph Curtatone
01/27/2015	The Boston Harbor Association
01/27/2015	Nancy S. Timmerman
02/02/2015	Massachusetts Department of Public Health

MAB/ACC/acc

This Page Intentionally Left Blank

The Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Charles D. Baker
GOVERNOR

Karyn E. Polito
LIEUTENANT GOVERNOR

Matthew A. Beaton
SECRETARY

Tel: (617) 626-1000
Fax: (617) 626-1181
http://www.mass.gov/envir

November 13, 2015

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
2014 LOGAN AIRPORT ENVIRONMENTAL DATA REPORT

PROJECT NAME	: 2014 Environmental Data Report
PROJECT MUNICIPALITY	: Boston/Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: October 7, 2015

As Secretary of Executive Office of Energy and Environmental Affairs (EEA), I hereby determine that the Environmental Data Report submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (MEPA) (M.G.L. c. 30, ss. 61-62l) and with its implementing regulations (301 CMR 11.00).

Background

The environmental review process for Logan Airport has been structured to occur on two levels: airport-wide and project-specific. The Environmental Status and Planning Report (ESPR) has evolved from a largely retrospective status report on airport operations to a broader analysis that also provides a prospective assessment of long-range plans. It has thus become, consistent with the objectives of the MEPA regulations, part of the Massachusetts Port Authority's (Massport) long-range planning process. The ESPR provides a "big picture" analysis of the environmental impacts of current and anticipated levels of activities, and presents an overall strategy to minimize impacts. The ESPR is supplemented by (and ultimately incorporates) the detailed analyses and mitigation commitments for project-specific Environmental Impact

Reports (EIR). The ESPR is generally updated on a five-year basis; the most recent ESPR for the year 2011 was filed in April of 2013. Environmental Data Reports (EDRs) (formerly referred to as Annual Updates) are filed in the years between ESPRs.

The EDRs are prepared annually to evaluate environmental conditions for the reporting year compared to the previous year. In the last several years, aircraft operations and passenger activity levels and associated environmental effects have remained well below levels previously analyzed for Logan Airport. Thus, the forecasted aviation growth presented in the 2004 ESPR, the predicate upon which the ESPR schedule was initially established, has not occurred. Accordingly, with the approval of the Secretary of Energy and Environmental Affairs, Massport prepared 2009 and 2010 EDRs in lieu of the ESPR originally planned for 2009. The 2011 ESPR, filed in early 2013, reported on calendar year 2011 passenger activity levels and aircraft operations forecasts. The 2012/2013 EDR presented conditions for both calendar years 2012 and 2013.

The 2014 EDR is the subject of this review. Additionally, this Certificate contains a Scope for the 2015 EDR. This 2014 EDR provides a comprehensive, cumulative analysis of the effects of all Logan Airport activities based on actual passenger activity and aircraft operational levels in 2014 and presents environmental management plans for addressing areas of environmental concern. It also reports on the status of project mitigation. The next anticipated ESPR will report on updated passenger activity levels, aircraft operations forecasts, and environmental conditions forecasts for 2016.

Passenger levels at Logan Airport reached a new peak in 2013, exceeding the 2007 historic peak, while aircraft operations at Logan Airport remained well below the historic peak reached in 1998. The 2014 EDR examines the effects of airlines operating much more efficiently with quieter fleets and flying more passengers per aircraft. As discussed in the 2011 ESPR, the 2014 EDR anticipates further increases in activity levels and some increases in environmental impacts compared to recent years; however, these will remain below levels projected in 2004.

Scope for the 2015 EDR

General

The 2015 EDR should follow the general format of the 2014 EDR. The 2015 EDR should include an Executive Summary and Introduction. To provide context for reviewing agencies and the public, it should provide background information on the environmental policies and planning that shape the environmental reporting, technical studies, and environmental mitigation initiatives at Logan Airport. A-1

The 2015 EDR should provide an update on conditions at Logan Airport for calendar year 2014, including passenger and aircraft operation activity levels. It should continue to serve as a background/context against which projects at Logan Airport can be evaluated. It should also report on the cumulative effects of Logan Airport operations and activities, compared to previous A-2 years, as appropriate. It should provide a status report on Massport's proposed planning initiatives, projects, and mitigation measures. A-2 Cont.

The technical studies in the 2015 EDR should include reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. The 2015 EDR must also respond to those issues explicitly noted in this Certificate and the comments received on the 2014 EDR. A-3

A distribution list for the 2015 EDR (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document. This section must also include copies of all ESPR and EDR Certificates issued since the 2011 Logan ESPR to provide context for reviewers. Supporting technical appendices should be provided as necessary. A-4

Responses to Comments

The 2015 EDR Responses to Comments should address all of the substantive comments from the letters listed at the end of this Certificate. The Responses to Comments included in the 2014 EDR is well-constructed and cross-referenced. I encourage Massport to use the same format in the 2015 EDR. A-5

The majority of comments received on the 2014 EDR focus on noise issues, including measurement of noise, modeling of noise contours, and noise abatement, and emissions reduction issues. In addition to responding to these comments, the 2015 EDR should continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commenters where appropriate. A-6

Activity Levels

The Activity Levels chapter provides a solid analysis of major activity issues and the technical appendix contains useful and detailed information. This chapter presents aviation activity statistics for Logan Airport in 2014. Logan Airport is New England's primary domestic and international airport, operating as an origin-destination airport, rather than a connecting hub for major airlines. The total number of air passengers increased by 4.7 percent to 31.6 million in 2014, compared to 30.2 million in 2013. The 2014 passenger level represents a new record high for Logan Airport.

Passenger-aircraft operations accounted for 91 percent of total aircraft operations. The total number of aircraft operations increased slightly from approximately 361,339 in 2013 to 363,797 in 2014, a 0.7 percent increase. This was preceded by a 2.4 percent increase in 2013. Despite the increase, aircraft operations at Logan Airport remained well below the 487,996 operations in 2000 and the historic peak achieved in 1998. In 1986, Logan Airport served 21.7 million air passengers, as compared to 31.6 million in 2014 with roughly the same number of total operations (363,995).

Aircraft efficiency continued to improve in 2014 as the average number of passengers per aircraft operation grew from 83.6 in 2013 to 87.0 in 2014. This positive trend is indicative of the industry-wide shift toward higher aircraft load factors and an increase in the number of domestic and international destinations. While the number of domestic and international passengers is increasing, international passenger demand is projected to increase at a faster rate than domestic passenger demand. Total international annual passenger numbers increased from 4.4 million in 2013 to 4.9 million in 2014, a 9.8-percent increase. The strong international passenger growth was driven by several new nonstop services introduced by a number of foreign airlines including Emirates, Turkish Airlines, Hainan Airlines, and Cathay Pacific. Recently launched international destinations include Mexico City, Tokyo, Beijing, Dubai, Istanbul, Panama City, Hong Kong, and Shanghai. International air passengers are anticipated to reach 6 million by 2022 and 8 million by 2030.

The 2015 EDR should report on airport activity levels and aircraft operations, including: A-7

- Aircraft operations, including fleet mix and scheduled airline services at Logan Airport;
- Passenger activity levels;
- Cargo and mail activities;
- Compare 2014 aircraft operations, cargo/mail operations, and passenger activity levels to 2013 activity levels; and
- Report on national aviation trends in 2014 and compare to trends at Logan Airport.

It should also report on Massport's activity level forecasts that will become the basis for the planning and impact sections that follow and for Massport's strategic planning initiatives for the future ESPR. Massport should address comments related to activity levels in the 2015 EDR. A-8

Sustainability at Logan Airport

The 2014 EDR describes Massport's airport wide sustainability goals. In October 2000, the Massport Board approved an Environmental Management Policy, which articulates Massport's commitment to protect the environment and to implement sustainable design principles. In 2013, Massport was awarded a grant by the Federal Aviation Administration (FAA) to prepare a Sustainability Management Plan (SMP) for Logan Airport. The purpose of the SMP is to enhance the efficiency and sustainability of Logan Airport's operations and to support the broader sustainability principles of the Commonweath. The Logan Airport SMP planning effort began in May 2013 and was completed in April 2015. The plan is intended to promote and integrate sustainability Airport-wide and to coordinate ongoing sustainability efforts at Massport. A baseline data assessment was completed in winter 2014 to assess current sustainability performance at the Airport. The Logan Airport SMP developed a framework and implementation plan, with metrics and targets, designed to track progress over time.

The 2014 EDR provides an excellent overview of Massport's commitment to incorporate sustainability into all aspects of Massport's activities: Planning and Design; Construction; Operations, Maintenance and Management; and Monitoring of Environmental Performance. It also identifies specific practices to reduce impacts of construction and efforts to address energy intensity, percentage of renewable energy, and GHG reductions. The SMP establishes goals for ten categories: Energy and Greenhouse Gases; Water Conservation; Community, Employee, and Passenger Well-being; Materials, Waste Management, and Recycling; Resiliency; Noise Abatement; Air Quality Improvement; Ground Access and Connectivity; Water Quality/Stormwater; and Natural Resources.

A specific example includes compliance with the Leading by Example Executive Order which requires state agencies to procure 15 percent of their electricity from renewable resources by 2012. The Leading by Example program has influenced Massport's own operations including its offices, heating plants, and garages resulting in Massport receiving the Leading by Example award in 2008. Massport is striving to achieve LEED certification for new and substantial rehabilitation of building projects over 20,000 square feet. Some recent examples of LEED certified buildings at Logan Airport. The new Rental Car Center in the Southwest Service Area (SWSA) began construction in 2010 and was completed in 2013and was awarded Logan Airport's first LEED Gold Certification in 2015.

I commend Massport for its commitment to sustainability and its leadership. Progress on the SMP should be incorporated into subsequent EDRs and ESPRs. The 2015 EDR should report on the progress towards each of the ten goals and sustainability-related performance. A-9

The 2015 EDR should report on the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have undergone MEPA review, including whether they are under construction or completed. The status of mitigation commitments made in the Section 61 Findings for the following projects should be included: A-10

- West Garage/Central Garage (EEA #9790)
- International Gateway (EEA #9791)
- Logan Airside Improvements Planning Project (EEA #10458)
- Terminal A Replacement Project (EEA #12096)
- Southwest Service Area Redevelopment Program/Rental Car Center (EEA #14137)
- Logan Runway Safety Area Improvements Project (EEA #14442)

<u>Planning</u>

The Airport Planning chapter in the 2014 EDR provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2014. It also describes future planning, construction, and permitting activities and initiatives. It includes the following Airport Projects:

- *Parking Consolidation Project*: Massport is consolidating 2,050 temporary parking spaces as an addition to the West Garage and at the existing surface lot between the Logan Office Center and the Harborside Hyatt. These spaces constitute all the remaining spaces permitted under the Logan Airport Parking Freeze. The West Garage addition is atop the existing Hilton Hotel parking lot. The project will incorporate sustainable design and resiliency elements. The consolidation is expected to be completed in 2015.
- *Terminal E Renovation and Enhancements Project*: This project includes interior and exterior improvements at Terminal E to accommodate regular service by wider and longer Group VI aircraft. The project does not include any new gates, but will reconfigure three existing gates to accommodate Group VI aircraft (including the Airbus A380 and Boeing 747-8 primarily used by international air carriers). An addition to the west side of Terminal E will allow passenger holdrooms to be reconfigured to accommodate the larger passenger loads associated with larger aircraft. The project also includes modifications to the airfield to meet required Federal Aviation Administration (FAA) safety and design standards to accommodate the larger aircraft. An Environmental Assessment (EA) was filed and FAA issued a Finding of No Significant Impact (FONSI) on July 29, 2015. Construction commenced in 2015.

- *Terminal E Modernization Project*: To accommodate existing and long range forecasted demand for international service in an efficient, environmentally-sound manner that also improves customer service, Massport is planning to expand Terminal E. Modernizing Terminal E would add the three contact gates approved in 1996 as part of the International Gateway West Concourse project (EEA #9791), which were never constructed, and an additional two to four additional new gates in an extended concourse. A key feature of this project is the first direct pedestrian connection from the MBTA Blue Line Airport Station to the terminal complex at Logan Airport. This project would also include improvements to Airport roadways to facilitate access. The project is in the conceptual design phase. Massport intends to commence construction prior to 2018. An Environmental Notification Form (ENF) for this project (EEA#15434) was published in the November 9 Environmental Monitor.
- *Logan Airport Greenway Connector Project:* The Logan Airport Greenway Connector ("Greenway Connector") is a pedestrian/bicycle path connecting the Bremen Street Park path to the future City of Boston Narrow Gauge Connector, a pedestrian/bicycle path that begins at the Greenway Overlook and continues to Constitution Beach. Construction of the Greenway Connector began in spring 2013 and was completed in July 2014.
- *The Rental Car Center (RCC)*: Consolidating the rental car shuttle bus fleet and some Massport shuttle buses into a unified shuttle route system resulted in the elimination of eight rental car bus fleets (a net total of 66 buses have been eliminated). It included intersection and roadway infrastructure improvements including signal coordination and dedicated ramp connections. It also created a Ground Transportation Operations Center (GTOC) to support efficient planning and operation of Airport-wide transit activities.

In recognition of the potential and significant effects of climate change on Massport infrastructure and operations, Massport has initiated the Disaster and Infrastructure Resiliency Planning (DIRP) Study. A particular concern for Massport is the effects of sea level rise and projected increases in the severity and frequency of storms. The Study includes Logan Airport, the Port of Boston, and Massport's waterfront assets in South and East Boston. The DIRP Study includes a hazard analysis; modeling of projected sea-level rise and storm surge; and, temperature and precipitation projections and anticipated increases in extreme weather events. The study is nearing completion. The 2015 EDR should provide a summary of the DIRP Study and identify which recommendations Massport will implement in the short term to increase the resiliency of its facilities to the potential effects of climate change. A-11

Massport is developing a long-term parking management plan for Logan Airport. The Long-Term Parking Management Plan will lay out a multi-part strategy for efficiently managing parking supply, pricing, and operations – both at Logan Airport and at off-Airport locations controlled by Massport – to maximize access for transit and shared-ride vehicles while minimizing both drive-and-park and pick-up/drop-off modes. The 2015 EDR should provide updates on this plan. A-12

The 2015 EDR should also report on Massport planning to improve Logan Airport's operations and services in a safe, secure, more efficient, and environmentally sensitive manner. As owner and operator of Logan Airport, Massport also must accommodate and guide tenant development. Specifically, the 2015 EDR should also describe the status of planning initiatives for the following areas: A-13

- Roadway Corridor Project;
- Airport Parking;
- Terminal Area;
- Airside Area;
- Service and Cargo Areas; and
- Airport Buffers and Landscaping.

The 2015 EDR should provide a status report on long-range planning activities. This chapter should include the status and effectiveness of the ground access changes, including roadway and parking projects, that will consolidate and direct airport-related traffic to centralized locations and minimize airport-related traffic on external streets in adjacent neighborhoods. A-14

Regional Transportation

The 2014 EDR describes activity levels at New England's regional airports in 2014 and provides an update on regional planning activities, including long-range transportation efforts. The New England region is anchored by Logan Airport and a system of 10 other commercial service, reliever, and general aviation (GA) airports (regional airports). Overall, passenger traffic at the New England airports in 2014 represented the highest passenger traffic level for the region since the economic downturn in 2008. The increase in the region's passenger traffic was largely driven by continued growth at Logan Airport. In 2014, the total number of air passengers utilizing New England's commercial service airports, including Logan Airport, increased by 3.1 percent from 45.4 million in 2013 to 46.8 million annual air passengers in 2014. Of the 46.8 million passengers using New England's commercial service airports in 2014, 67.6 percent of passengers (31.6 million) used Logan Airport compared to 66.6 percent (30.2 million) in 2013. While passenger activity levels have increased, aircraft operations in the New England region have decreased. In 2014, regional aircraft operations decreased by 4.3 percent, from 1.02 million operations in 2013 to 0.97 million operations in 2014.

The 2015 EDR should describe Logan Airport's role in the region's intermodal transportation system by reporting on the following: A-15

Regional Airports

- 2015 regional airport operations, passenger activity levels, and schedule data within an historical context;
- Status of plans and new improvements as provided by the regional airport authorities;
- Ground access improvements; and
- Role of the Worcester Regional Airport and Hanscom Field in the regional aviation system and Massport's efforts to promote these airports.

Regional Transportation System

- Massport's role in managing the regional transportation facilities within MassDOT;
- Massport's cooperation with other transportation agencies to promote efficient regional highway and transit operations; and
- Report on metropolitan and regional rail initiatives and ridership.

Ground Access to and from Logan Airport

The 2014 EDR reports on transit ridership, roadways, traffic volumes, and parking for both 2012 and 2013. Specifically, the EDR states that Massport has continued to invest in and operate Logan Airport with a goal of increasing the number of passengers arriving by transit or other high occupancy vehicle (HOV) modes. The HOV/transit mode share at Logan Airport continues to rank at the top of U.S. airports. However, private passenger vehicle trips continue to increase with growth in air travel. As Logan Airport air traveler numbers have increased, a constrained parking supply at Logan Airport has resulted in an increase in pick-up and drop-off vehicle trips. These trips generate automobile emissions both locally and regionally. As part of its Long-Term Parking Management Plan, Massport is considering a series of measures to minimize pick-up/drop-off activity.

In 2014, Massport remained in full compliance with the Logan Airport Parking Freeze regulations. Despite an increase in terminal area parking rates on July 1, 2014, daily parking demand more frequently approached the Parking Freeze cap in 2014. Massport is consolidating 2,050 temporary parking spaces in addition to the West Garage and at the existing surface lot between the Logan Office Center and the Harborside Hyatt. These spaces constitute all remaining spaces permitted under the Logan Airport Parking Freeze. Increases in weekday peak commercial parking demand places additional pressure on roadway and parking operations under the Logan Airport Parking Freeze. In 2014, due to high demand on Tuesdays, Wednesdays, and Thursdays, 30,314 cars were diverted to another garage or lot and 56,634 cars were valeted/stacked (when cars are parked in aisles, have their keys taken, and then are re-parked in empty spaces as they become vacant); this represents over a 50 percent increase since 2013. There were about 40 weeks in which one or more of these measures were put into effect in 2014.

The 2015 EDR should report on the following and compare trends to 2014:

- Detailed description of compliance with Logan Airport Parking Freeze;
- High occupancy vehicle (HOV) ridership (including Blue Line, Silver Line, Water Transportation, and Logan Express);
- Massport's cooperation with other transportation agencies to increase transit ridership to and from Logan Airport via the Blue Line and Silver Line;
- Logan Airport Employee Transportation Management Association (Logan TMA) services;
- Logan Airport gateway volumes;
- On-airport traffic volumes;
- On-airport vehicle miles traveled (VMT);
- Parking demand and management (including rates and duration statistics);
- Status of long-range ground access management strategy planning; and
- Results of the 2015 Logan Airport Passenger Survey.
- Massport's target HOV mode share along with incentives; and,
- Non-Airport through-traffic;
- Report on Logan Express usage and efforts to increase capacity and usage;
- Report on water transportation to and from Logan Airport; and
- Report on results of ongoing ground access studies.

A-16

Noise Abatement

The 2014 EDR updates the status of the noise environment at Logan Airport in 2012 and 2013, and describes Massport's efforts to reduce noise levels. Many of the issues raised in the noise analysis are ongoing and require continuous monitoring. The 2015 EDR should address the noise issues raised by numerous commenters on the 2014 EDR.

A-17

In 2014, an additional 106 residential units received sound insulation bringing the program total to 11,515 residential units treated, amongst the highest in the nation. Since 2000, the number of daily aircraft operations has declined by almost 27 percent (from 1,355 operations per day in 2000 to 997 operations per day in 2014). This trend reflects an increase in the use of larger aircraft, airline consolidation, and increased efficiencies on the part of airlines. As described throughout this EDR, this evolution towards fewer flights with larger, more efficient and quieter aircraft has yielded substantial environmental benefits. Compared to 2000, in 2014:

- Jet operations made up 86 percent of operations compared to 66 percent;
- Overall operations were down by 25 percent while overall passengers were up by 14 percent; and
- The number of people exposed to DNL 65 dB has declined by 50 percent since 2000. Compared to 2013, the 2014 DNL 65 dB noise contours were larger in most areas around the Airport. The DNL contour was larger over East Boston, Winthrop, and Revere.

There were several temporary FAA- mandated airfield/airspace operating factors that influenced the contour changes in 2014. Due to safety concerns at airports across the US in June of 2014, the FAA temporarily halted the use of head-to-head operations or opposite direction operations, in which planes arrive on a runway in one direction and depart in the opposite direction. When in use at Logan Airport, the procedure has aircraft departing from Runway 15R and landing on Runway 33L during the late night (typically midnight to 5:00 AM) when weather conditions are appropriate, including good visibility and little wind. At Logan Airport, head-to-head operations are an important part of the use of the late night noise abatement runway (Runway 15R-33L) since this keeps operations over Boston Harbor. Use of this procedure was restored in early 2015. FAA also restricted the use of converging runways across the United States in January 2014 due to safety concerns. At Logan Airport, Runways 22L and 22R and Runway 27 were affected by this change. While Runway 22R is in use for departing aircraft, arrivals that would typically be directed to Runway 27 were sent by the FAA Air Traffic Control to arrive on Runway 22L. This restriction has since been lifted. Runway 15L-33R was closed for a short period of time (eight weeks) during the summer of 2014 for Runway Safety Area Improvements. This resulted in aircraft using Runway 15R-33L, Runway 4L, and Runway 22L more frequently in 2014 than in 2013. The construction activity also resulted in short closures of the intersecting Runway 4L-22R and Runway 4R-22L, which increased usage of Runway 15R-33L. An additional factor influencing the contour changes was an increase in overall operations and nighttime operations in 2014 compared to 2013. Nighttime operations increased for passenger flights as airlines expanded destinations and the number of flights per day. Several new international airlines began service at Logan Airport in 2014.

The information in the Noise Abatement chapter is very informative. I expect detailed analysis will be provided in the 2015 EDR and that Massport will consider and address the comments on noise and noise related issues.

A-18

The 2015 EDR should provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, and the updates in noise modeling. The chapter should report on 2015 conditions and compare those conditions to those of 2014 for the following:

- Fleet Mix, including Stage II, Recertified Stage III, newly manufactured Stage III, and qualifying Stage IV aircraft;
- Nighttime operations;
- Runway utilization (report on aircraft and airline adherence with runway utilization goals);
- Preferential runway advisory system (PRAS) tracking; and
- Flight tracks.

A-19

In 2015, the FAA introduced a new combined noise and air quality modeling tool, the Aviation Environmental Design Tool (AEDT), which must be used for all airport projects. The AEDT is a software system that dynamically models aircraft performance in space and time to produce fuel burn, emissions, and noise information. Noise contours for 2015 will be developed using AEDT and compared to the most recent version of the Integrated Noise Model (INM) which has been in place for all previous EDRs and ESPRs. Logan Airport-specific model adjustments made to account for over-water sound propagation and the propagation of sound to areas of higher terrain may be reported as an add-on to AEDT, if accepted by the FAA. This 2015 EDR should report on the following:

- Changes in annual noise contours and noise-impacted population;
- Measured versus modeled noise values, including reasons for differences and any improvements attributable to the models deployed;
- Cumulative Noise Index (CNI);
- Times-Above for 65, 75, and 85 dBA threshold values/Dwell and Persistence of noise levels; and
- Flight track monitoring noise reports.

A-20

The 2015 EDR should also report on noise abatement efforts, results from Boston Logan Airport Noise Study (BLANS) study, and provide an update on the noise and operations monitoring system. A-21

Air Quality/Emissions Reduction

The 2014 EDR provides an overview of airport-related air quality issues in 2014 and also efforts to reduce emissions. The air quality modeling reported in 2014 EDR is based on aircraft operations, fleet mix characteristics, and airfield taxiing times combined with ground support equipment (GSE) usage, motor vehicle traffic volumes, and stationary source utilization rates. Total air quality emissions from all sources associated with Logan Airport in 2014 are significantly less than they were a decade ago. The EDR attributes this downward trend to Massport's longstanding objective to accommodate the demands of increasing passenger and cargo activity levels with fewer aircraft operations generating fewer emissions.

In 2014, calculated emissions of volatile organic compounds (VOC), oxides of nitrogen (NOx), and particulate matter (PM) went up slightly. This was primarily attributable to changes in the modeling software, MOVES2014. Overall, modeled air quality emissions were similar in 2014 to 2013 conditions and followed recent trends. The changes in 2014 modeled air quality emissions, as compared to 2013, are primarily due to technical changes in the model itself. Inputs to the model include aircraft operations, fleet mix characteristics, and airfield taxi times combined with ground service equipment (GSE) usage, motor vehicle traffic volumes, and stationary source utilization rates. Model versions used in the 2014 analyses differed in terms of emission factors, most notably otor vehicle emissions. The modeled air quality conditions in 2014 for Logan Airport were for carbon monoxide (CO), NOx, VOCs, and PM.

- Total VOC emissions went up by 3 percent (1,177 kilograms per day [kg/day]) in 2014 compared to 2013. The increase is primarily due to the corresponding increase in aircraft landing and take-offs (LTOs) and an increase in jet fuel and gasoline usage when compared to 2013. For comparison, total VOC emissions were 1,777 kg/day in 2000.
- Total NOx emissions went up by less than 1 percent in 2014 (4,040 kg/day) compared to 2013. This slight increase in 2014 is mostly attributable to the larger number of air carrier operations during this time period. For comparison, total NOX emissions were 5,707 kg/day in 2000.

- Total CO emissions went down by 5 percent in 2014 (6,987 kg/day) compared to 2013. This decrease is mostly attributable to the decrease in GSE factors and motor vehicle emission factors in accordance with MOVES2014. For comparison, total CO emissions were 13,111 kg/day in 2000.
- Total $PM_{10}/PM_{2.5}$ emissions went up by approximately 3 percent in 2014 (95 kg/day) compared to 2013. This small increase is primarily attributable to the higher emission factors of MOVES2014.
- Total greenhouse gas (GHG) emissions went down by approximately 1 percent in 2014 compared to 2013. This decrease was primarily due to a decrease in vehicle miles traveled (VMT).
- Massport's Air Quality Initiative (AQI) has tracked NOx emissions since the benchmark year of 1999. Total NO_x emissions in 2014 were 722 tons per year (tpy) lower than the 1999 benchmark which represents an overall decrease of 31 percent in NOx emissions since 1999 when the program was initiated. For comparison, NO_x emissions in 2013 were 730 tpy lower than the benchmark.

Massport has also committed to include an inventory of GHG emissions from Logan Airport in the 2015 EDR. GHG emissions should be quantified for aircraft, GSE, motor vehicles and stationary sources using appropriate emission factors and methodologies. The 2015 EDR should include an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, and the changes in air quality modeling. The 2015 EDR should provide discussion on progress on the national and international levels to decrease air emissions. It should also include analysis methodologies and assumptions and report on conditions using the FAA's new AEDT model, described above. It will compare results to the most recent version of the Emissions Dispersion Modeling System (EDMS) that has been used in recent EDR/ESPR filings. It should include emissions inventories for CO, NO_x, VOCs, and PM emissions by airline. The 2015 EDR should also report on Massport's and Tenant's Alternative Fuel Vehicle Programs and Logan Airport air quality studies undertaken by Massport or others, as available. A-22

The results of the 2015 GHG emissions inventory should be compared to the 2014 results. This chapter should also include an update on Massport's efforts to encourage the use of single engine taxiing under safe conditions. A-23

Water Quality/Environmental Compliance

The 2014 EDR describes Massport's ongoing environmental management activities including National Pollutant Discharge Elimination System (NPDES) compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan (MCP), and tank management. Massport's primary water quality goal is to prevent or minimize pollutant discharges, thus limiting adverse water quality impacts of airport activities. Massport employs several programs to promote awareness of activities that may impact surface and groundwater quality. Programs include implementing best management practices (BMPs) for pollution prevention by Massport, its tenants, and its construction contractors; training of staff and tenants; and a comprehensive stormwater pollution prevention plan. The EDR reports that Massport continues to comply with water quality and other environmental regulations.

The 2015 EDR should identify any planned stormwater management improvements and report on the status of:

- NPDES Permit and monitoring results for Logan Airport's outfalls and the Fire Training Facility;
- Jet fuel usage and spills;
- MCP activities;
- Tank management;
- Update on the environmental management plan; and
- Fuel spill prevention.

A-24

Conclusion

I have determined that the 2014 EDR for Logan Airport has adequately complied with MEPA. The EDR provides a comprehensive overview of environmental planning, issues and data. Massport may prepare the 2015 EDR for submission in 2016 consistent with the Scope included in this Certificate.

November 13, 2015
Date

Matthew A. Beaton

Comments received:

10/30/2015	Nancy S. Timmerman
11/05/2015	Town of Milton, Office of Selectmen
11/06/2015	Stephen H. Kaiser, PhD
11/06/2015	The Boston Harbor Association
11/06/2015	Cindy L. Christiansen, PhD
11/10/2015	Bill Deignan, Cambridge Community Development Department

MAB/ACC/acc

This Page Intentionally Left Blank.

Copy of the Secretary of the Executive Office of Energy and Environmental Affairs Certificate issued for the Terminal E Modernization Project Environmental Notification Form and Responses to Comments

This Page Intentionally Left Blank.

The Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Charles D. Baker
GOVERNOR

Karyn E. Polito
LIEUTENANT GOVERNOR

Matthew A. Beaton
SECRETARY

Tel: (617) 626-1000
Fax: (617) 626-1081
http://www.mass.gov/eea

December 16, 2015

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
ENVIRONMENTAL NOTIFICATION FORM

PROJECT NAME	: Terminal E Modernization
PROJECT MUNICIPALITY	: East Boston
PROJECT WATERSHED	: Boston Harbor
EEA NUMBER	: 15434
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: November 9, 2015

Pursuant to the Massachusetts Environmental Policy Act (M.G. L. c. 30, ss. 61-62I) and Section 11.06 of the MEPA regulations (301 CMR 11.00), I have carefully reviewed the Environmental Notification Form (ENF), comments submitted on it, and have carefully considered whether an EIR is warranted. The project is undergoing MEPA review and requires an ENF pursuant to 301 CMR 11.03(6)(b)(6) because it will be undertaken by a State Agency and consists of the expansion of an existing terminal at Logan Airport by greater than 100,000 sf. The project does not exceed a Mandatory EIR threshold. Mandatory EIR thresholds are established to identify a category of projects, or aspects thereof, for which it is presumed that the environmental impacts warrant additional analysis in an EIR.

Comments identify concerns with the project and its impacts and identify broader concerns associated with airport operations and growth. These include comments from Senator Petruccelli, Representative Madaro, and Councilor LaMattina; Representative Garett J. Bradley; the City of Boston Environment Department; the Town of Hull; the Milton Board of Selectmen; representatives of the Massport Citizens Advisory Committee (CAC); and many residents. I have weighed these concerns against the presumption that the project is not subject to a Mandatory EIR and that Massport will prepare an Environmental Assessment (EA) for review pursuant to the National Environmental Policy Act (NEPA), which will include additional opportunities for public comment.

I have determined that additional information regarding the necessary details of design and development of the Terminal E expansion is warranted to properly assess potential impacts. The Scope for the EIR is narrowly tailored to the project and its specific impacts. It is intended to

augment the federal review process, not duplicate it. The EIR is not intended to address broad concerns associated with airport operations and growth. The venue for addressing cumulative environmental impacts is through the Environmental Status and Planning Reports (ESPR) and Environmental Data Reports (EDR).

Through these reports, Logan Airport is subject to comprehensive and regular MEPA review, including opportunities for public comment. This regular updating and reporting on planning and cumulative impacts is unique among State Agencies. It reflects the challenge and complexity of managing and modernizing Logan Airport within a dense, urban area. It recognizes that the proximity of communities to the Airport warrants an enhanced level of public engagement and a concerted, long-term effort to minimize and mitigate impacts.

I expect that Massport can prepare a Draft EIR that will adequately address the Scope such that I may determine, pursuant to 301 CMR 11.08, that no substantive issues remain to be addressed and allow the DEIR to be reviewed as a Final EIR (FEIR) or as a Response to Comments on the DEIR.

Project Description

The project proposes modernizing Boston-Logan International Airport's John A. Volpe International Terminal (Terminal E) with a 500,000 to 700,000-square foot (sf) addition that corrects facility deficiencies and accommodates current and anticipated passenger volumes. The project includes three gates which previously underwent MEPA review (International Gateway Project, EEA #9791) but were not constructed, and two to four additional aircraft gates, passenger holdrooms, concourse, concessions, and passenger processing areas. The project includes Customs and Border Patrol (CBP) and Federal Inspection Services (FIS) facilities to replace and expand FIS facilities that were originally reviewed under MEPA (Terminal B, Pier A Improvements/Satellite FIS Facility, EEA #12235) but also not constructed. The project also includes a direct pedestrian connection between Terminal E and the Massachusetts Bay Transportation Authority's (MBTA) Blue Line Airport Station.

Terminal E was constructed in 1974 with 12 gates and served 1.4 million annual passengers. In 2014, it served approximately five million passengers. The ENF indicates that the current level of passenger activity routinely causes severe congestion in the terminal and negatively impacts customer service and operations. During peak late afternoon and early evening periods, passengers experience severe congestion and delays at the ticket counters and security screening areas, and there is insufficient seating, concessions, and other support services. The ENF indicates that aircraft must use remote parking facilities at hardstands in the North Cargo Area and passengers are bused to the terminal during peak periods when there are insufficient gates. Massport has clearly demonstrated the need for the project and made a compelling case for the expansion.

The project is proposed in two phases. The first phase could include up to five new gates; part of the concourse extension, including the majority of the additional terminal processing area; roadway and curb improvements; and direct pedestrian connections to the MBTA Blue Line Airport Station. The second phase would primarily consist of the remainder of the concourse area, additional gates, holdrooms, boarding bridges; support spaces such as concessions, mechanical spaces, airline and airport operations spaces; and passenger processing areas. Both phases include airside modifications to accommodate aircraft maneuvering, taxiing, parking, and docking operational requirements.

The project will displace ground service equipment (GSE), other airside activities, existing surface parking, the cell phone lot, and the gas station which will be relocated within existing airport boundaries.

Environmental Status and Planning Report (ESPR)

The MEPA environmental review process for Logan Airport occurs on two levels: airport-wide and project-specific. The ESPR and EDR provide a "big picture" analysis of the environmental impacts of current and anticipated levels of airport-wide activities (including aircraft operations and passenger activity), and presents comprehensive strategies to avoid, minimize and mitigate impacts. The ESPR is generally updated on a five-year basis; the most recent ESPR for the year 2011 was filed in April 2013. Environmental Data Reports (EDRs) evaluate environmental conditions for the reporting year as compared to the previous year and are filed in the years between ESPRs. The most recent EDR for the year 2014 was filed in October 2015. The ESPR is supplemented by (and ultimately incorporates) the EDRs and the detailed analyses and mitigation commitments that emerge from project-specific reviews. This process provides a comprehensive and continuous review of airport programs, projects, environmental impacts and associated data.

The MEPA regulations (Section 11.06(2)) indicate that during the course of an ENF review I may review any relevant information from any other source to determine whether to require an EIR, and, if so, what to require in the Scope. To provide context for this project-specific review and because many issues raised by commenters relate to airport-wide operations and impacts, this Certificate refers to documents from the Environmental Status and Planning Report (ESPR) process (EEA#3247/5146). Massport indicates that the Terminal E project is consistent with the analysis presented in the Environmental Status and Planning Report (ESPR) and has incorporated that document by reference into the ENF as the framework for analyzing cumulative impacts of, and mitigation for, Logan Airport projects, and considers the regional transportation context.

The 2011 ESPR reported on key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. In addition to the annual report on 2011 conditions, the ESPR evaluated the cumulative impacts of passenger growth and associated ground and aircraft operations looking forward to 2030. The ESPR also presented environmental management plans for addressing areas of environmental concern.

The 2011 ESPR identifies a future phase of the International Gateway Project – Terminal E, which includes three new gates, and assumes it is constructed by 2030. The 2012/2013 EDR also identifies this project and indicates it will be constructed beyond 2022. The 2014 EDR identifies the Terminal E Modernization Project as a stand-alone project. It indicates that it would include an additional two to four gates for a total of five to seven gates and construction could begin in 2018.

Logan Airport and Project Site

The Airport boundary encompasses approximately 2,400 acres in East Boston and Winthrop, including approximately 700 acres underwater in Boston Harbor. The Airport is surrounded on three sides by Boston Harbor and is accessible by two public transit lines and the roadway system. The airfield is comprised of six runways and approximately 15 miles of taxiway. Logan Airport has four passenger terminals, A, B, C, and E, each with its own ticketing, baggage claim, and ground transportation facilities.

Terminal E is located adjacent to the North Cargo Area, closest to the MBTA Blue Line Airport Station. Land uses in the area of the proposed project include UPS aircraft parking and loading area, the airport's Remain Over Night aircraft parking area, the North Cargo Area equipment storage area, a building occupied by United Parcel Service (UPS), the MBTA Blue Line Airport Station, airport roadways, various short-term and cell phone parking lots, and a gas station.

The project site is located within the coastal zone of Massachusetts. The entirety of the project site is comprised of previously disturbed impervious area. It is not located in Priority or Estimated Habitat as mapped by the Division of Fisheries and Wildlife's (DFW) Natural Heritage and Endangered Species Program (NHESP). The project site does not contain wetland resource areas regulated pursuant to the Wetland Protect Act and its implementing regulations (310 CMR 10.00).

The ENF identified the following projects within the vicinity of Terminal E that have been reviewed under MEPA: Terminal A Replacement (EEA#9329), Terminal E Modifications (EEA#9324), Federal Inspection Services (FIS) Facility and West Concourse Project / International Gateway (EEA#9791), and Terminal B, Pier A Improvements/Satellite FIS Facility (EEA#12235).

Permitting and Jurisdiction

The project is undergoing MEPA review and requires an ENF pursuant to 301 CMR 11.03(6)(b)(6) because it will be undertaken by a State Agency and results in the expansion of an existing terminal at Logan Airport by greater than 100,000 sf.

The project requires a Sewer Permit Modification from the Boston Water and Sewer Commission (BWSC) and may require an Industrial User Permit from the Massachusetts Water Resource Authority (MWRA). The project may be subject to Massachusetts Office of Coastal Zone Management (CZM) federal consistency review.

The project requires approval by the Federal Aviation Administration (FAA) for changes to the Airport Layout Plan and, therefore, requires an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA). The project also requires a National Pollutant Discharge Elimination System (NPDES) General Permit for Construction from the U.S. Environmental Protection Agency.

Because the project will be undertaken by a State Agency, MEPA jurisdiction is broad in scope and extends to all aspects of the project that may cause Damage to the Environment, as defined in the MEPA regulations.

Environmental Impacts and Mitigation

The project includes construction of approximately 500,000 to 700,000 sf of new floor area (for a maximum 1,500,000 sf total), and will increase both water consumption and wastewater generation by approximately 25,600 gallons per day (76,800 gpd total). The project will not create new impervious area and will eliminate approximately 60 parking spaces. The ENF indicates that the project will accommodate existing and forecasted passenger levels and operations and, therefore, will not increase passenger enplanements or vehicle trips.

Measures to avoid, minimize and mitigate project impacts include improving high-occupancy vehicle (HOV) access to the airport via a direct pedestrian connection to the MBTA Blue Line Airport Station and reducing air emissions, greenhouse gas (GHG) emissions, and energy consumption by providing better access to gate plug-ins and pre-conditioned air. The ENF also indicates that the building will act as a noise barrier to the adjacent neighborhood and Memorial Stadium Park.

Review of the ENF

The ENF includes a general description of proposed activities, a conceptual plan, and a limited analysis of alternatives. It does not provide a typical level of information necessary to evaluate the potential environmental impacts of the project for the purpose of MEPA review. The ENF does not address why construction projections have changed compared to the ESPR and EDR or how the increase in gates may affect the impact analysis which is based on the 2011 ESPR forecasts. The ENF provides a scope for the NEPA EA that identifies further analysis and data that will be provided to assess potential impacts and measures to avoid, minimize, and mitigate these impacts. As requested by Massport, the ENF was subject to an extended 30-day comment period to provide additional time for public review and comment. C.1

Environmental Justice

Massport provided outreach consistent with the spirit and intent of the enhanced public participation provisions of the EJ Policy. Massport requested and was granted an extension of the comment period to provide additional time to review and comment on the ENF. The meeting notice was published in The Boston Herald, The East Boston Times, and the Winthrop Transcript. It was translated into Spanish and also published in El Mundo. Spanish language translation was provided at the joint MEPA/NEPA meeting held on November 19, 2015. In addition, Massport held additional meetings and presented information regarding the Terminal E Expansion at a number of meetings from September through December. I expect that Massport will employ similar approaches to ensure public review and comment of the EIR. C.2

Massport has also provided enhanced air quality analysis and assessment of cumulative impacts in the ESPR and EDRs that address the spirit and intent of the EJ Policy. The Scope for the EA indicates that it will evaluate potential disproportionate noise and air quality impacts for existing and future build years 2022 and 2030; demonstrate how it will avoid, minimize, and/or mitigate these impacts to the greatest feasible extent; and, ensure that its proposed actions will not unduly burden low income or minority areas. C.3

I have received numerous comment letters regarding environmental justice and concerns that the burden of cumulative noise, air pollution, and traffic impacts associated with growth and increased operations will be borne by neighboring communities, independent of this specific project. The Executive Office of Energy and Environmental Affairs (EEA) Environmental Justice Policy (EJ Policy) was designed to improve protection of low income and communities of color from environmental pollution as well as promote community involvement in planning and environmental decision-making to maintain and/or enhance the environmental quality of their neighborhoods.

Alternatives Analysis

The ENF identified a maximum developable footprint and indicated that all Build Alternatives will be located within previously developed land within the Airport Boundary. It did not identify a Preferred Alternative or compare relative impacts/benefits of alternatives. The ENF indicated that conceptual Build Alternatives will be developed during the NEPA permitting process based on airport industry planning standards, FAA, Customs and Border Patrol, and Transportation Security Administration (TSA) requirements that define various terminal, airside, and landside functions. The key differences among potential alternatives will relate to the internal and external layout of the building, the ability to efficiently accommodate passengers, and constructability. According to the ENF, all Build Alternatives will include phased development of three gates followed by the development of between two and four additional new gates, additional concourse with supporting facilities, a new direct pedestrian connection to the MBTA's Blue Line Airport Station, reconfiguration of adjacent roadways and short-term parking areas, and reconfiguration of some airside operations. All Build Alternatives will be located within existing paved and developed areas of the airport that are currently used for aviation or aviation-related activities. C.4

The ENF indicates that under the No-Build alternative, passenger and aircraft operations would continue to increase as projected in the 2011 ESPR, but there would be no significant changes to Terminal E interior or exterior facilities. Gate service facilities would be inadequate to efficiently handle the increase in scheduled operations and passengers and arriving aircraft would wait on the apron with engines idling until an aircraft clears a gate or park at a "hardstand" away from the Terminal at a North Cargo Area aircraft parking area and passengers will deplane using mobile stairs and be bused to the terminal. Hardstand operations, aircraft idling, and the use of on-board diesel auxiliary power units (APU) require greater use of energy, including bussing passengers to and from the terminal, and use of the aircraft engines to provide electricity to the cabin during these ground operations. The ENF indicates that the No-Build alternative would result in insufficient passenger processing capacity, long wait times at ticketing and security, and additional congestion at the curb and roadway. Based on these considerations, the No-Build alternative was eliminated.

Comments on the ENF request Massport accommodate more demand at regional airports and evaluate regional project alternatives to the proposed project. I acknowledge that long-term strategies to mitigate Logan's impacts will continue to include an emphasis on diverting travel to regional airports and to rail. Regional transportation will continue to be addressed through the ESPR and EDR, not through this project-specific review. C.5

The 2011 ESPR and 2014 EDR provide a thorough analysis of trends in regional airport activity and identify initiatives and joint efforts to improve the efficiency of the regional transportation system (including regional rail transportation initiatives). The reports identify Massport investments in Hanscom Field and Worcester Regional Airports, consistent with the findings of the 2006 New England Regional Airport System Plan (NERASP) Study. Future ESPRs and EDRs will require Massport to report on Logan's role in the regional transportation system; Massport's efforts to promote the Worcester Regional Airport and Hanscom Field; the status of plans and improvements provided by the regional airport authorities; cooperation with other transportation agencies to promote efficient regional highway and transit operations; and, report on metropolitan and regional rail initiatives and ridership. The reports demonstrate that Massport has continued to emphasize and build on opportunities to strengthen regional transportation.

Climate Change Adaptation and Resiliency Measures

Massport recently completed a Disaster and Infrastructure Resiliency Planning (DIRP) Study and generated a Floodproofing Design Guide which are intended to improve their ability to restore operational capabilities during and after major disruptions, and to adapt and enhance facilities to be more resilient to the effects of extreme weather events. The DIRP Study identified increased storm and sea-level rise as the threats with the highest probability of occurring and impacting Massport operations. The Floodproofing Design Guide also notes that Logan Airport is increasingly susceptible to flooding hazards caused by extreme storms and rising sea levels as a result of climate change.

The ENF does not include information regarding current Federal Emergency Management Agency (FEMA) floodplain mapping. MassDEP comments note that preliminary flood mapping[1] depicts the 100-year flood zone to the west of the project site, near the Airport MBTA Station. Comments from MassDEP and CZM indicate the proximity of the project to the coastal environment may make it susceptible to sea level rise and increased storm intensity and frequency-related impacts. Massport should draw on the DIRP Study and Floodproofing Design Guide to develop mitigation strategies to support the functionality and resiliency of Terminal E in the near and distant future. I encourage Massport to consult with CZM as the project design process progresses. C.6

Greenhouse Gas Emissions

Because I am requiring an EIR, the project is subject to review under the May 2010 MEPA Greenhouse Gas (GHG) Emissions Policy and Protocol ("the Policy"). The ENF indicates that Massport will quantify stationary and mobile source GHG emissions generated by the project and will identify measures to avoid, minimize, or mitigate GHG emissions to determine the applicability of state and federal requirements. I note that mobile sources will only include passenger vehicles and GSE. The ENF indicates that the energy demand of the project may require a new substation and that energy modeling will be used to quantify the GHG emissions for the terminal building. C.7 C.8 C.9

[1] Preliminary Flood Insurance Rate Map, Map Number 25025C0082J, March 16, 2016

Massport has incorporated sustainability into all aspects of its activities through a Sustainability Management Plan as described in the 2014 EDR. Recent Massport accomplishments include compliance with the Leading by Example Executive Order which requires state agencies to procure 15 percent of their electricity from renewable resources; the new Rental Car Center in the Southwest Service Area receiving Logan's first LEED Gold Certification in 2015; and expansion of the Logan Express Bus Service and ongoing support of HOV measures.

Noise

The ENF asserts that the project will not increase the number of aircraft operations when compared to the Future No-Build Alternative. The ENF also indicates that the proposed terminal building will act as a sound barrier to dampen or reflect noise because it will be positioned between the airfield and roadway. These benefits were not analyzed in the ENF. The ENF indicates that the EA will assess the potential for anticipated ground noise impacts resulting from proposed changes to the functioning of the North Cargo Area. The EA will also contain an analysis of the specific sound barrier benefits of the proposed terminal.

Impacts associated with existing operations and noise levels, and potential increases in impacts associated with this project and long-term growth, are a major concern identified in most comment letters. Letters identify a particular concern with nighttime noise and concentrations of flight tracks and increased flight frequency due to the FAA's area navigation (RNAV) procedures. As documented in the ESPR and annual EDR submittals, implementation of several of the RNAV procedures have generated increased noise complaints in some towns surrounding Logan Airport. The procedures themselves have resulted in aircraft at higher altitudes, though in patterns that are concentrated over certain communities. Since 2000, the number of daily aircraft operations and the number of people exposed to the 65 decibel (dB) Day-Night Average Sound Level (DNL) has declined by approximately 27 percent and fifty percent (respectively); reflecting a trend towards fewer overall flights with larger, more efficient, and quieter aircraft. I acknowledge that projected increases in flight operations will increase cumulative noise impacts compared to existing conditions, although they will remain below historic levels. Cumulative impacts will continue to be addressed through the ESPR and EDR, not through project specific review of the Terminal E project. C.10

Air Quality

The ENF indicates that the project will not alter runway use and will not affect the number of anticipated aircraft operations or generate any new vehicle trips. The project may alter airside ground operations in the North Cargo Area, including aircraft taxiing and parking, use of hardstands and busing, and use of supporting ground service equipment (GSE). The ENF indicates that an emissions inventory for the EPA criteria pollutants for airside ground operations (not flight operations) will be conducted for existing and future-year conditions using the recently released FAA Aviation Environmental Design Tool (AEDT). The AEDT will evaluate changes in aircraft ground operations and associated GSE and airside motor vehicle emissions will be assessed using the EPA MOVES model.

Total air quality emissions from all sources at Logan Airport in recent years are significantly less than they were a decade ago. The ENF attributes this downward trend to

Massport's longstanding objective to accommodate the demands of increasing passenger and cargo activity levels with fewer aircraft operations generating fewer emissions. The 2014 EDR demonstrated that total emissions are incrementally increasing. Massport will continue to assess the applicability of emissions reduction measures to the extent practicable and report on air quality in the ESPR and the EDR. C.11

Many comments cite the findings or request additional information on the 2004 Logan Airport Health Study performed by the Massachusetts Department of Public Health (DPH)[2]. The study was published in May 2014 and identified two respiratory outcomes for adults and children living in the high exposure area. In addition to contributions from Logan Airport, the study identified high background levels of air pollutants. The results of this study and have been reported in the annual EDR filings and include actions Massport is taking based on recommendations of the study. Cumulative air quality impacts will continue to be addressed through the ESPR and EDR, not through project specific review of the Terminal E project. C.12

The 2014 EDR indicates that Massport is working with DPH and the East Boston Health Center on implementing the DPH recommendations, including:

- Massport is providing funding to the East Boston Neighborhood Health Center to help expand the efforts of its asthma and chronic obstructive pulmonary disease (COPD) prevention and treatment program in East Boston and launch a program in Winthrop for screening children, providing asthma kits, and home visits;
- Massport entered into an agreement with the Massachusetts League of Community Health Centers for the evaluation and assessment of the Asthma and COPD Prevention and Treatment Program, and engagement of community health centers in the North End, Charlestown, Chelsea, and South Boston. The East Boston Neighborhood Health Center will conduct the same evaluations for the East Boston and Winthrop Community Program.
- Massport entered into an agreement with DPH to expand or establish the Asthma and COPD Prevention and Treatment Program in South Boston, the North End, Chelsea, and Charlestown in collaboration with the Massachusetts General Hospital and the South Boston Neighborhood Health Center, and to conduct training on the Community Health Worker assessments.

Transportation

The ENF asserts that the project will not increase passenger enplanements or vehicle trips to the airport, and therefore, the transportation analysis will be limited to the airport transportation network. The project will require relocation of existing uses in the project area to other airport locations. The ENF indicates that the EA will describe the existing transportation network at the airport, anticipated modifications to the transportation network, and anticipated transportation impacts of the project. According to the ENF, the EA will evaluate potential transportation impacts that may result from the relocated uses. The analysis will evaluate traffic impacts of the preferred alternative and a No-Build Alternative. The analysis will be conducted

[2] The study is available for download at http://www.mass.gov/eohhs/gov/departments/dph/programs/environmental-health/investigations/logan-airport-health-study.html

using the Logan Airport VISSIM model for existing and proposed conditions, with supporting traffic analyses performed using other software (Synchro and QATAR). The analysis will use the VISSIM model results from 2014 (as reported in the 2014 EDR) as the baseline year and the build conditions will be evaluated for 2022 and 2030.

The project includes construction of a direct pedestrian connection between Terminal E and the MBTA Blue Line Airport Station. The EA will include an analysis of the existing public transportation options serving the airport and evaluate the potential impacts the direct connection may have on ridership and operations. C.13

Many comments urge that I require a detailed analysis of ground transportation issues due to the cumulative impacts of landside and air operations at Logan and the identified issues with limited parking capacity. The issues of ground transportation and parking are clearly relevant to any discussion of cumulative impacts, and are an important component of any cumulative air quality analysis, which will continue to be addressed through the ESPR and EDR, not through this project specific review of the Terminal E Expansion. C.14

The ESPR and annual EDR updates include a substantial body of analysis on ground transportation issues. The 2014 EDR indicates that Massport is developing a Long-Term Parking Management Plan intended to address the parking supply, pricing and operations associated with Logan's constrained parking. Strategies to address the parking issue may have implications for design of the Terminal E Modernization project, including curbside access and/or short-term parking areas. C.15

Wastewater & Water Supply

According to the ENF, the project will generate an additional 25,600 gallons per day (gpd) of wastewater flow, for a total of 76,900 gpd. Similarly, the project will consume an additional 25,600 gpd of potable water, for a total of 76,800 gpd. MassDEP has indicated that the project will not require a Sewer Connection Permit from MassDEP. However, under the terms of the new Sewer System Extension and Connection Regulations (314 CMR 12.00), MassDEP requires that sewer authorities with permitted combined sewer overflows (CSOs), including the Boston Water and Sewer Commission (BWSC), require the removal of four gallons of infiltration and inflow (I/I) for each gallon of new wastewater flows generated by any new connection that would generate greater than 15,000 gpd. I refer Massport to comments from BWSC that provide additional guidance on this issue and identify applicable design standards for all new or relocated water mains and sewers. C.16

Comments from MWRA indicate that the project site is served by BWSC combined sewers that discharge to the MWRA's East Boston Branch Sewer. The ENF indicates that there is sufficient capacity in the existing collection system to accommodate the additional flow. I refer Massport to comments from MWRA which request the analysis also consider wet weather flow conditions. C.17

Stormwater

The ENF indicates that the project will not create new impervious area as development of the terminal will occur in an area that is already paved. The Terminal E complex will continue to drain to the North Outfall, which is equipped with end-of-pipe treatment to remove debris and floating oils and grease from stormwater prior to discharge. Comments from CZM indicate that samples from the North Outfall recently exceeded water quality standards for bacteria and recommend that Massport develop a strategy to identify and eliminate illicit sewer connections to address this issue. C.18

According to the ENF, the EA will include a drainage analysis and description of the proposed stormwater management measures and identify the size and location of stormwater management features. The EA will also demonstrate how the project will meet MassDEP Stormwater Management Standards, Logan Airport's stormwater management practices, and the requirements of the NPDES Multi-Sector General Permit under which the airport operates. I refer Massport to comments from BWSC that identify applicable design standards and plan requirements, and provide guidance on discharge of dewatering drainage. C.19

Historic and Archaeological Resources

According to the ENF, the project site does not contain any properties listed in the State or National Registers of Historic Places. The project site contains both an area and a structure that are included in the Massachusetts Historical Commission's (MHC) Inventory of Historic and Archaeological Assets of the Commonwealth (the Inventory). Specifically, the entirety of Logan Airport is identified as an Inventoried Area (MHC ID#BOS.K) and Terminal E is identified as an Inventoried Structure (MHC ID#BOS.63). The ENF contains a commitment to coordinate with MHC to identify potential impacts and avoidance, minimization, and mitigation measures.

Construction Period

The ENF does not identify specific construction period impacts or associated mitigation measures. It indicates that construction period impacts, including noise, air quality, traffic, solid and hazardous waste, and water quality will be evaluated in the EA. It will also describe project phasing and sequencing. Massport participates in MassDEP's Clean Construction Equipment Initiative and requires engine retrofits to reduce exposure to diesel exhaust fumes and particulate emissions. The ENF indicates that demolition activities will comply with MassDEP's Solid Waste and Air Quality control regulations. I refer Massport to comments from MassDEP that provide guidance on asbestos removal and the handling of asphalt, brick, and concrete. The ENF indicates Massport will recycle construction & demolition (C&D) waste. C.20

The ENF indicates that contaminated material will be managed in compliance with the Massachusetts Contingency Plan (MCP) and that a Soil Management Plan may be required to determine whether excavated soils generated through foundation construction can be used onsite or hauled off-site for reuse and/or disposal. The ENF indicates that areas near the site have been regulated under c.21E Release Tracking Number (RTN) 3-10027 (Phase V) and RTN 3-324. MassDEP comments note RTN 3-324 appears to be linked to a site in a different city. Massport should review and confirm the RTN or provide the correct RTN for the site. C.21 I refer Massport to MassDEP comments, which provide additional guidance on the excavation, removal and/or C.22

disposal of contaminated soil, pumping of contaminated groundwater, and/or working on contaminated media. C.22 Cont.

Conclusion

The ENF has provided an overview of the Terminal E Expansion, identified potential environmental impacts, and identified opportunities to avoid, minimize and mitigate impacts; however, the ENF did not provide sufficient information to demonstrate that Massport has sufficiently analyzed alternatives and measures to avoid, minimize and mitigate potential impacts of this specific proposal to the maximum extent practicable.

As noted previously, numerous comments raise concerns about the project, the management of growth at Logan Airport, the environmental and community impacts of this growth, and the mitigation of impacts. I have also received comments that suggest review of the Terminal E Modernization project has been improperly segmented under MEPA from the review of airport operations as a whole.

Massport asserts that international passenger activity is forecast to increase independent of any additional facilities. The 2011 ESPR provides accurate forecasts of passenger demand and aviation activity in 2030 and documents that demand for passenger service is primarily determined by external factors, including economic growth, cost of travel, and demographic shifts. In addition, I note that Massport has been engaged in planning to accommodate growth in international passengers and operations since the 1990's.

The issue of cumulative airport-wide impacts and segmentation is not new to the review of projects at Logan Airport. The ESPR and EDR provide a cumulative analysis of Logan Airport operations, environmental impacts, and mitigation measures. Review of individual projects proceeds within the context of this long-term planning and analysis of cumulative impacts. The record of MEPA review clearly demonstrates that Massport has and continues to identify impacts associated with individual projects within the context of long-term plans and cumulative impacts of Logan Airport. Cumulative impacts and project specific impacts will continue to be assessed on separate tracks; they will complement each other and ensure that projects are not viewed in isolation. C.23

Based on a review of the ENF, consultation with State Agencies and review of comment letters, I am requiring that Massport submit an EIR consisting of the EA and limited additional information identified in the Scope. The DEIR will consist of a project specific review of the Terminal E Modernization project within the context of airport-wide operations and impacts as a whole. The purpose of the DEIR is to:

1. Provide a detailed and comprehensive project description including conceptual design; C.24
2. Identify protect-specific impacts and the project's consistency with Logan planning and annual reporting; C.25
3. Consider how alternative building design and location, within the project site, can minimize impacts and maximize benefits; and, C.26
4. Provide draft Section 61 Findings that identify project-specific mitigation measures. C.27

Through this review, Massport will demonstrate that it has met its obligations under MEPA to avoid, minimize and mitigate impacts of the Terminal E Modernization to the maximum extent feasible.

In recognition of the comment letters that raise concerns with cumulative airport-wide impacts pertaining to traffic and parking, air quality, and noise and, consistent with the MEPA review structure for Logan Airport, I am requiring Massport to respond to comments regarding airport operations and cumulative impacts in subsequent ESPR and/or EDR documents. The next ESPR will analyze calendar year 2016 and will likely be filed in late 2017 or 2018 and the next EDR will analyze calendar year 2015 and will likely be filed in the fall of 2016. C.28

The 2015 EDR Scope includes reporting on noise, air quality, and long-term parking management. C.29 The 2016 ESPR should revise growth projections based on the changes in the Terminal E Modernization Project that occurred subsequent to the 2011 ESPR (if necessary). C.30 It should also should reflect the proposed connection to the Airport Station and identify the anticipated ridership, changes in the HOV mode share, and ground access planning considerations. C.31

SCOPE

General

The ENF included a proposed scope for the Environmental Assessment that will undergo review pursuant to the National Environmental Policy Act (NEPA). It includes a project description and permitting, alternatives, air quality, climate, coastal resources, hazardous materials, solid waste, pollution prevention, historical, architectural, archaeological and cultural resources, land use, natural resources and energy supply, noise and compatible land use, transportation, water resources, and construction impacts. In the interest of harmonizing State and federal review and in recognition of the significant and on-going planning and analysis represented by the ESPR and the EDRs, Massport may submit the EA as the Draft EIR. The EA should be supplemented by addressing the additions and modifications identified in this Scope. If Massport would prefer to tailor the EIR rather than submit the EA, the EIR should consist of the standard MEPA requirements for an EIR (Section 11.07(6)) and address the requirements of the MEPA GHG Emissions Policy and Protocol. C.32

Massport may also choose to coordinate the State and federal review. MEPA comment and review periods may be adjusted to align with NEPA deadlines. Lastly, I note that this certificate applies to the review of the project under MEPA only, and does not restrict the ability of the federal government to act on those aspects of the project subject to NEPA.

Project Description and Permitting

The EIR should identify and describe any changes to the project since the filing of the ENF and provide an update on State, local, and federal permitting. It should include a discussion of permitting requirements and document the project's consistency with regulatory standards. C.33

The EIR should include updated site plans for existing and post-development conditions at a legible scale including curbside improvements and changes to the on-airport roadways. C.34

The EIR should provide an update on consultations with the MBTA regarding the proposed connection to the MBTA Airport Station. The EIR should identify whether a Land Transfer (including easement) from MBTA will be required to construct the pedestrian connection to the MBTA Airport Station. The EIR should include a conceptual design for the proposed connection to the Airport Station and identify anticipated ridership, potential changes in the HOV mode share, and associated ground access planning considerations. C.35

Alternatives Analysis

The EIR should identify the planning metrics, facility requirements, and assumptions used to design the project and to determine the final number and location of gates. It should compare and contrast benefits and potential impacts of alternatives in narrative form and it a tabular format. C.36 The EIR should identify the peak hour used to determine gate locations and design passenger hold rooms. The EIR should identify the number of planes that are currently forced to "hard stand" during peak hours due to lack of available gates to the number of planes. It should identify the number forced to "hard stand" during peak hours under proposed alternatives. C.37 The EIR should include a discussion of the proposed project and alternatives consistency with the long-term growth forecasts contained in the ESPR and EDR. C.38

GHG Emissions and Climate Change Adaptation and Resiliency

The project is in the conceptual design state and, as such, provides meaningful opportunities for reduction GHG emissions associated with the building location, orientation and design as well as incorporation of resiliency and adaptation considerations. The EIR should describe the project's consistency with the DIRP Study and Massport's Floodproofing Design Guide to demonstrate that the project will incorporate proactive site design measures to address potential impacts related to predicted sea level rise. C.39 In addition to Massport assets, I encourage Massport to consult with the MBTA to review existing station vulnerabilities, as operations of the Blue Line and this station are important to support Massport HOV goals. C.40

The EIR should include an analysis of GHG emissions and mitigation measures in accordance with the standard requirements of the MEPA GHG Policy and Protocol. The analysis should include project-related stationary source emissions and mobile source emissions (passenger vehicles and GSE). I refer Massport to comments from DOER and MassDEP which provide additional guidance regarding mitigation measures that should be explored as part of the GHG analysis. C.41 DOER identifies combined heat and power (CHP) as a particularly promising and effective energy efficiency measure that could also support resiliency of the facility. The EIR should include a feasibility analysis of CHP and a roof-mounted solar photovoltaic (PV) system. I encourage Massport to meet with representatives from MEPA and DOER prior to preparation of the GHG analysis. C.42

Noise

The EA will include a noise analysis. The EIR should identify how the sound barrier benefits of the terminal have been maximized through its location and design. The EIR should C.43

identify whether the addition of new gates constructed to current industry standards would affect the fleet mix and, potentially, alter/increase noise and vibration on Logan Airport and within the surrounding community compared to the 2030 forecasts. C.43 Cont.

Air Quality

The EA will include an emissions inventory for the EPA criteria pollutants for airside ground operations for existing and future-year conditions to evaluate changes in aircraft ground operations and associated GSE and airside motor vehicle emissions. C.44 The EIR should quantify the impacts or benefits of providing direct access to plug-in gate operations and decreasing reliance on auxiliary power units, ground support equipment, and busing passengers around the airport. C.45 Massport should consider the potential and relative benefits of alternative building locations on the site and design between the airfield and neighborhoods as it relates to creating a potential barrier to particulate matter and other hazardous air pollutants. C.46

Construction Period

The EA IR should identify construction period impacts, including noise, air quality, traffic, solid and hazardous waste, and water quality and identify avoidance, minimization, and mitigation measures. C.47 It should also describe project phasing and sequencing. C.48

Mitigation/Draft Section 61 Findings

The EIR should include a separate chapter summarizing proposed mitigation measures. This chapter should also include draft Section 61 Findings for each area of impact associated with Massport's Preferred Alternative. The EIR should contain clear commitments to implement these mitigation measures, estimate the individual costs of each proposed measure, identify the parties responsible for implementation (either funding design and construction or performing actual construction), and a schedule for implementation. C.49 To ensure that all GHG emissions reduction measures adopted by the Proponent in the Preferred Alternative are actually constructed or performed by the Proponent, I require Proponents to provide a self-certification to the MEPA Office indicating that all of the required mitigation measures, or their equivalent, have been completed. The commitment to provide this self-certification in the manner outlined above should be incorporated into the draft Section 61 Findings included in the EIR. C.50

Responses to Comments

The EIR should contain a copy of this Certificate and a copy of each comment letter received on the ENF. Based on the large volume of comment letters received, the comment letters may be provided electronically on a CD. In order to ensure that the issues raised by commenters are addressed, the EIR should include direct responses to these comments to the extent that they are within MEPA jurisdiction. This directive is not intended, and shall not be construed, to enlarge the scope of the EIR beyond what has been expressly identified in this Certificate. The response can refer to future EDRs and/or ESPRs to address issues that are not within the DEIR Scope. C.51 In addition to items noted in the Scope, the response to comments section should address comments from MassDEP pertaining to wastewater, recycling, source reduction and water conservation efforts. C.52 The EIR should also address wet weather capacity, C.53

wastewater flows, and I/I removal requirements as outlined in MWRA and BWSC's comments. C.53 Cont. I recommend that Massport employ an indexed response to comments format, supplemented as appropriate with direct narrative response. C.54

Circulation

In accordance with Section 11.16 of the MEPA Regulations and as modified by this Certificate, Massport should circulate a hard copy of the EIR to each State and City Agency from which the Proponent will seek permits. Massport must circulate a copy of the EIR to all other parties that submitted individual written comments. Per 301 CMR 11.16(5), the Proponent may circulate copies of the EIR to these other parties in CD-ROM format or by directing commenters to a project website address. However, Massport should make available a reasonable number of hard copies to accommodate those without convenient access to a computer and distribute these upon request on a first-come, first-served basis. Massport should send correspondence accompanying the CD-ROM or website address indicating that hard copies are available upon request, noting relevant comment deadlines, and appropriate addresses for submission of comments. A CD-ROM copy of the filing should also be provided to the MEPA Office. A copy of the EIR should be made available for review at the following Libraries: Boston Public Library – Main, Connolly, Orient Heights, Charlestown, and East Boson Branches, Chelsea Public Library, Winthrop Public Library, Revere Public Library, Everett Public Library, Milton Public Library, and Hull Public Library. C.55

December 16, 2015
Date

Matthew A. Beaton

Comments received:

12/07/2015	Massachusetts Department of Environmental Protection – Northeast Regional Office (MassDEP)
12/07/2015	Massachusetts Water Resources Authority (MWRA)
12/07/2015	Madeleine Steczynski
12/07/2015	Jane O'Reilly
12/07/2015	Alexis Daniels
12/07/2015	Chris Marchi (1st letter)
12/07/2015	Jason Burrell
12/07/2015	John Casamassima
12/07/2015	Kannan Thiruvengadam
12/07/2015	Robin Maguire
12/07/2015	Susanna Starrett
12/07/2015	Theresa Turino
12/08/2015	Alfred Pucillo
12/08/2015	Duane Eric Lock
12/08/2015	Jeannie Grieci
12/08/2015	Joanne Donatelli
12/08/2015	Joanne T. Pomodoro

12/08/2015	John Antonellis
12/08/2015	Lisa Rusch
12/08/2015	Lorraine Curry
12/08/2015	Magdalena Ayed
12/08/2015	Mary Elizabeth Nofziger
12/08/2015	Nancy Lagro
12/08/2015	Normairiis Casiano
12/08/2015	Rebecca Lock
12/08/2015	Sandra Downey
12/08/2015	Danielle Dell'Olio
12/08/2015	Allyson and Michael Simons
12/08/2015	Patricia J D'Amore
12/08/2015	Jessica L. Curtis
12/08/2015	Daniel Cano on behalf of the Eagle Hill Civic Association and Jeffries Point Neighborhood Association (dated 12/02/15)
12/08/2015	Dan Bailey
12/08/2015	Matthew Neave
12/08/2015	Salvador Cartagena
12/08/2015	Alexis Pumphrey
12/08/2015	Jeff Lee
12/08/2015	Kelly Rusch
12/08/2015	Christine Passarriello
12/08/2015	Rick Lockney (with attached data)
12/08/2015	Camille MacLean
12/09/2015	Angela Mroz
12/09/2015	Pamela Loring
12/09/2015	Brian Gannon
12/09/2015	Jay Benson
12/09/2015	Peter Chipman
12/09/2015	Kathyrn Leeber
12/09/2015	Carol Taylor
12/09/2015	Rebecca Lynds
12/09/2015	Georges Arnaout
12/09/2015	Lisa Locke
12/09/2015	James Linthwaite
12/09/2015	Mary J. Ryan
12/09/2015	Steve and Chrissy Holt
12/09/2015	Paul Paquin
12/09/2015	Karis L. North
12/09/2015	David and Carissa Juengst
12/09/2015	Caroline Sulick
12/09/2015	Maria Graceffa
12/09/2015	Robyn Riddle
12/09/2015	Elda and Mark Prudden
12/09/2015	Christine Thompson
12/09/2015	Frank J. Ciano, Arlington Logan CAC and Massport CAC Representative
12/09/2015	Senator Petruccelli, Representative Madaro, Councilor LaMattina
12/09/2015	Elke O'Brien

12/09/2015	Jeff Kerr (1st letter)
12/09/2015	Christina Leshock
12/09/2015	Collin Cameron
12/09/2015	Aaron M. Toffler, on behalf of Airport Impact Relief, Incorporated (AIR, Inc.)
12/09/2015	Jason Hibbard
12/09/2015	Gisela Voss and Dan Kernan
12/09/2015	Elizabeth Kay
12/09/2015	Harvey Rowe
12/09/2015	Jill Romano, Wenham Logan CAC Representative
12/09/2015	Leanne Tirabassi
12/09/2015	Myron Kassaraba, Belmont Logan CAC and Massport CAC Representative
12/09/2015	Nancy Plotkin
12/09/2015	Larry A. Butler
12/09/2015	Rowan Curran
12/09/2015	Lois Freedman
12/09/2015	Kathleen Conlon, Milton Board of Selectmen
12/09/2015	Frank Kerr, Hull Neighbors for Quiet Skies
12/09/2015	Jim Roberts
12/09/2015	Tom Hardey
12/09/2015	Donna Goes
12/09/2015	Colleen MacDonald
12/09/2015	Brian Carney
12/09/2015	Billy Avalos
12/09/2015	John Walkey
12/09/2015	Stephan Marin
12/09/2015	Amelia Cardona
12/09/2015	Jeff Karr (2nd Letter)
12/09/2015	Priscilla Beadle
12/09/2015	H. Gerald Zeller
12/09/2015	Arnie Freedman
12/09/2015	Bonita K Koelker
12/09/2015	Mary Ellen Welch
12/09/2015	Marie & James Fraher
12/09/2015	Erica Mattison, Environmental League of MA, Massport CAC Representative
12/09/2015	Lynn Marie Ray
12/09/2015	Dennis Saide
12/09/2015	Vera Schneider
12/09/2015	Neill K. Ray
12/09/2015	Boston Harbor Association
12/09/2015	Nicole Al Rashid
12/09/2015	Ellen M. Tan, Commonwealth Land Trust
12/09/2015	Cindy L. Christiansen, Milton Logan CAC Representative
12/09/2015	Patricia Waddleton
12/09/2015	Evie Rose
12/09/2015	Carey Lam
12/09/2015	Kathy Beitler
12/09/2015	Joe Berkeley
12/09/2015	Eileen M. Boylen

12/09/2015	David Flynn
12/09/2015	Michael Passariello
12/09/2015	Richard Armenia
12/09/2015	James B. Lampke, Town of Hull, Acting Town Manager
12/09/2015	Cindy Borges-Peralta
12/09/2015	Stephen Cooper
12/09/2015	Tina St. Gelais Kelly
12/09/2015	Tara Ten Eyck
12/09/2015	Maria Ticona
12/09/2015	Ira Fleishman
12/09/2015	Andrew Schmidt
12/09/2015	Debbie Ellerin
12/10/2015	Jeeyoon Kim
12/10/2015	Boston Water and Sewer Commission (BWSC)
12/10/2015	George and Diane Nassopoulos
12/10/2015	Betsy Lewenberg
12/10/2015	Representative Garett J. Bradley
12/11/2015	Massachusetts Office of Coastal Zone Management (CZM)
12/11/2015	Chris Marchi, (2nd letter)
12/11/2015	City of Boston – Environmental Department
12/11/2015	Mary Beth Hamwey
12/11/2015	Maureen White
12/11/2015	Jesse Purvis
12/11/2015	John Tyler
12/11/2015	Renee MacLean
12/11/2015	Edward MacLean
12/11/2015	E.F. (45 Grovers Ave.)
12/11/2015	D.P. (402 Meridian St.)
12/11/2015	Daniel Cordon
12/11/2015	Tanya Hahnel
12/11/2015	B.R. (412 Summer St.)
12/11/2015	A.V. (198 Everett St.)
12/11/2015	Gillian B. Anderson
12/12/2015	Elizabeth Stoy
12/15/2015	Department of Energy Resources (DOER)

MAB/PRC/prc

This Page Intentionally Left Blank.

Comment #	Author	Topic	Comment	Response
Terminal E Modernization Project C.5	Matthew Beaton, Secretary	Regional Transportation	I acknowledge that long-term strategies to mitigate Logan's impacts will continue to include an emphasis on diverting travel to regional airports and to rail. Regional transportation will continue to be addressed through the ESPR and EDR, not through this project-specific review.	Regional transportation is addressed in Chapter 4, *Regional Transportation,* of this *2016 Environmental Data Report (EDR).* It will continue to be addressed through the ongoing Environmental Status and Planning Report (ESPR) and EDR process.
Terminal E Modernization Project C.10	Matthew Beaton, Secretary	General	Cumulative impacts will continue to be addressed through the ESPR and EDR, not through project specific review of the Terminal E project.	This *2016 EDR* reports on cumulative, Airport-wide impacts for 2016. Massport is unique among state agencies and airports in the U.S. for publishing annual environmental reports specifically designed to describe, analyze, and project the cumulative effects of Logan Airport operations based on current and anticipated future operating conditions. This process was developed with the Executive Office of Energy and Environmental Affairs (EEA) to allow individual projects at Logan Airport to be considered and analyzed in the broader, airport-wide context. Additional information specific to the Terminal E Modernization Project will be reported on in future EDR/ESPR filings, as appropriate. While the next annual report was originally scheduled to be a *2017 ESPR*, with approval from EEA, Massport has prepared an EDR for 2016. The key difference between the two documents is that the ESPR provides future forecasts for airport activity levels and environmental conditions. In the past few years, passenger demand trends for air travel have been rapidly increasing and the air carrier landscape is changing. Additionally, the ground transportation arena at Logan Airport has also changed rapidly with the introduction of transportation network companies (TNCs) such as Uber and Lyft. Due to these rapid changes, Massport needs additional time to understand these trends and what it means for future activity levels and airport ground access. Massport will have a clearer sense of the effect of TNCs at Logan Airport after a full year of data has been collected. Therefore, Massport will prepare a *2017 ESPR* which will include an updated future forecast and a better understanding of future ground transportation options to and from Logan Airport. The scope for this document was established by the Secretary's Certificate dated March 9, 2018, which is included in Appendix A, *MEPA Certificates and Responses to Comments*. This *2016 EDR* fulfills all requirements laid out in the Secretary's Certificate. Future year forecasts and impact assessments will be provided in the *2017 ESPR.* See the cover letter and Chapter 1, *Introduction/Executive Summary* of this *2016 EDR* for more information.

Comment #	Author	Topic	Comment	Response
Terminal E Modernization Project C.11	Matthew Beaton, Secretary	Air Quality/ Emissions Reduction	The 2014 EDR demonstrated that total emissions are incrementally increasing. Massport will continue to assess the applicability of emissions reduction measures to the extent practicable and report on air quality in the ESPR and the EDR.	Massport will continue to assess the applicability of emissions reduction measures and report on air quality in the ESPR and the EDR. Chapter 7, *Air Quality/Emissions Reduction* reports on Airport emissions in 2016. The *2017 ESPR* will report on conditions in 2016 and will assess impacts through 2035. In response to the March 9, 2018 Secretary's Certificate on the 2016 EDR Notice of Project Change, Massport has augmented its GHG reporting to show normalized GHG emissions and building energy use data (see Chapter 7, Air Quality/Emissions Reduction). Normalizing the data shows that Logan Airport is operating more efficiently over time, serving more passengers in larger building footprints with less energy. GHG emissions per passenger (Scopes 1 and 2) have decreased by over 34 percent from 2007 to 2016. Logan Airport's energy use intensity, which is a measure of building-only energy consumption per square foot, has decreased by over 23 percent from 2007 to 2016. Building GHG emissions per square foot has decreased by over 43 percent from 2007 to 2016.
Terminal E Modernization Project C.12	Matthew Beaton, Secretary	Air Quality/ Emissions Reduction	Cumulative air quality impacts will continue to be addressed through the ESPR and EDR, not through project specific review of the Terminal E project.	As directed by the Secretary, this *2016 EDR* reports on cumulative, Airport-wide air quality impacts in Chapter 7, *Air Quality/Emissions Reduction.* Cumulative impacts will continue to be addressed through the ESPR and EDR.
Terminal E Modernization Project C.14	Matthew Beaton, Secretary	Ground Access/ Air Quality	The issues of ground transportation and parking are clearly relevant to any discussion of cumulative impacts, and are an important component of any cumulative air quality analysis, which will continue to be addressed through the ESPR and EDR, not through this project specific review of the Terminal E Expansion.	As directed by the Secretary, this *2016 EDR* reports on ground transportation and parking in Chapter 5, *Ground Access to and from Logan Airport.* The air quality analysis is reported in Chapter 7, *Air Quality/Emissions Reduction.* These issues will continue to be addressed through the ESPR and EDR.

Comment #	Author	Topic	Comment	Response
Terminal E Modernization Project C.15	Matthew Beaton, Secretary	Ground Access	The ESPR and annual EDR updates include a substantial body of analysis on ground transportation issues. The 2014 EDR indicates that Massport is developing a Long-Term Parking Management Plan intended to address the parking supply, pricing and operations associated with Logan's constrained parking. Strategies to address the parking issue may have implications for design of the Terminal E Modernization project, including curbside access and/or short-term parking areas.	This *2016 EDR* documents updates to Massport's Long-Term Parking Management Plan, which is intended to address the parking supply, pricing, and operations associated with Logan Airport's constrained parking. The Long-Term Parking Management Plan was originally published in the *2012/2013 EDR*. This *2016 EDR* report on this plan in Chapter 5, *Ground Access to and from Logan Airport*. Massport's ground transportation strategy is designed to provide a broad range of high occupancy vehicle (HOV), transit, and shared-ride options for travel to and from Logan Airport and to minimize vehicle trips, by providing convenient transit, shuttle, bike, and pedestrian connections to the Airport. The strategy also aims to provide on-Airport parking for passengers choosing to drive or who have limited HOV options. Massport continues to manage parking supply, pricing, and operations to promote the use of transit, HOV, shared-ride options. Increasing available on-airport parking is one strategy Massport employs to minimize drop-off/pick-up trips. On March 31, 2017, Massport filed an Environmental Notification Form (ENF) for the Logan Airport Parking Project, which proposes to build 5,000 new on-Airport commercial parking spaces at Logan Airport in two locations (on top of the existing Economy Garage and in the location of the existing Terminal E surface lot). On May 5, 2017, the Executive Office of Energy and Environmental Affairs (EEA) issued its Certificate on the ENF establishing the Scope for the required Draft Environmental Impact Report (EIR). The Draft EIR will further evaluate the environmental impacts of the Logan Airport Parking Project in accordance with the Secretary's Certificate. The construction of additional commercial parking spaces at Logan Airport was predicated on a regulatory change, by the Massachusetts Department of Environmental Protection (MassDEP), whereby MassDEP would need to amend the existing Logan Airport Parking Freeze to allow for some additional commercial parking spaces at Logan Airport. In response to Massport’s 2016 request to consider an amendment to the Logan Airport Parking Freeze (to increase the commercial parking freeze limit by 5,000 spaces), MassDEP conducted a stakeholder process, which was followed by a public process to amend the Parking Freeze regulation. MassDEP issued the amended regulation on June 30, 2017 approving the requested parking increase. On March 6, 2018, U.S. Environmental Protection Agency (EPA) formally amended the Massachusetts State Implementation Plan (SIP) to accommodate an increase of 5,000 spaces in the Logan Airport Parking Freeze.

Comment #	Author	Topic	Comment	Response
Terminal E Modernization Project C.23	Matthew Beaton, Secretary	General	The ESPR and EDR provide a cumulative analysis of Logan Airport operations, environmental impacts, and mitigation measures. Review of individual projects proceeds within the context of this long-term planning and analysis of cumulative impacts. The record of MEPA review clearly demonstrates that Massport has and continues to identify impacts associated with individual projects within the context of long-term plans and cumulative impacts of Logan Airport. Cumulative impacts and project specific impacts will continue to be assessed on separate tracks; they will complement each other and ensure that projects are not viewed in isolation.	Massport is unique among state agencies and airports in the U.S. for publishing annual environmental reports specifically designed to describe, analyze, and project the cumulative effects of Logan Airport operations based on current and anticipated future operating conditions. This process was developed to allow individual projects at Logan Airport to be considered and analyzed in the broader, airport-wide context. A brief overview of that long-standing process follows. Massport has been producing annual reports for MEPA and for public review since 1979. Initially, these annual reports were called the Generic Environmental Impact Report (GEIR) and are now called Environmental Status and Planning Reports (ESPR) with interim Environmental Data Reports (EDR). These reports assess the environmental effect of overall changes in operations at Logan Airport. The reports provide an overall context, within which changes in the total environmental impacts at Logan Airport can be assessed. As stated in the Introduction to the 1999 ESPR, "While the Logan ESPR and EDRs provide the broad planning context for projects proposed for Logan Airport and future planning concepts under consideration by Massport, no specific projects can be built solely on the basis of inclusion and discussion in the 1999 ESPR." Projects that require state (MEPA) or federal (NEPA) review undergo a separate review process. In short, Massport's annual reports provide the planning context which complements the individual, project-specific filings. This *2016 EDR* and the following *2017 ESPR* will continue to report on baseline and cumulative impacts of overall airport operations.
Terminal E Modernization Project C.28	Matthew Beaton, Secretary	General	In recognition of the comment letters that raise concerns with cumulative airport-wide impacts pertaining to traffic and parking, air quality, and noise and, consistent with the MEPA review structure for Logan Airport, I am requiring Massport to respond to comments regarding airport operations and cumulative impacts in subsequent ESPR and/or EDR documents.	This *2016 EDR* addresses comments regarding airport operations and cumulative impacts. While the next annual report was originally scheduled to be a *2016 ESPR*, with approval from EEA, Massport has prepared an EDR for 2016. The key difference between the two documents is that the ESPR provides future forecasts for airport activity levels and environmental conditions. In the past few years, passenger demand trends for air travel have been rapidly increasing and the air carrier landscape is changing. Additionally, the ground transportation arena at Logan Airport has also changed rapidly with the introduction of TNCs such as Uber and Lyft. Due to these rapid changes, Massport needs additional time to understand these trends and what it means for future activity levels and airport ground access. Massport will have a clearer sense of the effect of TNCs at Logan Airport after a full year of data has been collected. Therefore, Massport will prepare a *2017 ESPR* which will include an updated future forecast and a better understanding of future ground transportation options to and from Logan Airport. The scope for this document was established by the Secretary's Certificate dated March 9, 2018, which is included in Appendix A, *MEPA Certificates and Responses to Comments*. This *2016 EDR* fulfills all requirements laid out in the Secretary's Certificate. Future year forecasts and impact assessments will be provided in the *2017 ESPR*. See the cover letter and Chapter 1, *Introduction/Executive Summary* of this *2016 EDR* for more information.
C.29	Matthew Beaton, Secretary	General	The 2015 EDR Scope includes reporting on noise, air quality, and long-term parking management.	The *2016 EDR* includes an assessment of Airport-wide noise (Chapter 6, *Noise Abatement*), air quality conditions (Chapter 7, *Air Quality/Emissions Reduction*), and the status of Massport's Long-Term Parking Management Plan (Chapter 5, *Ground Access to and from Logan Airport*).

Comment #	Author	Topic	Comment	Response
C.30	Matthew Beaton, Secretary	Activity Levels	The 2016 ESPR should revise growth projections based on the changes in the Terminal E Modernization Project that occurred subsequent to the 2011 ESPR (if necessary).	The *2017 ESPR* will update aircraft operations and passenger activity levels through 2035 based on aviation industry trends, economic, and demographic factors. Consideration will also be given to the Federal Aviation Administration's (FAA's) terminal area forecasts. While the next annual report was originally scheduled to be a *2016 ESPR,* with approval from EEA, Massport has prepared an EDR for 2016. The key difference between the two documents is that the ESPR provides future forecasts for airport activity levels and environmental conditions. In the past few years, passenger demand trends for air travel have been rapidly increasing and the air carrier landscape is changing. Additionally, the ground transportation arena at Logan Airport has also changed rapidly with the introduction of TNCs such as Uber and Lyft. Due to these rapid changes, Massport needs additional time to understand these trends and what it means for future activity levels and airport ground access. Massport will have a clearer sense of the effect of TNCs at Logan Airport after a full year of data has been collected. Therefore, Massport will prepare a *2017 ESPR* which will include an updated future forecast and a better understanding of future ground transportation options to and from Logan Airport. The scope for this document was established by the Secretary's Certificate dated March 9, 2018, which is included in Appendix A, *MEPA Certificates and Responses to Comments* . This *2016 EDR* fulfills all requirements laid out in the Secretary's Certificate. Future year forecasts and impact assessments will be provided in the *2017 ESPR* . See the cover letter and Chapter 1, *Introduction/Executive Summary* of this *2016 EDR* for more information.
C.31	Matthew Beaton, Secretary	Ground Access	It should also should reflect the proposed connection to the Airport Station and identify the anticipated ridership, changes in the HOV mode share, and ground access planning considerations.	A review of ridership and trainset capacity on the Massachusetts Bay Transportation Authority (MBTA) Blue Line indicates that there is significant reserve capacity (passenger space available within the trainset) on the Blue Line during the peak hour in the peak direction. Even with a doubling of Blue Line use by air passengers, there is still significant Blue Line capacity available. This *2016 EDR* reports on HOV mode share, ridership, and ground access planning in Chapter 5, *Ground Access to and from Logan Airport.*

This Page Intentionally Left Blank.

Copy of the Secretary of the Executive Office of Energy and Environmental Affairs Certificate issued for the Terminal E Modernization Project Draft Environmental Assessment/Environmental Impact Report and Responses to Comments

This Page Intentionally Left Blank.

The Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Charles D. Baker
GOVERNOR

Karyn E. Polito
LIEUTENANT GOVERNOR

Matthew A. Beaton
SECRETARY

Tel: (617) 626-1000
Fax: (617) 626-1081
http://www.mass.gov/eea

September 16, 2016

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS ON THE DRAFT ENVIRONMENTAL IMPACT REPORT

PROJECT NAME	: Terminal E Modernization
PROJECT MUNICIPALITY	: East Boston
PROJECT WATERSHED	: Boston Harbor
EEA NUMBER	: 15434
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: July 20, 2016

As Secretary of Energy and Environmental Affairs, I hereby determine that the Draft Environmental Impact Report (DEIR) submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (MEPA; M.G.L. c.30, ss.61-621) and with its implementing regulations (301 CMR 11.00). Consistent with Section 11.08 (8)(b)(2)(b) of the MEPA regulations, I am requiring the Proponent to file responses to comments on the DEIR and draft Section 61 Findings. The responses to comments and draft Section 61 Findings shall be filed, circulated, and reviewed as a Final Environmental Impact Report (FEIR). C.1

Comments on the DEIR reflect myriad concerns regarding existing airport operations and noise levels and potential increases in impacts associated with long-term growth. I have received comment letters from elected officials, including U.S. Congressman Michael E. Capuano, State Senator Joseph Boncore, State Representative Adrian Madaro, Boston City Councilor Salvatore LaMattina, and Chelsea City Councilor Roy Avellaneda. Comments were also submitted by municipalities, State and regional agencies, environmental advocacy groups, businesses and residents. The issue of cumulative airport-wide impacts, particularly noise and air quality, is not new to the review of projects at Logan Airport. As noted in past Certificates, the EIR is not intended to address broad concerns associated with airport operations and growth. The venue for addressing cumulative environmental impacts is through the Environmental Status and Planning Reports (ESPR) and Environmental Data Reports (EDR). Through these reports, Logan Airport is subject to comprehensive and regular MEPA review, including opportunities for public comment on the cumulative impacts. This regular updating and reporting on planning and cumulative impacts is unique among State Agencies. It reflects the challenge and complexity of

managing and modernizing Logan Airport within a dense, urban area. It recognizes that the proximity of communities to the Airport warrants an enhanced level of public engagement and a concerted, long-term effort to minimize and mitigate impacts.

Subsequent ESPRs and EDRs will update the cumulative impacts of passenger growth and associated ground and aircraft operations based on revised forecasts and update and revise environmental management plans to address impacts. C.2 Future submittals will continue to document potential impacts and trends and propose measures to implement the broad goal of maintaining or reducing Logan's overall environmental impacts, even as annual passenger volumes rise in the future. The next ESPR will analyze calendar year 2016 and will likely be filed in 2017 or 2018 and the next EDR will analyze calendar year 2015 and will likely be filed in the fall of 2016. C.3

Over the past year, Massport has engaged in a concerted outreach effort with elected officials, municipalities and community groups to identify and discuss potential Massport projects, including but not limited to, Terminal E. Massport created the Logan Airport Impact Advisory Group (IAG) to solicit comment and to identify and prioritize projects and programs of significance to the IAG. One project prioritized through this process is the construction of a pedestrian connection between the Massachusetts Bay Transportation Authority (MBTA) Blue Line Airport Station to Terminal E. Massport has incorporated this connection into the Terminal E project. I commend Massport for its outreach efforts which have been beneficial to informing the MEPA process. I encourage Massport to continue a productive dialogue with interested stakeholders, including through the IAG. C.4

Project Description

The project proposes modernizing Boston-Logan International Airport's John A. Volpe International Terminal (Terminal E) with a 560,000-square foot (sf) addition that corrects facility deficiencies and accommodates current and anticipated passenger volumes. The project includes three gates which previously underwent MEPA review (International Gateway Project, EEA #9791) but were not constructed, and four additional aircraft gates, passenger holdrooms, concourse, concessions, and passenger processing areas. The project includes Customs and Border Patrol (CBP) and Federal Inspection Services (FIS) facilities to replace and expand FIS facilities that were originally reviewed under MEPA (Terminal B, Pier A Improvements/Satellite FIS Facility, EEA #12235) but also not constructed. The project includes a direct pedestrian connection between Terminal E and the MBTA Blue Line Airport Station.

Terminal E was constructed in 1974 with 12 gates and served 1.4 million annual passengers. In 2014, it served approximately five million passengers. The DEIR indicates that the current level of passenger activity routinely causes severe congestion in the terminal at peak times, leading to greatly reduced customer service, and inefficient operations in the terminal and gates. According to the DEIR, gate congestion leads to airside delays and inefficiencies on the North Apron. When no gates are available, arriving aircraft and passengers are held on the apron. The DEIR indicates that aircraft must use remote parking facilities at hardstands in the North Cargo Area and passengers are bused to the terminal during peak periods when there are insufficient gates. The DEIR builds upon the information presented in the ENF regarding challenges associated with current operations at Terminal E. Massport has clearly demonstrated the need for the project and made a compelling case for the expansion.

The DEIR provided additional information to clarify and revise project phasing. The project is proposed in two phases. Phase 1 will be constructed from 2018 – 2022 and will include construction of four new gates with associated passenger holdrooms and elevators/escalators to relieve existing deficiencies and accommodate interim growth. A partial new concourse will be constructed to allow for future expansion to a seven-gate facility at full build-out. Phase 1 will not require modifications to roadway realignment. Phase 2 will be built by 2028 and will provide three additional gates and the MBTA connection. The DEIR indicates the project will be fully constructed and operational by 2030. Due to planning and budget constraints, the MBTA pedestrian connection has been shifted from Phase 1 as proposed in the ENF to Phase 2. The DEIR indicates that no other significant changes have occurred since the ENF was filed.

The project will displace ground service equipment (GSE), other airside activities, existing surface parking, the cell phone lot, and the gas station which will be relocated within existing airport boundaries. Relocation of ground facilities that conflict with the new concourse location, including the gas station, will occur in Phase 1.

Environmental Status and Planning Report (ESPR) and Environmental Data Reports (EDRs)

The MEPA environmental review process for Logan Airport occurs on two levels: airport-wide and project-specific. The ESPR and EDR provide a "big picture" analysis of the environmental impacts of current and anticipated levels of airport-wide activities (including aircraft operations and passenger activity), and presents comprehensive strategies to avoid, minimize and mitigate impacts. The ESPR is generally updated on a five-year basis; the most recent ESPR for the year 2011 was filed in April 2013 and it contained updated passenger activity levels and aircraft operations forecasts through 2030. EDRs evaluate environmental conditions for the reporting year as compared to the previous year and are filed in the years between ESPRs. The most recent EDR for the year 2014 was filed in October 2015. The EDR provided a comprehensive cumulative analysis of the effects of all Logan Airport activities based on actual passenger activity and aircraft operation levels in 2014 and presents environmental management plans for addressing environmental impacts. The ESPR is supplemented by (and ultimately incorporates) the EDRs and the detailed analyses and mitigation commitments that emerge from project-specific reviews. This process provides a comprehensive and continuous review of airport programs, projects, environmental impacts and associated data.

The 2015 EDR Scope includes, but is not limited to, reporting on noise, air quality, and long-term parking management. The 2015 EDR and 2016 ESPR should reflect the proposed connection to the Airport Station, provide updates on the planning and design of the connection, and identify the anticipated ridership, changes in the HOV mode share, and ground access planning considerations. C.5

The MEPA regulations (Section 11.06(2)) indicate that during the course of an ENF review I may review any relevant information from any other source to determine whether to require an EIR, and, if so, what to require in the Scope. To provide context for this project-specific review and because many issues raised by commenters relate to airport-wide operations and impacts, this Certificate refers to documents from the ESPR process (EEA#3247/5146).

Logan Airport and Project Site

The Airport boundary encompasses approximately 2,400 acres in East Boston and Winthrop, including approximately 700 acres underwater in Boston Harbor. The Airport is surrounded on three sides by Boston Harbor and is accessible by two public transit lines and the roadway system. The airfield is comprised of six runways and approximately 15 miles of taxiway. Logan Airport has four passenger terminals, A, B, C, and E, each with its own ticketing, baggage claim, and ground transportation facilities.

Terminal E is located adjacent to the North Cargo Area, closest to the MBTA Blue Line Airport Station. Land uses in the area of the proposed project include UPS aircraft parking and loading area, the airport's Remain Over Night aircraft parking area, the North Cargo Area equipment storage area, a building occupied by United Parcel Service (UPS), the MBTA Blue Line Airport Station, airport roadways, various short-term and cell phone parking lots, and a gas station.

The project site is located within the coastal zone of Massachusetts. The entirety of the project site is comprised of previously disturbed impervious area. It is not located in Priority or Estimated Habitat as mapped by the Division of Fisheries and Wildlife's (DFW) Natural Heritage and Endangered Species Program (NHESP). The project site does not contain wetland resource areas regulated pursuant to the Wetland Protect Act and its implementing regulations (310 CMR 10.00).

The ENF identified the following projects within the vicinity of Terminal E that have been reviewed under MEPA: Terminal A Replacement (EEA#9329), Terminal E Modifications (EEA#9324), Federal Inspection Services (FIS) Facility and West Concourse Project / International Gateway (EEA#9791), and Terminal B, Pier A Improvements/Satellite FIS Facility (EEA#12235).

Permitting and Jurisdiction

The project is undergoing MEPA review and required an ENF pursuant to 301 CMR 11.03(6)(b)(6) because it will be undertaken by a State Agency and results in the expansion of an existing terminal at Logan Airport by greater than 100,000 sf.

The project requires a Sewer Permit Modification from the Boston Water and Sewer Commission (BWSC) and may require an Industrial User Permit from the Massachusetts Water Resource Authority (MWRA). The project may be subject to Massachusetts Office of Coastal Zone Management (CZM) federal consistency review.

The project requires approval by the Federal Aviation Administration (FAA) for changes to the Airport Layout Plan and, therefore, requires an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA). The project also requires a National Pollutant Discharge Elimination System (NPDES) General Permit for Construction from the U.S. Environmental Protection Agency.

Because the project will be undertaken by a State Agency, MEPA jurisdiction is broad in scope and extends to all aspects of the project that may cause Damage to the Environment, as defined in the MEPA regulations.

Environmental Impacts and Mitigation

As described in the ENF, the project includes construction of approximately 500,000 to 700,000 sf of new floor area (for a maximum 1,500,000 sf total), and will increase both water consumption and wastewater generation by approximately 25,600 gallons per day (76,800 gpd total). The project will not create new impervious area and will eliminate approximately 60 parking spaces. The DEIR indicates that the project will accommodate existing and forecasted passenger levels and operations and, therefore, will not increase passenger enplanements or vehicle trips.

Measures to avoid, minimize and mitigate project impacts include reducing air emissions, greenhouse gas (GHG) emissions, and energy consumption compared to existing conditions by improving access to gate plug-ins, pre-conditioned air, and reducing busing operations. In addition, the building is designed to act as a noise barrier to the adjacent residential areas and Memorial Stadium Park.

Review of the DEIR

The DEIR has been filed to provide additional information regarding the necessary details of design and development of the Terminal E expansion to support assessment of potential impacts and has been coordinated with the federal NEPA process. In accordance with my Certificate on the ENF, the Environmental Assessment (EA) as required under NEPA formed the basis of the DEIR.[1] This Certificate applies to the review of the project under MEPA only, and does not restrict the ability of the federal government to act on those aspects of the project subject to NEPA. The DEIR included FAA's draft Finding of No Significant Impact (FONSI). The DEIR described the proposed project, identified existing conditions, described potential environmental impacts and mitigation measures, and provided an expanded discussion of alternatives. It included an update on state, local, and federal permitting and provided a discussion of permitting requirements and the project's consistency with regulatory standards. At Massport's request, the comment period was extended by three weeks to September 9, 2016. C.6

The DEIR identified ongoing projects that are currently under construction and are assumed to be completed prior to commencement of construction for the Terminal E Project. It also identified a potential parking garage, which is predicated on the approval of a draft regulatory change by MassDEP to amend the Logan Airport Parking Freeze Regulation (310 CMR 7.30). The DEIR indicates that the potential parking garage will be subject to MEPA review pursuant to 301 CMR (6)(a)(7) because it will be constructed by a State Agency and will include construction of 1,000 or more new parking spaces. This project is conceptual in nature and the DEIR did not provide a schedule or timeline for its design or construction or for initiating MEPA review. I encourage Massport to consult with the MEPA Office prior to preparing an ENF for this project. C.7

[1] The Federal Aviation Administration (FAA) is reviewing the project as an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA).

Environmental Justice Policy

I have received numerous comment letters regarding environmental justice and concerns that the burden of cumulative noise, air pollution, and traffic impacts associated with growth and increased operations will be borne by neighboring communities, independent of this specific project. The Executive Office of Energy and Environmental Affairs (EEA) Environmental Justice Policy (EJ Policy) was designed to improve protection of low income and communities of color from environmental pollution as well as promote community involvement in planning and environmental decision-making to maintain and/or enhance the environmental quality of their neighborhoods. Massport provided outreach consistent with the spirit and intent of the enhanced public participation provisions of the EJ Policy. Massport requested and was granted an extension of the comment period to provide additional time to review and comment on the DEIR. The meeting notice was published in English and Spanish in the Boston Herald and the East Boston Times. Spanish language translation was also provided at a Public Information Meeting held the evening of August 10, 2016 at the Mario Umana Middle School Academy Auditorium in East Boston. I received many comment letters requesting Massport provide a Spanish language version of the Executive Summary provided with the DEIR filing. Massport has indicated it will provide a Spanish translation of the DEIR Executive Summary. I encourage Massport to continue providing translated Executive Summaries with all future MEPA filings. C.8

Alternatives Analysis

The DEIR included an expanded alternatives analysis that identified the planning metrics, facility requirements, and assumptions used to design the project and to determine the final number of gates based on the passenger projections for year 2030. The DEIR provided a gating analysis for forecast passenger activity and aircraft operations levels to determine the number of gates required to accommodate the volumes of passengers and aircraft that will be arriving and departing at Terminal E during the average weekday peak-hours. As described in the DEIR, Massport has limited control over the scheduling of transatlantic flights, which are subject to lengthy flight times and time zone changes that cause arrival and departure peaks to occur within a relatively short time period. The DEIR indicates that peak hour for international departures will be between 9:00 pm to 10:00 pm and the peak hour for international arrivals will be between 6:00 pm and 7:00 pm. According to the DEIR, approximately 1,954 passengers are projected to depart in 2030 during the peak hour (9:00 pm to 10:00 pm) and 1,885 passengers are projected to arrive during the peak hour (6:00 pm to 7:00 pm). Based on this, the gating analysis indicates that Logan Airport will require an additional seven gates for a total of 19 gates to efficiently support international operations.

The DEIR identified the number of planes that are forced to "hard stand" during peak hours due to lack of available gates under existing, future No-Build, and future Build-Conditions. As described in the DEIR, in the summer of 2015, aircraft scheduling demanded 13 gates, one more than the existing twelve gates. Throughout 2015, only 10 of the existing 12 Terminal E gates were available for use as two were decommissioned to allow for construction of the Terminal E Renovation and Enhancements Project. From April to September 2015, facility constraints at Terminal E resulted in 293 gate-delays, which affected approximately 44,000 passengers and 49 ramp busing operations to remote hardstands which affected over 8,200 passengers. As described in the DEIR, aircraft waiting for gates account for 55-percent of total delays at Terminal E, while busing operations to remote hardstands account for 11-percent of total delays. According to the DEIR, in the proposed (2030) Build-Condition, only two operations will require use of a "hard stand" and busing, whereas under the No-Build, 17 flights (arrival and departure) per day will require busing operations. The DEIR also included a summary of key aircraft gate and passenger terminal area facility program requirements for the proposed project to address current deficiencies and meet the needs for future anticipated aircraft and passenger handling.

The DEIR evaluated the following alternate configurations of the new terminal area and the North Apron:

- Alternative A: Separate Core Terminal – New linear concourse and terminal core, with new separate curb frontage.
- Alternative B: Concourse Extension – Extension from existing concourse extending westward from the Gate 12 area at the west end of Terminal E.
- Alternative C: Satellite Concourse – New portion of the terminal positioned as a separate two-sided concourse structure with underground passageway connecting the new gates to the existing terminal space.
- Alternative D: Extended Core Terminal *(Preferred Alternative)* – New extension of the existing concourse, terminal core, and terminal frontages.

Each alternative included seven new gates consistent with the need identified in the gating analysis. The key differences among the terminal configuration alternatives relate to efficiency of interior operations, frontage on the adjacent roadway, disruption to the existing operations during construction, and cost. With the exception of the ability to buffer ground noise from ground operations, there is little difference in environmental impacts among the alternatives. Alternative D was selected as it provides the greatest passenger processing efficiency, interior space, and noise buffering benefits compared to the other alternatives. Massport also evaluated three alternative roadway configurations based on the preferred terminal configuration. The three roadway alternatives (Bi-Level S-Curves, Single S-Curve, and Northern Loop Ramps) all extend the roadway frontage to facilitate drop-off and pick-up along the new building area, and realign the roadway ramps servicing Terminal E. The DEIR indicates that the roadway configurations have similar environmental impacts since the limit of work is currently fully developed and that all build options will replicate the existing traffic flow patterns. The Preferred Alternative (Single S-Curve) was selected as it provides the best alignment for traffic operations while minimizing the overall footprint.

Comments on the DEIR continue to request that Massport accommodate more demand at regional airports in lieu of or in conjunction with the proposed project. I acknowledge that long-term strategies to mitigate Logan's impacts will continue to include an emphasis on diverting travel to regional airports and to rail. As indicated in the Certificate on the ENF, regional transportation will continue to be addressed through the ESPR and EDR, not through this project specific review. C.9

GHG Emissions

Because I required an EIR, the project is subject to review under the May 2010 MEPA Greenhouse Gas (GHG) Emissions Policy and Protocol ("the Policy"). The DEIR included an analysis of GHG emissions and mitigation measures that is generally in accordance with the standard requirements of the MEPA GHG Policy and Protocol; however, the FEIR must address C.10

several issues. The DEIR did not address many of the comments and recommendations provided in the DOER ENF comment letter. I refer Massport to DOER's comment letter. In addition, discrepancies exist between the mitigation measures presented in Table 6-1 (Summary of Terminal E Modernization Beneficial Measures), the "Sustainability Features" narrative (Section 6.2.2), the Draft Section 61 Findings (Appendix B), and the information provided in the MEPA Greenhouse Gas Analysis Technical Report (Appendix G). It is unclear which GHG reduction measures have been committed to by the Proponent and which will continue to be evaluated. For example, many measures included in Table 6-1 which summarizes Massport's commitments to beneficial measures are subsequently referred to (in Section 6.2.2 of the narrative) as measures "to-be considered for their feasibility and applicability" during the preliminary design phase and later design phases. As indicated below, the Response to Comments must provide a detailed response to address each of the issues identified in DOER's comment letter and draft Section 61 Findings should be revised accordingly. C.11 C.12 C.13

The Base Case scenario is based on the 8th Edition of the Massachusetts Building Code that includes the International Energy Conservation Code 2012. The eQUEST v.3.64 modeling software was used to perform the GHG analysis. The DEIR indicates that Massport will build the Terminal E project to achieve LEED Silver or higher certification. The DEIR summarized the following design mitigation measures that were modeled in the GHG analysis and proposed for adoption by the Proponent: C.14

- Improved building envelope (wall insulation of U-0.05, roof insulation of U-0.037, improved glazing of U-0.34, and reduced window to wall ration of 25%)
- Improved Air Handling Units (Variable Air Volume with reduced fan power per cfm; dual enthalpy air economizer to maximize benefit of using outdoor air to condition the building; automatic rest of fan static pressure and supply air temperature based on space loading to reduce fan power, cooling energy, and heating energy);
- Efficient water loops with reduced water supply temperature and wider return temperatures to reduce demand on the pumping and fan systems; and
- Reduced interior lighting power density (LPD) of 0.62 W/SF and reduced exterior lighting power of 9.3 kW.

These design measures were not identified in Table 6-1 or specifically identified in the draft Section 61 Findings. They should be incorporated into revised draft Section 61 Findings. The DEIR identifies the several energy conservation measures that were considered and eliminated primarily for concerns regarding constructability, ease of operations and maintenance and cost. Measures that were eliminated include automated reflective interior blinds to reduce solar heat gain, geothermal heat pumps, fan cycling based on occupancy load, and combined heat and power (CHP). I refer the Proponent to DOER' s comment letter which recommends further evaluation of CHP to address Terminal E's service water loads. Massport has indicated that conversion of the equipment at Logan's Central Heating and Cooling Plant will be evaluated as the equipment reaches the end of its useful life. I expect that further evaluation of CHP will be evaluated as part of that process and reported in future EDRs and ESPRS. C.15 C.16 C.17

Massport has committed to evaluate the following energy efficiency measures as project design progresses: dual box minimum, fin tube radiation, energy recovery wheel, dynamic V8 filtration, and implementation of a solar photovoltaic (pv) array. According to the DEIR, these C.18

measures could increase energy savings by 70% compared to the currently proposed project. C.18
However, the DEIR does not indicate why these mitigation measures cannot be incorporated into the project design at this time nor does it identify the additional analysis that would be required to inform a determination during subsequent design. C.19 In addition, Section 6.2.2 of the DEIR notes that Massport will investigate the feasibility of providing 2.5% of the project's power with on-site renewable energy through the use of Solar PV; and the Greenhouse Gas Analysis Technical Report (Appendix G) indicates that a 300 kW solar PV array may continue to be evaluated for inclusion in the project. As part of this evaluation, Massport should identify the total rooftop area available for a potential solar PV array and perform a financial feasibility analysis. To date Massport has installed a total of approximately 916 kW of solar PV at Logan and Hanscom airports. The FEIR should identify the basis for delaying a decision regarding installation of a C.20 solar PV project on the rooftop of Terminal E or, at a minimum, re-affirm the commitment to build it as "solar ready" until subsequent design phases. C.21

Stationary source GHG emissions associated with the energy use of the proposed Terminal E expansion are estimated to generate 5,850 tpy of CO_2 in the Base Case Scenario. Through the adoption of energy efficiency measures, the Preferred Alternative will reduce CO_2 emissions associated with the terminal expansion by 685 tpy, for a total of 5,165 tpy, or a 11.7 percent decrease. The GHG analysis also evaluated total net new GHG emissions from aircraft, GSE, airside ground access vehicles, and additional energy demand associated with the Terminal E expansion. The FAA's Aviation Environmental Design Tool (AEDT) and EPA's MOVES and NONROAD models were used to calculate the GHG emissions associated with the operations, including aircraft engines, GSE/auxiliary power units (APUs), and ground access vehicles. Changes to operations are estimated to reduce GHG emissions by an additional 5,371 tpy.

Climate Change Adaptation and Resiliency

The DEIR described the project's consistency with Massport's Disaster and Infrastructure Resiliency Planning (DIRP) Study and Floodproofing Design Guide. Terminal E will be above the projected 2070 coastal flood elevation. The Design Guide establishes Design Flood Elevations (DFEs) that are more conservative than existing building code requirements. The DEIR indicates that the first level of the project and associated utilities and critical equipment is generally located above the DFE. In areas where spaces must be located below the DFE, critical areas will be flood proofed or protected through use of the following measures: watertight shields on doors, windows, and louvers; exterior and interior membranes and sealants; drainage collection systems and sump pumps; early warning devices to monitor water levels; sealing electrical conduits and other utilities; back-flow preventer valves on drainage and sanitary sewer piping; and use of flood openings to equalize hydrostatic pressure. The DEIR notes that Massport has consulted with CZM regarding development of coastal resiliency design measures. Massport will continue consultations with CZM and MBTA and to review existing station vulnerabilities, as operations of the Blue Line and this station are important to support Massport C.22 HOV goals. Updates on this consultation and the design measures that are considered and/or incorporated into the design to improve the MBTA station's coastal resiliency should be provided in the EDR and ESPR documents.

Air Quality

The DEIR included an analysis to determine whether and to what extent the proposed project will increase criteria pollutants. The analysis evaluated changes in emissions from aircraft engines, APUs and GSE, airside vehicles, and airport passenger and employee motor vehicles under the 2030 No-Build and 2030 Build scenarios. The FAA's AEDT was used to evaluate changes in emissions from aircraft ground operations. EPA's MOVES and NONROAD models were used to evaluate changes in emissions from ground support equipment and motor vehicle emissions. Results of the analysis indicate that total emissions of all pollutants will decrease within the project area under future conditions with the proposed project compared to future conditions without the project.

	Carbon Monoxide	Volatile Organic Compounds	Nitrogen Oxides	Sulfur Oxides	Particulate $Matter_{10}$	Particulate $Matter_{2.5}$
2030 No-Build	294 tpy	35 tpy	59 tpy	9 tpy	11 tpy	4 tpy
2030 Build Condition	268 tpy	33 tpy	33 tpy	6 tpy	10 tpy	3 tpy
Percent Change	-9%	-6%	-44%	-33%	-9%	-25%

The DEIR indicates that the reductions are largely due to the availability and use of gate-furnished electricity and air conditioning rather than APUs while parked at hardstands; reduced reliance on GSE to transport passengers, baggage, and cargo; and improved aircraft operational conditions (e.g., less congestion and delay) on the taxiways and aprons. The DEIR indicates that project complies with the applicable emission thresholds contained in the State Implementation Plan (SIP) and will not cause or contribute to a violation of the National Ambient Air Quality Standards (NAAQS). The DEIR quantified temporary construction-related impacts and confirmed that construction-related emissions will not exceed applicable emission thresholds.

Total air quality emissions from all sources at Logan Airport in recent years are significantly less than they were a decade ago; however, the 2014 EDR demonstrated that total emissions are increasing incrementally. The overall reduction is associated with industry trends of accommodating the demands of increasing passenger and cargo activity levels with fewer aircraft operations generating fewer emissions. Massport will continue to assess the applicability C.23 of emissions reduction measures to the extent practicable and report on air quality in the ESPR and the EDR.

Noise

The DEIR asserts that the project will not result in any changes to the number and type of aircraft operations when compared to the Future No-Build Alternative. It indicates that demand C.24 is driven by economic and market factors; and, therefore, growth at Logan Airport will continue to occur regardless of the Terminal E project. Cumulative impacts will continue to be addressed through the ESPR and EDR.

The DEIR included a noise evaluation which evaluated project-related ground noise conditions and the ability of the terminal extension to mitigate noise. The noise model also identified how changes in the use of Terminal E gates and the North Cargo Area will affect ground noise levels. The extension of Terminal E has been designed to provide a noise barrier between the airport and the community. It will result in reduced noise levels at Jeffries Point, East Boston Memorial Park, and most residential areas in East Boston west of the ramp areas between Route 1A and Putnam Street. Specifically, the project will reduce noise from aircraft ground operations near Terminal E by five to 18 dB and from single event maximum noise levels by two to 15 dB in the Jefferies Point neighborhood. It will reduce noise from aircraft ground operations near Terminal E by three to 15 dB and from single event maximum noise levels by 1 to eleven dB in the Bremen Street area south of Putnam Street to Route 1A. The DEIR indicates that the project will not result in a significant noise increase within the Day-Night Average Sound Level (DNL) 65 dB contour.

I received many letters which identify a particular concern with concentrations of flight tracks and increased flight frequency due to the FAA's area navigation (RNAV) procedures. The primary purpose of the RNAV procedures is to increase safety and operational efficiency. As documented in the ESPR and annual EDR submittals, implementation of several of the RNAV procedures have generated increased noise complaints in some towns surrounding Logan Airport and I have received many comment letters from residents of the Town of Hull on this issue. The procedures themselves have resulted in aircraft at higher altitudes although patterns are concentrated over certain communities. I note that the FAA is implementing the RNAV program nation-wide. This program is separate from and unrelated to the Terminal E Modernization project. Through my review of the ESPR and EDRs, I am aware of The Boston Logan Airport Noise Study (BLANS)[2]; an ongoing and joint effort between the FAA, Massport, and the Logan Airport Citizen Advisory Committee (CAC). The RNAV procedures to Runways 27, 4L, and 33L were subject to review during Phase 3 of the BLANS[3]. The purpose of Phase 3, currently underway, is to identify opportunities to balance the use of Logan's runways and reduce persistent noise over communities. Flight operations are significantly lower than historic levels; however, I acknowledge that projected increases in flight operations will increase cumulative noise impacts compared to existing conditions. As noted previously, the ESPR and EDRs provide a forum and meaningful opportunities for public review of information and analysis related to these issues. I also encourage residents to contact their CAC representatives to identify additional methods to participate in improving the noise environment around Boston-Logan Airport.

C.25

C.26

Construction Period

The DEIR provided additional construction phase information (presented below in the Mitigation Measures section) to identify construction period impacts and measures to control construction traffic, air quality, noise, and water quality impacts.

Mitigation/Draft Section 61 Findings

The DEIR contained a separate chapter on mitigation measures and provided draft Section 61 Findings in an Appendix. It generally describes mitigation measures and contains commitments to mitigation. As noted earlier, additional clarity is necessary regarding those

C.27

[2]Information on the Boston Logan Airport Noise Study can be found at http://www.bostonoverflight.com/index.aspx
[3] These environmental documents can be found at http://www.bostonoverflight.com/phase3_documents.aspx

measures that are commitments and those that will be evaluated as project design progresses. This is particularly relevant to the GHG mitigation measures. The Proponent has committed to implement the following measures to avoid, minimize, and mitigate environmental impacts:

C.27 Cont.

Operational Impacts

- The Terminal E expansion has been sited and will be designed to act as a noise barrier to the adjacent East Boston neighborhoods and Memorial Stadium park to the southwest of the North Apron. The new structures will have a minimum height of 45-ft above ground level.
- New gates will have electric power and pre-conditioned air to allow aircraft to plug in at gate rather than be serviced remotely to reduce need for on-board engine/auxiliary power unit operation, thereby reducing aircraft air emissions and GHG emissions.
- New gates will increase ramp efficiency and reduce movements on North Apron and the need to bus passengers between terminal and remote aircraft parking locations, thereby reducing ground transportation related air emissions and mobile source GHG emissions.
- Roadway and curb improvements which will improve vehicle flow and high-occupancy vehicle access.

Sustainable Design Features/Greenhouse Gas Emissions

- Improved building envelope (wall insulation of U-0.05, roof insulation of U-0.037, improved glazing of U-0.34, and reduced window to wall ratio of 25%).
- Improved Air Handling Units.
- Efficient water loops with reduced water supply temperature and wider return temperatures to reduce demand on the pumping and fan systems.
- Reduced interior lighting power density of 0.62 W/SF and reduced exterior lighting power of 9.3 kW.
- The roof design will incorporate materials with a minimum reflectance rating of 0.70 and emittance value of at least 0.75 for a minimum of 75% of the available roof area. Roofing materials will be non-glare to reduce heat island effect.
- Final design will incorporate infrastructure for collection, storage, and handling of recyclable materials.
- The contractor will be required to develop a construction waste management plan that requires diversion or reduction of construction waste by at least 75%.
- Massport will establish a project-specific goal for sourcing materials extracted, harvested, recovered, and or manufactured within New England.
- The project will be designed to achieve energy efficiencies of a minimum of 20% below the MA Energy Code.
- Continued investigation into the feasibility of supplying 2.5% of the project's power with on-site renewable energy systems.
- The project will be developed to accommodate rooftop solar.
- Project will include water conservation devices that reduce water use by 20% below the MA Plumbing Code.
- Project will incorporate occupancy sensors in all indoor areas to reduce electrical demand.

Construction Period

- Work hours will be limited to 7:00 AM to 5:00 PM unless constrained by operational conditions at the Airport.

- Adequate storage areas for construction supplies will be maintained on airport property.
- Soil Management Plan will be developed based on sub-surface investigations to address identification and disposal of contaminated materials.
- Stormwater Pollution Prevention Plan will be developed to keep sediment and contaminants out of the stormwater management system during construction.
- Management Plan for Dewatering will be developed (if required) to address requirements for testing, handling, and treatment prior to discharge of contaminated groundwater.
- Rodent control, inspection, monitoring, and treatment will be carried out before, during, and after completion of all foundation and utilities demolition and construction work. Rodent extermination prior to work will consist of treatment throughout the project area, including building exteriors and interiors and will continue throughout construction.
- Noise control techniques will be used to reduce noise from pile driving by at least 5 A-weighted decibels (dBA) below unmitigated levels through enclosing the point of impact for the pile drive; installation of an impact cushion between the pile drive and the pile; or requiring the application of energy-absorbing material to steel piles.
- Measures to reduce ground transportation impacts from project construction include:
  - Designated truck routes designed to keep construction-related traffic off of residential streets unless they are seeking construction-related access to or from local businesses.
  - Concrete production/batching will occur in existing plants with access to Route 1A or I-90 to reduce on-airport activities and to consolidate truck trips.
  - Construction companies will be encouraged to provide off-Airport parking for their employees and to provide shuttle services from these locations.
- The following measures will address construction phase air quality impacts:
  - Enforcement of construction vehicle anti-idling provisions;
  - Retrofitting diesel construction equipment with diesel oxidation catalysts and/or particulate filters;
  - Fugitive dust will be controlled via wetting or sweeping and all trucks hauling materials from the construction site will be covered.

Responses to Comments

The Response to Comments should contain a copy of this Certificate and a copy of each C.28
comment letter received on the DEIR. Comment letters may be provided electronically on a CD. C.29
As many of the comment letters identify similar concerns, the FEIR may contain a thematic C.30
response to comments to the extent that they are within MEPA jurisdiction. The response can
also refer to future EDRs and/or ESPRs to address issues that are not within the Scope of this C.31
review. This directive is not intended, and shall not be construed, to enlarge the scope beyond
what has been expressly identified in this Certificate. I recommend that Massport employ an C.32
indexed response to comments format, supplemented as appropriate with direct narrative
response. C.33

The response to comments section should address specific comments from DOER and a
revised GHG analysis should be provided, if necessary to provide a meaningful response. The C.34
Response to Comments should clarify GHG reduction measures and to demonstrate that GHG
emissions will be minimized, avoided, and mitigated to the maximum extent practicable. I expect C.35
that the FEIR will provide a comprehensive and thoughtful response to the DOER comment
letter and that Massport will consult with DOER prior to filing the Response to Comments. C.36

Mitigation/Draft Section 61 Findings

The Response to Comments should include revised draft Section 61 Findings which
should include a complete list of all mitigation measures developed through MEPA review of the C.37
project, including but not limited to, measures specifically incorporated into the terminal design
or operational measures to minimize GHG emissions. The Section 61 findings should clarify
which GHG mitigation measures are proposed as mitigation and which will continue to be
evaluated. It should reconcile the data contained in Table 6-1, Sustainability Features narrative in C.38
Section 6.2.2, and the information provided in the GHG Analysis Technical Report (Appendix
G). The revised draft Section 61 Findings should clarify the reduction in GHG emissions
(compared to the base case) that is being committed to as mitigation. The draft Section 61 C.39
Findings should also identify whether each mitigation commitment will be incorporated or
provided as part of Phase 1, Phase 2, or both phases of the project. C.40

To ensure that all GHG emissions reduction measures adopted by the Proponent in the
Preferred Alternative are actually constructed or performed, I require proponents to provide a
self-certification to the MEPA Office. Specifically, Massport must provide a certification to the C.41
MEPA Office signed by an appropriate professional (e.g., engineer, architect, transportation
planner, general contractor) indicating that the all of the mitigation measures proposed in the EIR
have been incorporated into the project. Alternatively, Massport may certify that equivalent
emissions reduction measures that collectively are designed to reduce GHG emissions by the
same percentage as the measures outlined in the EIR, based on the same modeling assumptions, C.42
have been adopted. The certification should be supported by plans that clearly illustrate where
GHG mitigation measures have been incorporated. For those measures that are operational in
nature (i.e. TDM) the Proponent should provide an updated plan identifying the measures, the
schedule for implementation and how progress towards achieving the measures will be obtained. C.43
The commitment to provide this self-certification in the manner outlined above should be
incorporated into the draft Section 61 Findings included in the EIR.

Circulation

In accordance with Section 11.16 of the MEPA Regulations and as modified by this
Certificate, Massport should circulate a hard copy of the FEIR to each State and City Agency C.44
from which the Proponent will seek permits. Massport must circulate a copy of the FEIR to all
other parties that submitted individual written comments. Per 301 CMR 11.16(5), the Proponent C.45
may circulate copies of the FEIR to these other parties in CD-ROM format or by directing
commenters to a project website address. However, Massport should make available a reasonable
number of hard copies to accommodate those without convenient access to a computer and
distribute these upon request on a first-come, first-served basis. Massport should send C.46
correspondence accompanying the CD-ROM or website address indicating that hard copies are
available upon request, noting relevant comment deadlines, and appropriate addresses for
submission of comments. A CD-ROM copy of the filing should also be provided to the MEPA
Office. A copy of the EIR should be made available for review at the following Libraries: Boston
Public Library – Main, Connolly, Orient Heights, Charlestown, and East Boston Branches, C.47
Chelsea Public Library, Winthrop Public Library, Revere Public Library, Everett Public Library,
Milton Public Library, and Hull Public Library.

Conclusion

Based on a review of the DEIR, consultation with State Agencies, and a review of comment letters, I have determined that the DEIR adequately and properly complies with MEPA and its implementing regulations. The Proponent may submit the Response to Comments and draft Section 61 Findings as the FEIR.

C.48

September 16, 2016
Date

Matthew A. Beaton

Comments received:

7/28/2016	Greater Boston Convention & Visitors Bureau
8/1/2016	MassEcon
8/1/2016	Murphy, Hesse, Toomey & Lehane, LLP on behalf of the Town of Milton
8/3/2016	Local 22, Construction & General Laborers' Union
8/3/2016	Mary J. Ryan
8/3/2016	Air Impact Relief (AIR) via Aaron Toffler
8/5/2016	American Council of Engineering Compananies of Massachusetts (ACEC/MA)
8/5/2016	Associated Industries of Massachusetts (AIM)
8/10/2016	Conference of Boston Teaching Hospitals
8/11/2016	Boston Financial Services Leadership Council (BFSLC)
8/11/2016	Susanna Starrett
8/12/2016	Massachusetts Business Roundtable
8/14/2016	Magdalena Ayed
8/15/2016	Juan Ramos
8/15/2016	Linda Barber
8/15/2016	Sema Bekiroglu
8/16/2016	Town of Hull, Philip Lemnios, Town Manager
8/16/2016	Edward J. MacLean
8/16/2016	Renee MacLean
8/17/2016	Andrea White
8/17/2016	David Gardner
8/17/2016	Eugene Courier
8/17/2016	Evie Rose
8/17/2016	Herb Zeller
8/17/2016	Hull Neighbors for Quiet Skies
8/17/2016	Ira Fleishman
8/17/2016	Jen Hartnett-Bullen

8/17/2016	Joe Berkeley
8/17/2016	Juliet Floyd
8/17/2016	Karen Delano
8/17/2016	Kathy A. Beitler
8/17/2016	Linda Karoff
8/17/2016	Lisa Borden
8/17/2016	Maria Graceffa
8/17/2016	Mary Schultz
8/17/2016	Michael Doiron
8/17/2016	Michael Parks
8/17/2016	Philip R. Delano
8/17/2016	Richard Monarch
8/17/2016	Robert Stenberg
8/17/2016	Rosanne Bush
8/17/2016	Sallyann Kakas
8/17/2016	Sarah & Harold Chisholm
8/17/2016	Susan Ovans
8/17/2016	Thomas Hardey
8/17/2016	Tim Fox
8/17/2016	Val Woolley
8/18/2016	Betsy Lewenberg
8/18/2016	Jeff Kerr
8/18/2016	Karen Walsh
8/18/2016	Lloyd Emery
8/18/2016	Nancy Curtis
8/18/2016	Robyn Riddle
8/18/2016	Sheila Connor
8/18/2016	Stephen Etkind
8/18/2016	Nicole Dunn
8/18/2016	Patricia Hynes
8/18/2016	Mr. and Mrs. Tomassini
8/18/2016	Pamela Loring
8/18/2016	Canice Thynne
8/18/2016	John Brennan
8/18/2016	James & Barbara Barrow
8/18/2016	Rebecca and Tillmann Hein
8/18/2016	Stephanie B. Shafran
8/18/2016	Diane & George Nassopoulos
8/18/2016	Chris Maher
8/18/2016	Donna Goes
8/18/2016	Liz West
8/18/2016	Mary Devin
8/18/2016	Marjorie E. Wiseman
8/18/2016	Ellen

8/18/2016	Dorothy Tan
8/18/2016	Charleen Tyson
8/19/2016	Searose@comcast.net
8/19/2016	Town of Milton, Board of Selectmen
8/19/2016	Liz Kinkead
8/19/2016	Colleen MacDonald
8/19/2016	A Better City
8/19/2016	Steve West
8/19/2016	Lois Freedman
8/19/2016	Pam Sargent
8/19/2016	Paul Karoff
8/19/2016	Neill K. Ray
8/19/2016	Arlington and Belmont Representatives to the Logan CAC and Massport CAC
8/19/2016	Kathleen T. McCarthy
8/19/2016	William G. McCarthy
8/19/2016	Boston Harbor Now
8/19/2016	Andrew Schmidt
8/19/2016	Alex D. Doucette
8/19/2016	Massachusetts Department of Environmental Protection (MassDEP)
8/20/2016	Robert Banzett
8/22/2016	Association of Independent Colleges and Universities in Massachusetts (AICUM)
8/23/2016	Patricia McKinley
8/23/2016	Maria Argos Barber
8/23/2016	Joshua Acevedo
8/23/2016	Elizabeth Kay
8/25/2016	Elda Prudden
9/6/2016	Tom Carey
9/6/2016	Congressman Michael Capuano
9/7/2016	Greater Boston Chamber of Commerce
9/8/2016	Chris Marchi
9/8/2016	Steve Holt
9/8/2016	Caroline J. Mailhot
9/8/2016	Eneida Figueroa
9/8/2016	Sam Albertson
9/8/2016	Emily Hyman
9/8/2016	Peter I. Dunn
9/8/2016	Mimi L. Callum
9/8/2016	Massachusetts High Technology Council
9/8/2016	Jane O'Reilly
9/9/2016	Roy Avellaneda, Councilor at Large, Chelsea
9/9/2016	Susanna Starrett
9/9/2016	Michael, Allyson, Willa and Miles Simons
9/9/2016	Carlos Rosales
9/9/2016	Margaret Morris

9/9/2016	Kathleen McCauley
9/9/2016	Lindsay Rosenfeld
9/9/2016	John Antonellis
9/9/2016	John Casamassima
9/9/2016	Brian Gannon
9/9/2016	Celeste Ribeiro Myers
9/9/2016	Theresa Teshia Malionek
9/9/2016	Melissa Tyler
9/9/2016	Sandra Nijjar
9/9/2016	Joanne T. Pomodoro
9/9/2016	Air Impact Relief (AIR) via Aaron Toffler
9/9/2016	Alexis Pumphrey
9/9/2016	Maria Eugenia Corbo
9/9/2016	Magdalena Ayed
9/9/2016	Gail Miller
9/9/2016	Daniel Ryan
9/9/2016	Karen Sullivan
9/9/2016	John Walkey
9/9/2016	Edward, Camille & Renee MacLean
9/9/2016	Service Employees International Union (SEIU) 32BJ, District 615
9/9/2016	Alternatives for Community & Environment, Inc. (ACE)
9/9/2016	Judy Gates
9/9/2016	Mary Ellen Welch
9/9/2016	David Aiken
9/9/2016	Kannan Thiru
9/9/2016	Frederick Salvucci
9/9/2016	Neighbors United for a Better East Boston (NUBE)
9/9/2016	Angel C
9/9/2016	Rudi Seitz
9/9/2016	Alfred A. Pucillo
9/9/2016	Lydia Edwards
9/9/2016	Patricia J. D'Amore
9/9/2016	Alexis Daniels
9/9/2016	Tina Kelly
9/9/2016	Barbara McDonough
9/9/2016	Madeleine Steczynski
9/9/2016	Karen Connor
9/9/2016	Regina Marchi
9/9/2016	Roberto Verthelyi
9/9/2016	Vanessa Fazio
9/9/2016	Chrissy Holt
9/9/2016	Liz Nofziger
9/9/2016	Heather Kros
9/9/2016	June Krinsky-Rudder

9/9/2016	Kim Foltz
9/9/2016	Nancy Lee
9/9/2016	Jessica L. Curtis, JD
9/9/2016	Matthew Neave
9/9/2016	Cindy L. Christiansen
9/9/2016	Michael Passariello
9/9/2016	Elizabeth Kay
9/10/2016	Rob Pyles
9/10/2016	Jesse Borthwick
9/10/2016	Steve Passariello
9/10/2016	Carrie Van Horn
9/10/2016	John Tyler
9/10/2016	Kristen D'Avolio
9/10/2016	Craig Belaney
9/10/2016	Cindy M. López
9/10/2016	Laura Macias Grondin
9/10/2016	Sandra Downey
9/10/2016	Christopher A. Zeien
9/10/2016	Carol Doering
9/12/2016	Department of Energy Resources (DOER)
9/13/2016	Anthony M. Majahad
9/13/2016	State Senator Boncore, State Representative Madaro, and City Councilor LaMattina
9/13/2016	Mary Mitchell
9/14/2016	Olena Chuyan
9/14/2016	Julia Howington
9/16/2016	Karen Maddalena
9/16/2016	Boston Transportation Department (BTD)

MAB/PRC/prc

Comment #	Author	Topic	Comment	Response
Terminal E Modernization Project C.2	Matthew Beaton, Secretary	Cumulative Impacts	Subsequent ESPRs and EDRs will update the cumulative impacts of passenger growth and associated ground and aircraft operations based on revised forecasts and update and revise environmental management plans to address impacts.	This *2016 Environmental Data Report (EDR)* assesses cumulative environmental impacts for 2016 and reports on the status of Section 61 mitigation commitments. The upcoming *2017 Environmental Status and Planning Report (ESPR),* will include updated passenger, operations, and cargo forecasts and will assess the future cumulative environmental impacts of additional flights and passenger activity levels for noise, air quality/greenhouse gas (GHG) emissions, and ground access. Environmental management plans will be updated to address anticipated impacts, as appropriate.
Terminal E Modernization Project C.3	Matthew Beaton, Secretary	Cumulative Impacts	Future [EDR/ESPR] submittals will continue to document potential impacts and trends and propose measures to implement the broad goal of maintaining or reducing Logan's overall environmental impacts, even as annual passenger volumes rise in the future.	This *2016 EDR* assesses cumulative environmental impacts for 2016 and reports on Massport's initiatives to reduce environmental impacts. The upcoming *2017 ESPR* will include updated passenger, operations, and cargo forecasts and will assess the future cumulative environmental impacts of additional flights and passenger activity levels for noise, air quality/GHG emissions, and ground access. Environmental management plans will be updated to address anticipated impacts, as appropriate.
Terminal E Modernization Project C.5	Matthew Beaton, Secretary	Cumulative Impacts	The 2015 EDR Scope includes, but is not limited to, reporting on noise, air quality, and long-term parking management. The 2015 EDR and 2016 ESPR should reflect the proposed connection to the Airport Station, provide updates on the planning and design of the connection, and identify the anticipated ridership, changes in the HOV mode share, and ground access planning considerations.	The *2016 EDR* describes the current state of planning for the direct connection to Airport Station. The *2017 ESPR* will also describe progress on planning and design for the proposed connection to the Airport Station, and will identify the anticipated ridership, changes in the high occupancy vehicle (HOV) mode share, and ground access planning considerations. The direct connection between Terminal E and the Massachusetts Bay Transportation Authority (MBTA) Blue Line Airport Station is currently being studied and various approaches are under consideration. Consideration is being given to constructing an Automated People Mover (APM) which ultimately could connect the MBTA Blue Line Station to all the terminals. The APM concept is in the very early stages of feasibility assessment and will be more definitive as the Terminal E Modernization Project moves into Phase 2. The *2017 Environmental Status and Planning Report* will provide further information.
Terminal E Modernization Project C.8	Certificate Secretary Matthew Beaton	Environmental Justice/Outreach	Massport has indicated it will provide a Spanish translation of the DEIR Executive Summary. I encourage Massport to continue providing translated Executive Summaries with all future MEPA filings.	Massport has included a Spanish-language version of Chapter 1, *Introduction/Executive Summary,* of the *2016 EDR* (included after the English-version).
Terminal E Modernization Project C.9	Certificate Secretary Matthew Beaton	Regionalization	Comments on the DEIR continue to request that Massport accommodate more demand at regional airports in lieu of or in conjunction with the proposed project. I acknowledge that long-term strategies to mitigate Logan's impacts will continue to include an emphasis on diverting travel to regional airports and to rail. As indicated in the Certificate on the ENF, regional transportation will continue to be addressed through the ESPR and EDR, not through this project specific review.	This *2016 EDR* reports on Airport planning initiatives in Chapter 3, *Airport Planning,* and the regional transportation system in Chapter 4, *Regional Transportation.* The *2017 ESPR* will also report on Airport planning and regional transportation.

Comment #	Author	Topic	Comment	Response
Terminal E Modernization Project C.16	Certificate Secretary Matthew Beaton	Energy / GHG	I refer the Proponent to DOER's comment letter which recommends further evaluation of CHP to address Terminal E's service water loads. Massport has indicated that conversion of equipment at Logan's Central Heating and Cooling Plant will be evaluated as the equipment reaches the end of its useful life.	The evaluation of the CHP is part of the ongoing design of the Terminal E Modernization. An update will be included in the *2017 ESPR* .
Terminal E Modernization Project C.17	Matthew Beaton, Secretary	EDR/ESPR	I expect that further evaluation of CHP will be evaluated as part of that process and reported in future EDRs and ESPRS.	The evaluation of the CHP is part of the ongoing design of the Terminal E Modernization project. An update will be included in the *2017 ESPR* .
Terminal E Modernization Project C.22	Matthew Beaton, Secretary	Resiliency	The DEIR notes that Massport has consulted with CZM regarding development of coastal resiliency design measures. Massport will continue consultations with CZM and MBTA and to review existing station vulnerabilities, as operations of the Blue Line and this station are important to support Massport HOV goals. Updates on this consultation and the design measures that are considered and/or incorporated into the design to improve the MBTA station's coastal resiliency should be provided in the EDR and ESPR documents.	Updates on this consultation and the design measures that are considered and/or incorporated into the design will be provided in future EDR and ESPR filings as updates are available.
Terminal E Modernization Project C.23	Matthew Beaton, Secretary	Energy / GHG	Massport will continue to assess the applicability of emissions reduction measures to the extent practicable and report on air quality in the ESPR and the EDR.	Massport will continue to assess the applicability of emissions reduction measures and report on air quality in the ESPR and the EDR. Chapter 7, *Air Quality/Emissions Reduction,* reports on Airport emissions in 2016. The *2017 ESPR* will report on conditions in 2016 and will assess future impacts.
Terminal E Modernization Project C.24	Matthew Beaton, Secretary	Cumulative Impacts	… project will not result in any changes to the number and type of aircraft operations when compared to the Future No-Build Alternative. It indicates that demand is driven by economic and market factors; and, therefore, growth at Logan Airport will continue to occur regardless of the Terminal E project. Cumulative impacts will continue to be addressed through the ESPR/ EDR.	The EDRs and ESPRs provide a detailed assessment and reporting of the cumulative impacts of Logan Airport aviation operations and related activities. Massport is unique among state agencies and airports in the U.S. for publishing annual environmental reports specifically designed to describe, analyze, and forecast the cumulative effects of Logan Airport operations based on current and anticipated future operating conditions. This process was developed to allow individual projects at Logan Airport to be considered and analyzed in the broader, Airport-wide context. The ESPRs and EDRs also include information regarding all the projects planned or under construction at Logan Airport and provides a preview to the public and regulators of upcoming projects and activities. Subsequent ESPRs and EDRs will update the cumulative impacts of passenger growth and associated ground and aircraft operations based on revised forecasts and will update and revise environmental management plans to address impacts. Future EDRs/ESPRs will continue to document potential impacts and trends and propose measures to implement the broad goal of maintaining or reducing Logan Airport's overall environmental impacts, even as annual passenger volumes rise in the future. These annual publications will continue reporting on Massport's progress in meeting its mitigation commitments. ESPR and EDRs provide a forum and meaningful opportunities for public review of information and analysis related to airport planning and operations, Airport activities, and effects on noise, air quality, ground access, and water quality.

Comment #	Author	Topic	Comment	Response
Terminal E Modernization Project C.25	Matthew Beaton, Secretary	RNAV	The primary purpose of the RNAV procedures is to increase safety and operational efficiency. As documented in the ESPR and annual EDR submittals, implementation of several of the RNAV procedures have generated increased noise complaints in some towns surrounding Logan Airport and I have received many comment letters from residents of the Town of Hull on this issue. The procedures themselves have resulted in aircraft at higher altitudes although patterns are concentrated over certain communities. I note that the FAA is implementing the RNAV program nation-wide. This program is separate from and unrelated to the Terminal E Modernization project.	The FAA NextGen initiative, is a national effort to improve the daily operations of the entire National Airspace System. This has resulted in changes in flight track and airspace around the country with resultant changes in the noise environment. The FAA conducted its own environmental review under the National Environmental Policy Act (NEPA) that studied the changes in RNAV, which enables aircraft to fly on any desired flight path within the coverage of ground- or space-based navigation aids, within the limits of the capability of the self-contained systems, or a combination of both capabilities. RNAV aircraft have better access and flexibility for point-to-point operations. Massport actively engages with surrounding communities on noise and other issues through the Massport Community Advisory Committee (CAC).
Terminal E Modernization Project C.26	Matthew Beaton, Secretary	Cumulative Impacts	As noted previously, the ESPR and EDRs provide a forum and meaningful opportunities for public review of information and analysis related to these issues.	Massport is committed to providing information on activity levels and forecasts, planning projects, environmental impacts, and progress on meeting mitigation commitments in the EDRs and ESPRs. These annual documents provide an opportunity for Massport to share the status of activities with the community and receive input.
Terminal E Modernization Project C.31	Matthew Beaton, Secretary	MEPA Process	The response can also refer to future EDRs and/or ESPRs to address issues that are not within the Scope of this review.	The Secretary's Certificates for the Terminal E Modernization Project, for the Environmental Notification Form (ENF) and the Draft Environmental Assessment (EA)/Environmental Impact Report (EIR), are provided in Appendix A, *MEPA Certificates and Responses to Comments,* of this EDR. Airport-wide issues will continue to be addressed in EDRs and ESPRs.
Terminal E Modernization Project C.32	Matthew Beaton, Secretary	MEPA Process	This directive is not intended, and shall not be construed, to enlarge the scope beyond what has been expressly identified in this Certificate.	Massport is unique among state agencies and airports in the U.S. for publishing annual environmental reports specifically designed to describe, analyze, and project the cumulative effects of Logan Airport operations based on current and anticipated future operating conditions. This process was developed to allow individual projects at Logan Airport to be considered and analyzed in the broader, airport-wide context. A brief overview of that long-standing process follows. Massport has been producing annual reports for MEPA and for public review since 1979. Initially, these annual reports were called the Generic Environmental Impact Report (GEIR) and are now called Environmental Status and Planning Reports (ESPR) with interim Environmental Data Reports (EDR). These reports assess the environmental effect of overall changes in operations at Logan Airport. The reports provide an overall context, within which changes in the total environmental impacts at Logan Airport can be assessed. As stated in the Introduction to the 1999 ESPR, "While the Logan ESPR and EDRs provide the broad planning context for projects proposed for Logan Airport and future planning concepts under consideration by Massport, no specific projects can be built solely on the basis of inclusion and discussion in the 1999 ESPR." Projects that require state (MEPA) or federal (NEPA) review undergo a separate review process. In short, Massport's annual reports provide the planning context which complements the individual, project-specific filings. This *2016 EDR* and the following *2017 ESPR* will continue report on baseline and cumulative impacts of overall airport operations.

This Page Intentionally Left Blank.

Copy of the Secretary of the Executive Office of Energy and Environmental Affairs Certificate issued for the Terminal E Modernization Project Final Environmental Assessment/Environmental Impact Report

This Page Intentionally Left Blank.

The Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Charles D. Baker
GOVERNOR

Karyn E. Polito
LIEUTENANT GOVERNOR

Matthew A. Beaton
SECRETARY

Tel: (617) 626-1000
Fax: (617) 626-1081
http://www.mass.gov/eea

November 10, 2016

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
FINAL ENVIRONMENTAL IMPACT REPORT

PROJECT NAME	: Terminal E Modernization
PROJECT MUNICIPALITY	: East Boston
PROJECT WATERSHED	: Boston Harbor
EEA NUMBER	: 15434
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: October 5, 2016

As Secretary of Energy and Environmental Affairs, I hereby determine that the Final Environmental Impact Report (FEIR) submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (MEPA; M.G.L. c.30, ss.61-62I) and with its implementing regulations (301 CMR 11.00). As noted in my Certificate on the Draft EIR (DEIR) issued September 16, 2016, the DEIR fully responded to the Scope contained in the Certificate on the Environmental Notification Form (ENF) and therefore the scope of the Final EIR (FEIR) was limited to a response to comments and draft Section 61 Findings.

Comments received on the FEIR continue to identify concerns regarding existing airport operations and noise levels and potential increases with long-term growth. I have received comment letters from elected officials (including U.S. Congressman Michael E. Capuano, the Milton Board of Selectmen, and Revere Mayor Brian Arrigo), state agencies, environmental advocacy groups, businesses, and residents. The issue of cumulative airport-wide impacts, particularly noise and air quality, is not new to the review of projects at Logan Airport. As noted in past Certificates, the EIR is not intended to address broad concerns associated with airport operations and growth. The venue for addressing cumulative environmental impacts is through the Environmental Status and Planning Reports (ESPR) and Environmental Data Reports (EDR). Through these reports, Logan Airport is subject to comprehensive and regular MEPA review, including opportunities for public comment on the cumulative impacts. This regular updating and reporting on planning and cumulative impacts is unique among State Agencies. It reflects the challenge and complexity of managing and modernizing Logan Airport within a dense, urban

area. It recognizes that the proximity of communities to the Airport warrants an enhanced level of public engagement and a concerted, long-term effort to minimize and mitigate impacts.

Subsequent ESPRs and EDRs will update the cumulative impacts of passenger growth and associated ground and aircraft operations based on revised forecasts and update and revise environmental management plans to address impacts. Future submittals will continue to document potential impacts and trends and propose measures to implement the broad goal of maintaining or reducing Logan's overall environmental impacts, even as annual passenger volumes rise in the future. The next ESPR will analyze calendar year 2016 and will likely be filed in 2017 or 2018 and the next EDR will analyze calendar year 2015 and will likely be filed in the fall of 2016.

I note many comments identify a particular concern with concentrations of flight tracks due to the Federal Aviation Administration's (FAA) area navigation (RNAV) procedures. The primary purpose of the RNAV procedures is to increase safety and operational efficiency. As documented in the ESPR and annual EDR submittals, implementation of several of the RNAV procedures have generated increased noise complaints in some towns surrounding Logan Airport. The procedures themselves have resulted in aircraft at higher altitudes and concentration of flight patterns over certain communities. I note that the FAA is implementing the RNAV program nation-wide. This program is separate from and unrelated to the Terminal E Modernization project. Nonetheless, I am aware that Massport and the FAA recently signed a Memorandum of Understanding (MOU) to frame a new process for analyzing opportunities to incrementally reduce noise through changes or amendments to Performance Based Navigation, including RNAV procedures. I commend Massport and the FAA for establishing this agreement, which is a unique project between the FAA and an airport operator. Massport has indicated that this process will incorporate community outreach and public input. I expect that updates on this process will be provided in in future ESPRs and EDRs which will provide an additional forum and meaningful opportunities for public review of information related to these issues.

Over the past year, Massport has engaged in a concerted outreach effort with elected officials, municipalities, and community groups to identify and discuss potential Massport projects, including but not limited to, Terminal E. Massport created the Logan Airport Impact Advisory Group (IAG) to solicit comment and to identify and prioritize projects and programs of significance to the IAG. I commend Massport for its outreach efforts and encourage Massport to continue a productive dialogue with interested stakeholders, including through the IAG.

I have received comments that identify concerns with other potential Massport projects, including the potential parking garage identified in the DEIR, which would require an amendment to the Logan Airport Parking Freeze Regulation (310 CMR 7.30). As noted in the DEIR and previous Certificate, the potential parking garage will be subject to MEPA review pursuant to 301 CMR (6)(a)(7) because it will be constructed by a State Agency and will include construction of 1,000 or more new parking spaces. Subsequent MEPA review will include review of potential environmental impacts and development of project-specific impact avoidance, minimization, and mitigation measures.

Project Description

The project proposes modernizing Boston-Logan International Airport's John A. Volpe International Terminal (Terminal E) with a 560,000-square foot (sf) addition that corrects facility deficiencies and accommodates current and anticipated passenger volumes. The project includes three gates which previously underwent MEPA review (International Gateway Project, EEA #9791) but were not constructed, and four additional aircraft gates, passenger holdrooms, concourse, concessions, and passenger processing areas. The project includes Customs and Border Patrol (CBP) and Federal Inspection Services (FIS) facilities to replace and expand FIS facilities that were originally reviewed under MEPA (Terminal B, Pier A Improvements/Satellite FIS Facility, EEA #12235) but also not constructed. The project includes a direct pedestrian connection between Terminal E and the MBTA Blue Line Airport Station.

Terminal E was constructed in 1974 with 12 gates and served 1.4 million annual passengers. In 2014, it served approximately five million passengers. The DEIR indicated that the current level of passenger activity routinely causes severe congestion in the terminal at peak times, leading to greatly reduced customer service, and inefficient operations in the terminal and gates. According to the DEIR, gate congestion leads to airside delays and inefficiencies on the North Apron. When no gates are available, arriving aircraft and passengers are held on the apron. The DEIR indicated that aircraft must use remote parking facilities at hardstands in the North Cargo Area and passengers are bused to the terminal during peak periods when there are insufficient gates. The DEIR built upon the information presented in the ENF regarding challenges associated with current operations at Terminal E. Massport has clearly demonstrated the need for the project and made a compelling case for the expansion.

The project is proposed in two phases. Phase 1 will be constructed from 2018 – 2022 and will include construction of four new gates with associated passenger holdrooms and elevators/escalators to relieve existing deficiencies and accommodate interim growth. A partial new concourse will be constructed to allow for future expansion to a seven-gate facility at full build-out. Phase 1 will not require modifications to roadway realignment. Phase 2 will be built by 2028 and will provide three additional gates and the MBTA connection. The project will be fully constructed and operational by 2030.

The project will displace ground service equipment (GSE), other airside activities, existing surface parking, the cell phone lot, and the gas station which will be relocated within existing airport boundaries. Relocation of ground facilities that conflict with the new concourse location, including the gas station, will occur in Phase 1.

Environmental Status and Planning Report (ESPR) and Environmental Data Reports (EDRs)

The MEPA environmental review process for Logan Airport occurs on two levels: airport-wide and project-specific. The ESPR and EDR provide a "big picture" analysis of the environmental impacts of current and anticipated levels of airport-wide activities (including aircraft operations and passenger activity), and presents comprehensive strategies to avoid, minimize and mitigate impacts. The ESPR is generally updated on a five-year basis; the most recent ESPR for the year 2011 was filed in April 2013 and it contained updated passenger activity levels and aircraft operations forecasts through 2030. EDRs evaluate environmental conditions for the reporting year as compared to the previous year and are filed in the years

between ESPRs. The most recent EDR for the year 2014 was filed in October 2015. The EDR provided a comprehensive cumulative analysis of the effects of all Logan Airport activities based on actual passenger activity and aircraft operation levels in 2014 and presents environmental management plans for addressing environmental impacts. The ESPR is supplemented by (and ultimately incorporates) the EDRs and the detailed analyses and mitigation commitments that emerge from project-specific reviews. This process provides a comprehensive and continuous review of airport programs, projects, environmental impacts and associated data.

The 2015 EDR Scope includes, but is not limited to, reporting on noise, air quality, and long-term parking management. The 2015 EDR and 2016 ESPR should reflect the proposed connection to the Airport Station, provide updates on the planning and design of the connection, and identify the anticipated ridership, changes in the HOV mode share, and ground access planning considerations.

The MEPA regulations (Section 11.06(2)) indicate that during the course of an ENF review I may review any relevant information from any other source to determine whether to require an EIR, and, if so, what to require in the Scope. To provide context for this project-specific review and because many issues raised by commenters relate to airport-wide operations and impacts, this Certificate refers to documents from the ESPR process (EEA#3247/5146).

Logan Airport and Project Site

The Airport boundary encompasses approximately 2,400 acres in East Boston and Winthrop, including approximately 700 acres underwater in Boston Harbor. The Airport is surrounded on three sides by Boston Harbor and is accessible by two public transit lines and the roadway system. The airfield is comprised of six runways and approximately 15 miles of taxiway. Logan Airport has four passenger terminals, A, B, C, and E, each with its own ticketing, baggage claim, and ground transportation facilities.

Terminal E is located adjacent to the North Cargo Area, closest to the MBTA Blue Line Airport Station. Land uses in the area of the proposed project include UPS aircraft parking and loading area, the airport's Remain Over Night aircraft parking area, the North Cargo Area equipment storage area, a building occupied by United Parcel Service (UPS), the MBTA Blue Line Airport Station, airport roadways, various short-term and cell phone parking lots, and a gas station.

The project site is located within the coastal zone of Massachusetts. The entirety of the project site is comprised of previously disturbed impervious area. It is not located in Priority or Estimated Habitat as mapped by the Division of Fisheries and Wildlife's (DFW) Natural Heritage and Endangered Species Program (NHESP). The project site does not contain wetland resource areas regulated pursuant to the Wetland Protect Act and its implementing regulations (310 CMR 10.00).

The ENF identified the following projects within the vicinity of Terminal E that have been reviewed under MEPA: Terminal A Replacement (EEA#9329), Terminal E Modifications (EEA#9324), Federal Inspection Services (FIS) Facility and West Concourse Project / International Gateway (EEA#9791), and Terminal B, Pier A Improvements/Satellite FIS Facility (EEA#12235).

Permitting and Jurisdiction

The project is undergoing MEPA review and required an ENF pursuant to 301 CMR 11.03(6)(b)(6) because it will be undertaken by a State Agency and results in the expansion of an existing terminal at Logan Airport by greater than 100,000 sf.

The project requires a Sewer Permit Modification from the Boston Water and Sewer Commission (BWSC) and may require an Industrial User Permit from the Massachusetts Water Resource Authority (MWRA). The project may be subject to Massachusetts Office of Coastal Zone Management (CZM) federal consistency review.

The project requires approval by the Federal Aviation Administration (FAA) for changes to the Airport Layout Plan and, therefore, requires an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA). The project also requires a National Pollutant Discharge Elimination System (NPDES) General Permit for Construction from the U.S. Environmental Protection Agency.

Because the project will be undertaken by a State Agency, MEPA jurisdiction is broad in scope and extends to all aspects of the project that may cause Damage to the Environment, as defined in the MEPA regulations.

Environmental Impacts and Mitigation

As described in the ENF, the project includes construction of approximately 500,000 to 700,000 sf of new floor area (for a maximum 1,500,000 sf total), and will increase both water consumption and wastewater generation by approximately 25,600 gallons per day (76,800 gpd total). The project will not create new impervious area and will eliminate approximately 60 parking spaces. The DEIR indicated that the project will accommodate existing and forecasted passenger levels and operations and, therefore, will not increase passenger enplanements or vehicle trips.

Measures to avoid, minimize and mitigate project impacts include reducing air emissions, greenhouse gas (GHG) emissions, and energy consumption compared to existing conditions by improving access to gate plug-ins, pre-conditioned air, and reducing busing operations. In addition, the building is designed to act as a noise barrier to the adjacent residential areas and Memorial Stadium Park.

Review of the FEIR

The FEIR was responsive to the scope issued in the Certificate on the DEIR. It included responses to comments filed on the DEIR and revised draft Section 61 Findings that outline Massport's mitigation commitments for the project. The FEIR included an Executive Summary of the DEIR both in English and a translated version in Spanish. The FEIR included the FAA's revised draft Finding of No Significant Impact/Draft Record of Decision (Draft FONSI/DROD) which was updated since the DEIR. This Certificate applies to the MEPA review of the project.

MEPA review cannot and does not restrict the ability of the federal government to act on those aspects of the project subject to the National Environmental Act (NEPA).

The only change to the project since the review of the DEIR is incorporation of additional mitigation measures to reduce GHG emissions (described below). No other changes to project programming, layout, or anticipated environmental impacts are identified. State Agencies did not request additional MEPA review or identify further analysis that would warrant additional MEPA review.

Response to Comments

The Response to Comments contained a copy of the DEIR Certificate and a copy of each comment letters received on the DEIR. A total of 186 comment letters were provided on the DEIR, of which 120 consisted of form letters. The FEIR contained a summary table that identified each commenter, the issues identified in their comment letter, and the corresponding section(s) of the FEIR to assist in locating the response. The FEIR contained both thematic responses to frequent comments and separate responses to individual comments. I commend Massport for providing a comprehensive response to comments and recognize the time and effort that Massport has invested in the preparation of the FEIR.

Responses to individual comments were provided for state agencies, municipalities, elected officials, and key stakeholders. Thematic responses were provided for the following categories: alternatives, cumulative impacts, environmental justice, ground transportation, health effects, induced growth, MEPA process, mitigation, noise, parking, regionalization, resiliency, RNAV departure procedures, and stakeholder outreach. Many of the comments received on the DEIR identify concerns related to existing airport operations and noise levels and potential increases in impacts associated with long-term growth. As noted in past Certificates, the EIR is not intended to address broad concerns associated with airport operations and growth. The venue for addressing cumulative environmental impacts is through the Environmental Status and Planning Reports (ESPR) and Environmental Data Reports (EDR). The Response to Comments refers to future EDRS and/or ESPRs to address these issues which are not within the Scope of this review.

As required in the Scope, the response to comments section of the FEIR provided a direct response to comments from the Department of Energy Resources (DOER) that clarified the GHG reduction measures proposed for the project and included a revised GHG analysis. Based on the revised analysis, the project incorporated two additional and significant mitigation measures: a 25,000 square feet (sf) rooftop solar photovoltaic (PV) system (300 kW) and solar thermal heating of domestic hot water for public restrooms. These two measures will reduce GHG emissions by 363 tons per year (tpy) compared to the proposed as presented in the DEIR. With these additional mitigation measures, the Preferred Alternative will reduce CO_2 emissions associated with the terminal expansion by 1,390 tpy, for a total of 3,818 tpy, or a twenty-seven percent decrease. The FEIR revised the draft Section 61 findings to reflect the revised mitigation measures.

The FEIR also evaluated and quantified the potential GHG reduction associated with the following five mitigation measures: Dual Box Minimum, Fin Tube Radiation, Energy Recovery Wheel, Dynamic V8 Filtration, and additional 50,000 sf of solar PV panels. The incorporation of these measures would reduce GHG emissions by fifty-percent. Massport has committed to continue evaluating these measures as design progresses. The FEIR also included an analysis of additional wall, roof, and fenestration improvements which indicated they are not effective GHG reduction strategies for the project. It included an evaluation of solar thermal for the concession-area hot water; however this measure remains under deliberation as concession needs are still being developed.

I acknowledge and appreciate the consultation between Massport and DOER which has resulted in the identification and commitment to additional and significant GHG emission reductions.

Mitigation/Draft Section 61 Findings

The FEIR identified measures to avoid, minimize, and mitigate environmental impacts and included draft Section 61 Findings for use by State Agencies. The FEIR clarified that the timing and responsibility for implementation of each measure. The direct connection to the Airport MBTA Blue Line Station, full sound barrier benefits associated with extending the full width of the terminal, and curb improvements will be implemented during the second phase of the project. The other energy reduction and greenhouse gas reduction measures will be implemented in the first phase of the project. Measures to avoid, minimize, and mitigate environmental impacts include:

Operational Impacts

- The Terminal E expansion has been sited and will be designed to act as a noise barrier to the adjacent East Boston neighborhoods and Memorial Stadium park to the southwest of the North Apron. The new structures will have a minimum height of 45-ft above ground level.
- New gates will have electric power and pre-conditioned air to allow aircraft to plug in at gate rather than be serviced remotely to reduce need for on-board engine/auxiliary power unit operation, thereby reducing aircraft air emissions and GHG emissions.
- New gates will increase ramp efficiency and reduce movements on North Apron and the need to bus passengers between terminal and remote aircraft parking locations, thereby reducing ground transportation related air emissions and mobile source GHG emissions.
- Roadway and curb improvements which will improve vehicle flow and high-occupancy vehicle access.
- Construction of a weather-protected pedestrian connector from the Terminal to the MBTA Airport Blue Line Station (proposed as part of Phase 2).

Sustainable Design Features/Greenhouse Gas Emissions

- Project will seek LEED Certification at the Silver level rating or better and meet or exceed the goals of the MA LEED Plus program.
- Improved building envelope (wall insulation of U-0.05, roof insulation of U-0.037, improved glazing of U-0.34, and reduced window to wall ratio of 25%).
- Improved Air Handling Units.
- Efficient water loops with reduced water supply temperature and wider return temperatures to reduce demand on the pumping and fan systems.
- Reduced interior lighting power density of 0.62 W/SF and reduced exterior lighting power of 9.3 kW.

- The roof design will incorporate materials with a minimum reflectance rating of 0.70 and emittance value of at least 0.75 for a minimum of 75% of the available roof area. Roofing materials will be non-glare to reduce heat island effect.
- Final design will incorporate infrastructure for collection, storage, and handling of recyclable materials.
- Massport will establish a project-specific goal for sourcing materials extracted, harvested, recovered, and or manufactured within New England.
- The project will be designed to achieve energy efficiencies of a minimum of 20% below the MA Energy Code.
- The project will reduce operational-related GHG emissions associated with the Project by a minimum of 30%.
- The project will include water conservation devices that reduce water use by 20% below the MA Plumbing Code.
- The project will be built 'solar ready' to accommodate rooftop solar.
- The Terminal E rooftop will include a minimum 25,000 sf of rooftop solar PV (300 kW).
- Solar thermal PV system will be used to provide hot water for the restrooms.
- Project will incorporate occupancy sensors in all indoor areas to reduce electrical demand.
- Continue to evaluate feasibility of the following measures as design progresses: Energy Recovery Wheel, additional rooftop solar PV, Dual Box Minimum, and Dynamic Filtration.
- A self-certification will be provided to the MEPA office upon completion of the project construction signed by an appropriate professional (e.g. civil engineer, traffic engineer, architect, general contractor) indicating that all of the GHG mitigation measures, or equivalent measures that are designed to collectively achieve the proposed stationary source GHG emission reduction committed to in the FEIR, have been incorporated into the project.

Air Quality

- Project will result in a decrease in carbon monoxide (CO) emissions in the area of Terminal E and the associated aircraft apron by approximately 9%, nitrogen oxide (NO_x) emissions by approximately 44%, and sulfur oxides (SO_x) emissions by approximately 33%.
- Project will result in decrease of Volatile Organic Compounds (VOCs) in the project area by approximately 6% and particulate matter (PM_{10} and $PM_{2.5}$) by approximately 9% and 25%, respectively.

Construction Period Impacts

- Development of a construction waste management plan that requires diversion or reduction of construction waste by a minimum of 75%.
- Use of high efficiency space heating/cooling systems in temporary work spaces.
- Work hours will be limited to 7:00 AM to 7:00 PM unless constrained by operational conditions at the Airport. The sound levels from construction activities will employ measures to voluntarily comply with the City of Boston's noise standards.
- Soil Management Plan will be developed based on sub-surface investigations to address identification and disposal of contaminated materials.
- Implement Indoor Air Quality (IAQ) Management Plan during construction.

- Stormwater Pollution Prevention Plan will be developed to keep sediment and contaminants out of the stormwater management system during construction.
- Soil and groundwater management during construction will be conducted in accordance with the appropriate submittals (i.e., Release Abatement Measures, Immediate Response Actions, and/or Safety Management Plans) and subsurface contamination (if encountered) will be remediated in compliance with the Massachusetts Contingency Plan.
- Measures to reduce impacts from the approximately 60 daily truck trips associated with project construction include:
  - Construction-related traffic will be required to use the North Gate using only state and federal highways and the airport roadway network to keep construction-related traffic off of local East Boston roadways.
  - Use of police detail, as necessary, to manage traffic and ensure public safety.
  - Construction companies will be required to provide off-Airport parking for their employees and to provide shuttle services or other HOV service from these locations.
- The following measures will address construction phase air quality impacts:
  - Contractor will comply with MassDEP's Clean Air Construction Initiative regarding installation of emission control devices (such as diesel oxidation catalyst and/or particulate filters) on equipment;
  - Enforcement of construction vehicle anti-idling provisions;
  - Retrofitting diesel construction equipment with diesel oxidation catalysts and/or particulate filters;
  - Fugitive dust will be controlled via wetting or sweeping and all trucks hauling materials from the construction site will be covered.

Conclusion

Based on a review of the FEIR, comment letters, and consultation with State Agencies, I find that the FEIR adequately and properly complies with MEPA and its implementing regulations. Future EDRs and ESPR submittals will continue to document potential impacts and trends and propose measures to implement the broad goal of maintaining or reducing Logan's overall environmental impacts, even as annual passenger volumes rise in the future. Massport and State Agencies should forward copies of the final Section 61 Findings to the MEPA Office for publication in accordance with 301 CMR 11.12.

November 10, 2016
Date

Matthew A. Beaton

Comments received:

10/08/16	David Waite
10/10/16	Sarah James
10/10/16	Peter Houk
10/15/16	Marjorie Smith
10/18/16	Lahra Tillman

10/18/16	Maureen Wing
10/18/16	Reena Freedman
10/18/16	John Vitagliano
10/21/16	David Bowen
10/21/16	Ken Bader
10/23/16	Estella and David Keefer
10/24/16	Carolann Barrett
10/25/16	Shelia Mooney
10/27/16	Luke Preisner
10/28/16	Frederick Salvucci
10/28/16	Mary Ryan
10/31/16	Amelia Kantrovitz
10/31/16	Caslynn Carambelas and Vaishal Patel
10/31/16	Elizabeth Gazda
10/31/16	Juan Carlos Garzon
10/31/16	Stephen Raymond
10/31/16	Scott Johnson
10/31/16	Julie Vail
11/01/16	Sema Bekiroglu
11/01/16	Catherine Stacy
11/01/16	Cady Landa
11/01/16	Dominica Bonanno
11/01/16	Congressman Michael Capuano
11/01/16	Hull Neighbors for Quiet Skies
11/02/16	Tonya Saccardo
11/02/16	Robert Saccardo
11/02/16	Milton Board of Selectmen
11/02/16	Matthew Stachler, M.D., Ph.D.
11/03/16	Barbara L Lawrence
11/03/16	Magdalena Ayed
11/03/16	City of Lynn, Bill Bochnak, Massport CAC & Logan Airport Member
11/03/16	G. Bernadette Cantalupo, 156 Porter St.
11/03/16	William Schneiderman
11/04/16	Gail Miller
11/04/16	Massachusetts Department of Environmental Protection (MassDEP)
11/04/16	Chris Marchi
11/04/16	James Linthwaite
11/04/16	Catherine Stalberg
11/04/16	Mary Ellen Welch (1 of 2)
11/04/16	Mary Ellen Welch (2 of 2)
11/04/16	Department of Energy Resources (DOER)
11/04/16	Vickie Livermore
11/04/16	City of Revere, Mayor Arrigo
11/04/16	AIR Inc., Aaron Toffler
11/04/16	Deborah Hartman
11/04/16	Mimi Callum
11/04/16	Andrea Vilanova
11/04/16	Ann Jansen
11/04/16	John Casamassima
11/04/16	Alyssa Vangeli
11/04/16	Tara Ten Eyck
11/04/16	Boston Harbor Now

11/07/16 28 Form Letters from Residents of the Porter156 Condominium Association
11/07/16 Jesse Borthwick

MAB/PRC/prc

This Page Intentionally Left Blank.

Copy of the Secretary of the Executive Office of Energy and Environmental Affairs Certificate issued for the Logan Airport Parking Project Environmental Notification Form and Responses to Comments

This Page Intentionally Left Blank.

The Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Charles D. Baker
GOVERNOR

Karyn E. Polito
LIEUTENANT GOVERNOR

Matthew A. Beaton
SECRETARY

Tel: (617) 626-1000
Fax: (617) 626-1081
http://www.mass.gov/eea

May 5, 2017

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
ENVIRONMENTAL NOTIFICATION FORM

PROJECT NAME	: Logan Airport Parking Project
PROJECT MUNICIPALITY	: Boston
PROJECT WATERSHED	: Boston Harbor
EEA NUMBER	: 15665
PROJECT PROPONENT	: Massachusetts Port Authority (Massport)
DATE NOTICED IN MONITOR	: April 5, 2017

Pursuant to the Massachusetts Environmental Policy Act (MEPA; M.G. L. c. 30, ss. 61-621) and Section 11.03 of the MEPA regulations (301 CMR 11.00), I have reviewed the Environmental Notification Form (ENF) and hereby determine that this project requires the preparation of a Mandatory Environmental Impact Report (EIR).

Project Description

As described in the ENF, the project includes the construction of 5,000 additional commercial parking spaces at the Logan International Airport (the "Airport"). The parking spaces will be located on additional floors within the existing Economy Garage and at a new parking garage in the location of the existing Terminal E surface parking lot. Potential phasing of the project and design of the parking structures is being developed; however, the ENF indicates that all 5,000 additional commercial parking spaces will be operational between 2022 and 2024. The ENF indicates that the parking spaces are intended to accommodate existing and anticipated air passenger demand for parking at the Airport. According to the ENF, the project will reduce

drop-off/pick-up activity at the Airport and will reduce regional air passenger-related vehicle miles traveled (VMT) and associated air emissions.

In addition to the overall air quality benefits, the ENF indicates that Massport is considering additional high occupancy vehicle (HOV) mode improvement measures in conjunction with this project. These include enhancing Logan Express bus service through expanded parking at existing locations and increased frequency of service and expanding the Logan Express service area to new suburban locations and urban/downtown areas based on the success of the Back Bay Logan Express pilot program. The ENF also indicates that Massport is considering purchasing additional Silver Line buses to increase service capacity to the Airport.

Project Background and Context

The number of commercial and employee parking spaces allowed at Logan Airport is regulated by the Massachusetts Department of Environmental Protection (MassDEP) through the Massport/Logan Airport Parking Freeze (310 CMR 7.30), an element of the Massachusetts State Implementation Plan (SIP) under the federal Clean Air Act. The ENF indicates that peak day demand for on-Airport parking has been increasing, resulting in daily demand frequently nearing the Logan Airport Parking Freeze cap. Massport has filed this ENF concurrent with MassDEP's issuance of a draft regulation to amend the Parking Freeze. At Massport's request, the amendment would allow the creation of an additional 5,000 commercial parking spaces at the Airport. The MassDEP public comment period on the proposed regulations will close on May 8th, after this Certificate is issued.

As currently drafted, the regulations would increase the Logan Airport commercial parking freeze limit by 5,000 spaces (from 18,640 to 23,640 spaces) and would increase the total cap to 26,088 commercial and employee parking spaces (comprised of 23,640 commercial spaces and 2,448 employee parking spaces). The draft regulations include a requirement that Massport complete the following studies, each within 24 months of when the final regulations are promulgated, to identify ways to further support alternative transit options to the airport:

1. A study to evaluate the costs, feasibility, and effectiveness of potential measures to improve HOV access to the Airport. The study would consider, among other things, possible improvements to Logan Express bus service and the benefits of adding Silver Line buses with service to the Airport.
2. A study of costs and pricing for different modes of transportation to and from the Airport to identify a pricing structure and the use of revenues so generated to promote the use of HOV modes of transportation by Airport air travelers and visitors. The study will include evaluation of short-term and long-term parking rates and their influence on different modes of Airport transportation.
3. A study of the feasibility and effectiveness of potential operational measures to reduce non-high occupancy vehicle pick-up / drop-off modes of transportation to Logan Airport, including an evaluation of emerging ride-sharing and transportation network company modes.

This Project is contingent upon MassDEP amending the Logan Airport Parking Freeze regulation and EPA approval of an amendment to the SIP. If the regulations are not amended, the

Logan Airport Parking Project cannot proceed. The MassDEP regulatory amendment would provide the larger framework of the Logan Airport Parking Freeze, while project-specific impacts and mitigation measures will be analyzed through the MEPA review process for the Logan Airport Parking Project.

Logan Airport and Project Site

The Airport boundary encompasses approximately 2,400 acres in East Boston and Winthrop, including approximately 700 acres underwater in Boston Harbor. The airfield is comprised of six runways and approximately 15 miles of taxiway. Logan Airport has four passenger terminals, A, B, C, and E, each with its own ticketing, baggage claim, and ground transportation facilities. The Airport is surrounded on three sides by Boston Harbor and is accessible by two public transit lines and the roadway system. The preferred locations for the parking structures are the Economy Garage and the Terminal E surface parking lot. The Economy Garage is located in the northwest portion of the Airport campus at the intersection of Service Road and Prescott Street. It is comprised of two levels and provides over 2,700 spaces. The Terminal E surface parking lot is located within the Airport interior and adjacent to Terminal E.

As described in the ENF, the airport is well-served by public transportation and approximately 30% of travelers accessing the Airport arrive via HOV modes. Specifically, the Airport is served by several Massachusetts Bay Transportation Authority (MBTA) public transit routes, including Blue and Silver Lines for the rapid transit system, commuter ferry service, and local and express bus routes. Specifically, Massport provides free shuttle service between the Blue Line Airport Station and all Airport terminals and subsidizes the Silver Line Logan Airport Route (SL1) by providing free outbound Silver Line trips from the Airport on eight Silver Line buses purchased for this route by Massport. Massport also operates an extensive Logan Express Bus service, serving five locations. The airport is also served by other private express bus service and intercity bus service as part of the range of HOV modes available for ground access.

The Economy Garage and the Terminal E parking lot sites are both located within the coastal zone of Massachusetts. Both locations are comprised of previously disturbed impervious area. They are not located in Priority or Estimated Habitat as mapped by the Division of Fisheries and Wildlife's (DFW) Natural Heritage and Endangered Species Program (NHESP). The parking lot sites do not contain wetland resource areas regulated pursuant to the Wetland Protect Act and its implementing regulations (310 CMR 10.00).

Environmental Impacts and Mitigation

The project includes construction of 5,000 new commercial parking spaces at two locations. The project is located within previously altered impervious area and will not create new impervious area. According to the ENF, the new spaces are intended to accommodate existing and anticipated air passenger demand for parking at the Airport while minimizing pick-up and drop-off activity and decreasing regional air passenger-related VMT and associated vehicle emissions. Specifically, the ENF indicates that the project will reduce carbon dioxide (CO_2), volatile organic compounds (VOC), and oxides of nitrogen (NO_x) emissions by

approximately 25% in 2022 and approximately 20% in 2030 as compared to the future No-Build Alternative.

The ENF indicates that expanded overall HOV capacity will be necessary to maintain the current HOV mode share as total passenger trips increase. In addition to the overall project benefits and HOV related measures proposed as part of the amendment to the Logan Parking Freeze, the ENF indicates that Massport is considering undertaking additional HOV measures in conjunction with the construction of the proposed 5,000 parking spaces. These include: enhancing existing Logan Express scheduled bus service; expanding Logan Express scheduled bus service; exploring Logan Express scheduled bus service in the urban/downtown area; and investing in additional MBTA Silver Line buses. In addition, the parking garages may be designed to be certified in the new "Parksmart" program, which applies Leadership in Energy and Environmental Design (LEED) sustainability strategies to structured parking facilities. The ENF indicates that measures to avoid, minimize, and mitigate project impacts will be further defined in the DEIR.

Jurisdiction and Permitting

The project is undergoing MEPA review and requires preparation of a mandatory EIR pursuant to 301 CMR 11.03(6)(a)(7) because it will be undertaken by a State Agency and will construct greater than 1,000 parking spaces in a single location.

The project may require a Sewer Permit Modification from the Boston Water and Sewer Commission (BWSC). The project may be subject to Massachusetts Office of Coastal Zone Management (CZM) federal consistency review. As indicated above, this project is contingent upon MassDEP amending the Logan Airport Parking Freeze to allow the creation of an additional 5,000 commercial parking spaces at the Airport. Should the draft regulations which propose amending the freeze be promulgated as final, MassDEP will submit the final amended Parking Freeze regulations to the U.S. Environmental Protection Agency (EPA) for approval and incorporation into the SIP.

The project may require approval by the Federal Aviation Administration (FAA), which would trigger review under the National Environmental Policy Act (NEPA).[1] The project also requires a National Pollutant Discharge Elimination System (NPDES) General Permit for Construction from the EPA.

Because the project will be undertaken by a State Agency, MEPA jurisdiction is broad in scope and extends to all aspects of the project that may cause Damage to the Environment, as defined in the MEPA regulations.

[1] The ENF indicates that the level of NEPA review, if required, will depend on the chosen alternative and will be at the discretion of the FAA.

Review of the ENF

The ENF includes a general description of proposed activities, a conceptual discussion of proposed conditions, a brief analysis of alternative locations, and an executive summary of the project in English and in Spanish. The ENF provides a suggested scope for the DEIR that identifies further analysis and data that will be provided to assess potential impacts and measures to avoid, minimize, and mitigate these impacts. The ENF does not provide project plans nor a description of the parking structures and notes that design of the structures is pending MassDEP amending the Parking Freeze. I expect that the DEIR will be a comprehensive and thorough filing that includes project plans for the Preferred Alternative and demonstrates that impacts have been avoided, minimized, and mitigated to the maximum extent feasible. C.1

Comments

MassDEP comments indicate that the draft Parking Freeze Amendment is under review and public comment is ongoing. Their comments identify design recommendations for the parking structures (including installation of electric vehicle (EV) charging stations and designation of preferred parking spaces for alternative fuel vehicles) request Massport implement measures to increase HOV and transit travel modes to the airport, including those identified by Massport in the ENF and providing incentives to increase HOV use.

Comments from industry and labor groups support the project and identify the economic support that the Airport provides to the region, including jobs, tax revenue, and financing for business growth. Other comments emphasize the importance of Massport implementing additional measures to reduce reliance on single occupancy vehicles (SOV), including those identified by Massport in the ENF. In addition, comments request Massport consider: implementing a toll for vehicles entering or exiting the airport to be used for HOV improvement measures, improving silver line (SL1) service (in addition to adding new vehicles), and improving the shuttle connection between the Blue Line and the terminals. The Scope for the DEIR requires additional information regarding project mitigation measures and methods to sustain and increase HOV mode share. C.2

Alternatives Analysis

The ENF indicates that the planning process considered six alternative on-airport locations for the structured parking facilities. All of the sites are paved and developed areas that are currently used for parking or vehicle storage. The ENF indicates that each of the sites are comparable in terms of regional VMT and emissions reductions since regional access routes will not vary as a result of the garage siting.

- Harborside Drive – Structured parking in location of existing vehicle layover space
- Porter Street – Structured parking over existing taxi pool
- North Cargo Area – Expand Economy Garage in the location of existing surface parking and the Massachusetts State Police building
- Southwest Service Area – Structured parking in location of current bus/limousine pool and overflow parking

- Economy Garage (Preferred Alternative) – Additional spaces above existing garage
- Terminal E Surface Lot (Preferred Alternative) – Structured parking in location of existing surface parking lot

According to the ENF, the Preferred Alternative was selected based on input from the East Boston Logan Impact Advisory Group (LIAG). The ENF indicates that Harborside Drive and Porter Street sites were eliminated due to potential wayfinding and operational challenges and the North Cargo Area was eliminated due to the need to relocate the existing uses. The Southwest Service Area was eliminated as it would require construction of a new parking structure and integration of existing uses into the ground floor. The ENF indicates that the No-Build alternative was eliminated as it would result in higher pollutant emissions and roadway congestion due to the higher VMT associated with the drop-off/pick-up mode. The ENF identifies the Economy Garage and Terminal E Surface Lots as the Preferred Alternative. The ENF indicates the Economy Garage location was selected as the Preferred Alternative because the site access is well defined, it does not require significant changes to existing roadway infrastructure, and it is adjacent to compatible land uses and the Terminal E Surface Lot location was selected due to its proximity to Airport terminals, compatibility with adjacent land uses, and location within the Airport interior to minimize impacts to adjacent communities.

Air Quality

The project is anticipated to shift mode share from drop-off/pick-up modes and result in reductions in regional off-Airport VMT compared to the future No-Build scenario. The project will result in CO_2, VOC, and NO_x reductions of 25.8%, 25.5% and 25.6% (respectively) in 2022 and 20.2%, 20.0%, and 20.2% (respectively) in 2030 as compared to the future No-Build scenario.

The analysis assumes that HOV modes can accommodate the proportional growth in passenger levels. The ENF indicates that Massport will continue to strive to maintain the current HOV mode share levels, and expand overall HOV capacity as total passenger trips increase.

The ENF indicates that an updated air quality analysis will be provided in the DEIR.

GHG Emissions and Sustainability

The project is subject to review under the May 5, 2010 MEPA Greenhouse Gas Emissions Policy and Protocol ("the Policy"). The ENF indicates that Massport will quantify stationary and mobile source emissions (passenger vehicles) generated by the project. Massport has indicated that stationary source emissions will only be evaluated if the garage contains conditioned spaces. I refer Massport to DOER's comment letter which identifies a limited number of GHG measures that should be evaluated regardless of whether the garages include conditioned space.

The ENF identified Massport's efforts to maintain and increase HOV modes, including strategies related to pricing (incentives and disincentives), service availability, service quality, marketing, and traveler information. The ENF indicates that the parking garages may be designed to be certified in the new "Parksmart" program, which applies LEED sustainability strategies to structured parking facilities.

Noise

The ENF indicates that ground noise impacts will not change significantly as the project will not require proposed relocation of or changes to existing land use. The ENF indicates that the proposed vertical addition to the Economy Garage may act as an additional noise barrier to the adjacent neighborhood.

Construction Period Impacts

The ENF indicates that construction period impacts and associated mitigation measures, including noise, air quality, traffic, solid and hazardous waste, and water quality will be evaluated in the DEIR. It will also describe project phasing and sequencing. Massport participates in MassDEP's Clean Construction Equipment Initiative and requires engine retrofits to reduce exposure to diesel exhaust fumes and particulate emissions. The ENF indicates that construction activities will comply with MassDEP Solid Waste and Air Quality control regulations.

SCOPE

General

The ENF included a proposed scope for the DEIR. It includes an executive summary, project description, alternatives analysis, planning and sustainable design, traffic and multi-modal transportation, air quality and GHG, and construction impacts. In addition to the Scope items proposed in the ENF, the Scope for the DEIR should be supplemented by the additions and modifications identified below.

Project Description and Permitting

The DEIR should include site plans for existing and post-development conditions at a legible scale including the proposed garage structures and any curbside improvements and C.3
changes to the on-airport roadways. The DEIR should provide additional information to address construction sequencing and phasing. The DEIR should address traffic volumes and crash rates C.4
at the Airport. It should include a description of existing and proposed conditions, including on C.5
and off-Airport access, on-Airport circulation, and parking. The project description should address pedestrian and transit connections between the garages and the airport; pedestrian, C.6
transit, and vehicular access and egress locations; access and revenue control systems; anticipated rate structures; and identify hybrid, alternative fuel, and EV parking locations. As requested by MassDEP, it should include an evaluation of incorporating EV charging stations C.7
into the parking garages and identify the number and location of proposed stations. It should

include a discussion of how the construction and design of the garage could facilitate future expansion of EV charging stations if warranted by demand. C.7 Cont.

As indicated above, the draft amended Parking Freeze regulations would require Massport to complete three studies to identify ways to further support alternative transit options to the Airport. The results of these studies can be used to inform and benefit the development of mitigation measures for the Logan Airport Parking Project. The DEIR should clarify the C.8
timeframe for completed studies relative to the timeframe for developing specific mitigation measures for the Logan Airport Parking Project which are identified in the ENF. It should identify any commitments that would be contingent on the completion of a study.

The DEIR should address ground access considerations associated with the parking C.9
structures. It should describe site and design constraints for both locations. It should identify how the Terminal E garage will be designed consistent with the curbside improvements and changes C.10
to on-airport runways associated with the Terminal E Modernization Project which will commence construction in 2018. The DEIR should identify and describe any changes to the project since the filing of the ENF and provide an update on permitting. It should include a C.11
discussion of permitting requirements and document the project's consistency with regulatory standards, as appropriate.

Alternatives Analysis

The DEIR should expand on the initial alternatives analysis and summarize the findings of and the input provided by the community process that guided site selection. The DEIR should identify the number of parking spaces that could be accommodated at each of the alternative C.12
locations and describe in more detail why the Southwest Service Area location was eliminated from consideration. The DEIR should evaluate potential construction phasing and configurations. C.13
It should compare and contrast benefits and potential impacts of alternatives in narrative form C.14
and in a tabular format. The ENF indicates that the project will provide sufficient parking to accommodate approximately five years of peak-day parking demand if growth trends continue at current rates. The DEIR should identify the planning metrics and analysis used to determine the C.15
final number of proposed parking spaces (5,000 spaces).

Air Quality

As indicated above, the project is anticipated to shift mode share from drop-off/pick-up modes and result in reductions in regional off-Airport VMT compared to the future No-Build scenario. The project will result in CO_2, VOC, and NO_x reductions of 25.8%, 25.5% and 25.6% (respectively) in 2022 and 20.2%, 20.0%, and 20.2% (respectively) in 2030 as compared to the future No-Build scenario. As noted in the ENF, although there has been a long-term trend of decreasing emissions since 1990, airport-wide emissions of VOCs and NO_x are predicted to increase slightly from 2010 to 2030. The ENF indicates that a portion of this increase may be attributed to anticipated increases in air passenger activity levels and associated rise in regional and on-Airport VMT.

The air quality analysis provided in the ENF is predicated on maintaining an approximately 30% HOV mode share and proportional growth in demand for HOV. The DEIR should demonstrate that the HOV programs and any proposed HOV improvement measures will provide the capacity to meet demand associated with growth. Massport has made significant investments in programs to maintain and increase HOV modes and has been recognized as one of the top-ranking airports in terms of HOV/transit mode share. I note the 2015 Environmental Data Report (EDR) indicated that Massport's current ground access goal is to attain a 35.2% HOV mode share when annual air passenger levels reach 37.5 million. The ENF indicates that passenger levels are approaching this level with over 36 million passengers in 2016. To support Massport's investments and extend their benefits, the DEIR should include an evaluation of measures to support HOV use and extend the associated air quality benefits of the program and identify to what extent these measures will contribute towards attaining the future mode share goal. C.16

These additional measures include: increasing the frequency of transit services, expansion of transit services, parking supply, and pricing; and implementation of tolls or charges that can be used to improve HOV measures. I note improvements to reduce idling time of HOV modes (i.e. Logan Express, Blue Line Airport Shuttle, and SL1 Silver Line) will also provide air quality benefits. I refer Massport to comment letters which recommend additional measures to improve HOV and reduce VMT. I note monitoring and reporting on the progress towards achieving the goals and success of the mitigation program can be addressed in the Long-Term Parking Management Plan and future Environmental Status and Planning Reports (ESPRs) and Environmental Data Reports (EDRs) (EEA#3247/5146). C.17 C.18

The DEIR should identify and analyze localized on-Airport, community ground access, and air quality conditions at each of the proposed locations. The updated air quality analysis for existing and future year conditions should evaluate the changes in transportation and air quality emissions. The air quality analysis provided in the ENF should be revised to reflect the proposed construction phasing and timeframe to identify when the air quality benefits associated with reduced VMT will be realized. C.19

GHG Emissions and Sustainability

The DEIR should include an analysis of GHG emissions and mitigation measures in accordance with the standard requirements of the MEPA GHG Policy and Protocol. The analysis should include project-related stationary source emissions (exterior/interior parking structure lighting, ventilation, etc.) and mobile source emissions (passenger vehicles). The DEIR should present an evaluation of mitigation measures as outlined in the comments from the Department of Energy Resources (DOER) as appropriate based on whether the parking structures will contain conditioned spaces. I note that DOER's comments also identify mitigation measures that should be explored absent conditioned space, including but not limited to reduced lighting power densities (LPD) for interior and exterior lighting, parking structure ventilation, and solar photovoltaic (PV) installations. At a minimum, I expect the DEIR will present an evaluation of the feasibility and impact of these measures. This evaluation can be performed as separate calculations in lieu of energy modeling. C.20 C.21 C.22

The DEIR should include an evaluation of rooftop or carport solar PV. It should include a cost analysis to determine the financial feasibility of solar (including potential payback periods) and propose an installation that can be supported by the maximum available roof area (excluding areas dedicated for mechanical equipment) on both parking structures. The DEIR should include the assumed panel efficiency, estimate the electrical output of the system, and estimate annual GHG reductions due to the use of renewable energy instead of electricity or natural gas. The analysis should include a narrative and data to support the Proponent's adoption (or dismissal) of solar PV systems. C.23

The GHG analysis should include an evaluation of the potential GHG emissions of the project's mobile emissions sources using the EPA MOVES emissions model. The DEIR should use data gathered as part of the air quality analysis to determine mobile emissions for Existing Conditions, and the future No-Build, Build, and Build with Mitigation Conditions. The Build with Mitigation Conditions should incorporate measures and associated reductions identified in the Air Quality section above that will support HOV use and extend the associated air quality benefits of the program. C.24

The DEIR should provide emission tables that compare base case emissions in tons per year (tpy) with the Preferred Alternative showing the anticipated reduction in tpy and percentage by emissions source (direct, indirect and transportation). If the garages include conditioned space, information should be provided for each building in a format similar to the example table provided in DOER's comment letter. C.25 C.26

The project is in the conceptual design stage and, as such, provides meaningful opportunities for incorporation of sustainability measures. The DEIR should describe the project's consistency with Massport's Floodproofing Design Guide to demonstrate that the project will incorporate measures into the structure and site design to address potential impacts related to predicted sea level rise. C.27

Noise

The ENF indicates that constructing additional levels on the Economy Garage can serve as an additional noise barrier to the adjacent neighborhood. The DEIR should identify how the sound barrier benefits of the taller garage have been maximized through its design. This evaluation should account for the expanded Terminal E building. C.28

Construction Period Impacts

The DEIR should identify construction period impacts, including noise, air quality, traffic, solid and hazardous waste, and water quality, and identify avoidance, minimization, and mitigation measures. The DEIR should describe the project phasing and sequencing and address how construction will occur to avoid impacting the existing constrained parking supply. It should address construction phasing and whether construction will occur simultaneously with the Terminal E project. C.29 C.30 C.31

Mitigation and Draft Section 61 Findings

The DEIR should include a separate chapter summarizing proposed mitigation measures. C.32
This chapter should also include draft Section 61 Findings for each area of impact associated
with Massport's Preferred Alternative. The DEIR should contain clear commitments to
implement these mitigation measures, estimate the individual costs of each proposed measure, C.33
identify the parties responsible for implementation (either funding design and construction or
performing actual construction), and a schedule for implementation. To ensure that all GHG
emissions reduction measures adopted by the Proponent in the Preferred Alternative are actually
constructed or performed by the Proponent, I require Proponents to provide a self-certification to C.34
the MEPA Office indicating that all of the required mitigation measures, or their equivalent, have
been completed. The commitment to provide this self-certification in the manner outlined above
should be incorporated into the draft Section 61 Findings included in the DEIR.

Response to Comments

The DEIR should contain a copy of this Certificate and a copy of each comment letter C.35
received on the ENF. In order to ensure that the issues raised by commenters are addressed, the
DEIR should include direct responses to these comments to the extent that they are within
MEPA jurisdiction. This directive is not intended, and shall not be construed, to enlarge the C.36
scope of the EIR beyond what has been expressly identified in this Certificate. The response can
refer to future EDRs and/or ESPRs to address issues that are not within the DEIR Scope. I
recommend that Massport employ an indexed response to comments format, supplemented as C.37
appropriate with direct narrative response.

Circulation

In accordance with Section 11.16 of the MEPA Regulations and as modified by this C.38
Certificate, Massport should circulate a hard copy of the DEIR to each State and City Agency
from which the Proponent will seek permits. Massport must circulate a copy of the DEIR to all
other parties that submitted individual written comments. Per 301 CMR 11.16(5), the Proponent C.39
may circulate copies of the DEIR to these other parties in CD-ROM format or by directing
commenters to a project website address. However, Massport should make available a reasonable
number of hard copies to accommodate those without convenient access to a computer and
distribute these upon request on a first-come, first-served basis. Massport should send C.40
correspondence accompanying the CD-ROM or website address indicating that hard copies are
available upon request, noting relevant comment deadlines, and appropriate addresses for
submission of comments. A CD-ROM copy of the filing should also be provided to the MEPA
Office. A copy of the EIR should be made available for review at the following Libraries: Boston C.41
Public Library – Main, Orient Heights, and East Boson Branches, Chelsea Public Library, C.42
Winthrop Public Library, and Revere Public Library.

May 5, 2017
Date

Matthew A. Beaton

Comments received:

4/13/2017	Matthew Barison
4/14/2017	Massachusetts Competitive Partnership (MACP)
4/21/2017	Associated Industries of MA (AIM)
4/18/2017	South Shore Chamber of Commerce
4/21/2017	Association of Independent Colleges and Universities in Massachusetts (AICUM)
4/24/2017	Bill Schmidt, Vice Chairman, Winthrop Board of Health
4/21/2017	Boston Water and Sewer Commission (BWSC)
4/20/2017	Local 22 Construction & General Laborers' Union
4/25/2017	Patricia J. D'Amore
4/25/2017	John Vitagliano
4/25/2017	Frederick Salvucci
4/25/2017	Metropolitan Area Planning Council (MAPC)
4/25/2017	Massachusetts High Technology Council (MAHT)
4/25/2017	Wig Zamore (1 of 4)
4/25/2017	Wig Zamore (2 of 4)
4/25/2017	Wig Zamore (3 of 4)
4/25/2017	Wig Zamore (4 of 4)
4/27/2017	Boston Financial Services Leadership Council
4/27/2017	Department of Energy Resources (DOER)
5/5/2017	Massachusetts Department of Environmental Protection (MassDEP)

MAB/PRC/prc

Comment #	Author	Topic	Comment	Response
Logan Airport Parking Project C.18	Matthew Beaton, Secretary	Ground Access, Mitigation Tracking	I note monitoring and reporting on the progress towards achieving the goals and success of the mitigation program can be addressed in the Long-Term Parking Management Plan and future Environmental Status and Planning Reports (ESPRs) and Environmental Data Reports (EDRs) (EEA#324 7 /5146).	The *2016 Environmental Data Report* (EDR) includes an update to the Long-Term Parking Management Plan in Chapter 5, *Ground Access to and from Logan Airport*. The upcoming *2017 Environmental Status and Planning Report (ESPR)*, will include updated passenger, operations, and cargo forecasts and will assess the future cumulative environmental impacts of additional flights and passenger activity levels for noise, air quality/greenhouse gas (GHG) emissions, and ground access. Environmental management plans will be updated to address anticipated impacts, as appropriate. Future EDRs and ESPRs will track the Section 61 mitigation commitments associated with the Logan Airport Parking Project in Chapter 9, *Project Mitigation Tracking.*
Logan Airport Parking Project C.36	Matthew Beaton, Secretary	General	In order to ensure that the issues raised by commenters are addressed, the DEIR should include direct responses to these comments to the extent that they are within MEPA jurisdiction. This directive is not intended, and shall not be construed, to enlarge the scope of the EIR beyond what has been expressly identified in this Certificate. The response can refer to future EDRs and/or ESPRs to address issues that are not	This *2016 EDR* assesses cumulative environmental impacts for 2016. The upcoming *2017 ESPR* will include updated passenger, operations, and cargo forecasts and will assess the future cumulative environmental impacts of additional flights and passenger activity levels for noise, air quality/GHG emissions, and ground access. Environmental management plans will be updated to address anticipated impacts, as appropriate.

This Page Intentionally Left Blank.

B

Comment Letters and Responses

- The twelve comment letters received by the Massachusetts Environmental Policy Act (MEPA) Office on the *2015 Environmental Data Report (EDR)* are reprinted here in the order shown below. As requested in the Secretary of the Executive Office of Energy and Environmental Affairs' Certificate, Massport has provided responses to substantive comments raised in the following letters:

  - Aaron M. Toffler, Esq., Airport Impact Relief
  - Julie Wormser and Jill Valdes Horwood, Boston Harbor Now
  - Brian Palmucci, City of Quincy, Ward Four Councilor
  - Chris Marchi, East Boston resident
  - Cindy L. Christiansen, Ph.D., Milton resident
  - James Linthwaite, East Boston resident
  - James Roberts, Cambridge resident
  - Darryl Pomicter, President, Logan Airport Community Advisory Committee
  - Nancy S. Timmerman, P.E., consultant in Acoustics and Noise Control
  - Stephen H. Kaiser, Ph.D., City of Cambridge resident
  - Board of Selectmen of the Town of Milton, H. Thomas Hurley, David T. Burnes, and Kathleen M. Conlon
  - Wig Zamore, Cambridge resident

This Page Intentionally Left Blank.

January 31, 2017

The Honorable Matthew Beaton, Secretary
Executive Office of Energy and Environmental Affairs
100 Cambridge Street Suite 900
Boston, MA 02114

Re: 2015 Environmental Data Report – EOEA #3247

Dear Secretary Beaton,

On behalf of Airport Impact Relief, Incorporated (AIR, Inc.), I am submitting this comment letter on the 2015 Environmental Data Report (EDR) filed by Massport on December 21, 2016. For the first time in a filing with this office, Massport has acknowledged that it operates in the middle of an Environmental Justice neighborhood and has provided an Executive Summary of the document in Spanish. It is a small step, but for having taken it, they should be acknowledged. We are hopeful that in the future there will be more steps taken to encourage the meaningful involvement of community members in the application of environmental policies.

On the filing itself, we note that there is much time devoted to comparing 2015 air quality and noise levels with levels that existed in 1990 and 2000. This makes it appear as if things are trending in the right direction. A closer look at the data reveals otherwise in several cases. The number of people living within the noise contours that have been identified as being incompatible with residential land use has increased dramatically over the past several years (see Table 6-7). Although it is not directly stated in the EDR, it seems logical that this is due to the increase in international routes over the past few years. As such, we incorporate herein our comments on the Terminal E Modernization project. None of these comments were sufficiently responded to at the time they were submitted. Instead, we were told that the year-end EDR is the time to address cumulative impacts. We now reiterate that the cumulative impacts in several areas are trending in the wrong direction and need to be addressed by Massport, particularly as it appears that they anticipate further international growth in the years to come. The following comments reference the ENF for the Terminal E project, but the impacts discussed apply to the EDR as well. We are submitting them again now, as directed by Massport and the MEPA office, and would like for them to be addressed in response to this comment letter:

> **Transportation Impacts**
> The Massachusetts Port Authority (Massport) has done an insufficient job of addressing the transportation impacts of the Terminal E Modernization. The ENF projects that this expansion will not create any additional vehicle trips at all, but instead is designed to meet the demand that is anticipated to occur whether or not the project is built. ENF, page 3. The ENF simply states that "[I]n the last five years, international traffic at Logan Airport grew at unprecedented rates and this trend is projected to continue." ENF, page 4. However, much of this anticipated growth in international travel is due to the fact that Massport has been remarkably successful in the past several years in attracting, through incentives that by their own calculations add up to over $5.6 million dollars, additional international carriers to Logan Airport. Logan has signed up five new international airlines in the past three years, courting carriers from around the globe. See, wbur.org/2014/03/10/logan-new-international-airlines. They have added direct routes to Israel, Costa Rica, Beijing, Dubai, Istanbul and others using incentives such as offering free advertising for the airlines and temporarily waiving landing fees. The ENF does not provide credible evidence that the proposed terminal expansion will not produce additional induced demand for vehicle trips and parking. It stands to reason that, as was the case with the Big Dig, if the terminal's capacity is increased at the same time as new carriers are being wooed, demand for parking at the airport will increase along with vehicle trips. An EIR should include an analysis of this increased demand as well as its impact on the surrounding neighborhoods. 1-1

Further analysis is also warranted to determine the impact that this project will have on the public transportation infrastructure. The ENF suggests that more people will arrive at the airport via the MBTA because of a new direct connection between Terminal E and the Airport Station on the Blue Line. As the MBTA is already experiencing service problems, this anticipated extra burden on the system should be evaluated. 1-1 Cont.
Enhancements to Logan Express, extending the Blue Line and funding the Red / Blue Connector to provide alternative modes of transportation to and from Logan may be necessary to meet the extra demand associated with this project. An EIR should be required to evaluate how to meet this additional demand for public transportation while maintaining or improving current levels of service. 1-2

Finally, in public meetings about this project, Massport has suggested that they will likely need request that the current parking freeze be lifted and add an additional five thousand parking spaces on airport property. Although Massport has not explicitly linked the current project with the anticipated future need to lift the parking freeze, their 2014 Environmental Data Report (2014 EDR) attributes much of their future growth to the international market. Because this project will get rid of sixty existing spaces as well as the cell phone lot, and because the additional anticipated demand for parking spots at the airport can be linked primarily to the anticipated growth in the international air travel market, MEPA should regard these projects together, and require a holistic evaluation of parking needs on site. Related projects such as these should not be segmented and evaluated in a piecemeal fashion. An EIR should be required to evaluate parking needs on site that will result largely from increased international passenger demand. 1-3

Failure to Consider Alternatives

An EIR should be required so that viable regional transportation alternatives can be considered. 1-4 Community residents have promoted regional air travel planning for over thirty years. Yet now, despite the negative health impacts caused by Logan Airport pollution found by the recently completed Department of Public Health study, Massport's planners are attempting to build their way to success; looking only at on-airport solutions for Massachusetts' international air travel needs, without adequately weighing the societal, public health and related economic costs. The ENF only considers three alternatives to the project, with no consideration given to utilizing other airports or other forms of transportation to meet regional needs. This should be rectified by requiring a more regional transportation analysis in an EIR.

Health / Pollution

The recently released Logan Airport Health Study[1] (done by the Massachusetts Department of Public Health – Bureau of Environmental Health) found that pollution from Logan Airport causes an increased risk of childhood asthma and chronic obstructive pulmonary disease. AIR, Inc. has commissioned a review of this health study and found that other studies of airport impacts on public health have found even greater associations between airport pollution and disease. It is clear that more study needs to be done to assess the impact of Logan's operations on public health. 1-5

This project, responding to an increased induced demand for international travel, should be studied for its contribution to adverse public health outcomes, particularly in light of the impending request to lift the parking freeze. 1-6 Massport's own data (reported in the 2014 EDR) shows increases in particulate matter, VOCs and NOx emissions in 2014. Because increases in international air travel are expected to continue to provide the

[1] http://www.mass.gov/eohhs/docs/dph/environmental/investigations/logan/logan-airport-health-study-executive-summary.pdf

majority of Logan's growth over the next several years, it is important to understand the health impacts of such growth on the surrounding communities. In order to fully understand the impact of airport pollution on these communities, a comprehensive monitoring program should be put in place and the data made available to researchers across the state. An EIR should include a proposed monitoring and evaluation program that would support the protection of public health. 1-7

With respect to the EDR itself, we note that there continues to be no discussion or measurement of ultrafine particulate matter, despite it being potentially the most damaging of the particulate matter. We request that this pollutant be included in future analyses. 1-8 Massport should also develop a plan to address what looks like a dramatic increase in PM10 and PM2.5 emissions over the past five years (see Table 7-7). 1-9 Also not included in the EDR is an EJ/Title VI analysis. This should be included in the annual EDRs going forward, as well as in next year's ESPR. 1-10 Finally, we would request that the raw data upon which the conclusion that 5,000 new parking spaces are both warranted and will lead to a DECREASE in air pollution for the community be shared with the community so that it can be independently evaluated. This would include the surveys that are referenced in the EDR (2013 Logan Airport Passenger Ground Access Survey) as well as any analysis thereof done by Massport. Ideally, such information would form the basis of a joint Massport/community planning session to identify ways to achieve Massport's objectives of reducing trips to the airport in a mutually beneficial way. 1-11

Thank you for the opportunity to submit this comment letter. If you have any questions or concerns, please feel free to contact me at aaron.toffler@gmail.com.

Very truly yours,

Aaron M. Toffler, Esq.
Airport Impact Relief, Inc.

cc: Stewart Dalzell, Deputy Director, Environmental Planning and Permitting, Massport

This Page Intentionally Left Blank.

Comment ID	Author	Topic	Comment	Response
1-1	Aaron M. Toffler, Esq. Airport Impact Relief, Inc.	Ground Access, Terminal E Modernization Project	It stands to reason that, as was the case with the Big Dig, if the terminal's [Terminal E] capacity is increased at the same time as new carriers are being wooed, demand for parking at the airport will increase along with vehicle trips. An EIR should include an analysis of this increased demand as well as its impact on the surrounding neighborhoods. Further analysis is also warranted to determine the impact that this project will have on the public transportation infrastructure.	The Terminal E Modernization Project has completed the environmental review process under the National Environmental Policy Act (NEPA) and the Massachusetts Environmental Policy Act (MEPA). Massport prepared a Draft and Final Environmental Assessment (EA)/Environmental Impact Report (EIR) for the project. Chapter 5, *Ground Access to and from Logan Airport* of this *2016 Environmental Data Report* (EDR) provides details of Massport's overall ground access and parking strategy that strives to increase high occupancy vehicle (HOV) mode share and enhance accessibility to the Airport through promoting use of alternative modes of transportation to single occupant vehicles, and trip reduction.
1-2	Aaron M. Toffler, Esq. Airport Impact Relief, Inc.	Ground Access, Terminal E Modernization Project	Enhancements to Logan Express, extending the Blue Line and funding the Red / Blue Connector to provide alternative modes of transportation to and from Logan may be necessary to meet the extra demand associated with this project [Terminal E Modernization]. An EIR should be required to evaluate how to meet this additional demand for public transportation while maintaining or improving current levels of service.	The Terminal E Modernization Project has completed the environmental review process under NEPA and MEPA. Massport prepared a Draft and Final EA/EIR for the project. Chapter 5, *Ground Access to and from Logan Airport* of this *2016 EDR* describes Massport's comprehensive ground access strategy for Logan Airport which includes promotion of HOV use through a blend of initiatives related to pricing (incentives and disincentives), service availability, service quality, marketing, and traveler information. Massport's ground access strategy for HOV includes public transit (Blue Line rapid transit, Silver Line rapid transit, Massachusetts Bay Transportation Authority (MBTA) bus, and water transportation), Logan Express scheduled bus service, scheduled vans and buses, courtesy shuttle buses, charter buses, and unscheduled private limousines and vans. Additional elements of the ground access strategy include accommodations for private vehicles (pick-up, drop-off, cell phone waiting lot, and parking), taxis, rental cars, and Transportation Network Companies (TNCs). Massport evaluated a potential connection between the Massachusetts Bay Transportation Authority (MBTA) Red Line and Blue Line in the Terminal E Modernization EA/EIR. The assessment included an analysis of the existing capacity on the MBTA Blue Line. A review of ridership and trainset capacity on the Blue Line indicated that there is significant reserve capacity (passenger space available within the trainset) remaining on the Blue Line during the peak hour in the peak direction. Massport will continue to work with MBTA on the status and the potential design of the pedestrian connector to the Blue Line Airport Station. This connection is currently being studied and various approaches are under consideration. Consideration is being given to constructing an Automated People Mover (APM) which ultimately would connect the MBTA Blue Line Station to all the terminals. The APM concept is in the very early stages of feasibility assessment and will be more definitive as the Terminal E Modernization Project moves into Phase 2.

Comment ID	Author	Topic	Comment	Response
1-3	Aaron M. Toffler, Esq. Airport Impact Relief, Inc.	Ground Access, Terminal E Modernization Project, Logan Airport Parking Project	Although Massport has not explicitly linked the current project with the anticipated future need to lift the parking freeze, their 2014 Environmental Data Report (2014 EDR) attributes much of their future growth to the international market. Because this project [Terminal E Modernization] will get rid of sixty existing spaces as well as the cell phone lot, and because the additional anticipated demand for parking spots at the airport can be linked primarily to the anticipated growth in the international air travel market, MEPA should regard these projects together, and require a holistic evaluation of parking needs on site. Related projects such as these should not be segmented and evaluated in a piecemeal fashion. An EIR should be required to evaluate parking needs on site that will result largely from increased international passenger demand.	The annual EDRs and Environmental Status and Planning Reports (ESPRs) serve as a holistic evaluation of overall airport environmental impacts, a point noted in the Secretary's Certificate completing the environmental review by the Executive Office of Environmental Affairs (EEA) for the Terminal E Modernization Project. Chapter 5, *Ground Access to and from Logan Airport* of this *2016 EDR* provides an overview of parking conditions and plans at Logan Airport under the sections *Parking Conditions* and *Long-term Parking Management Plan*. The Terminal E Modernization Project has completed the environmental review process under NEPA and MEPA. The Logan Airport Parking Project is a separate project from the Terminal E Modernization Project as each project serves to meet distinct needs. On March 31, 2017, Massport filed an Environmental Notification Form (ENF) for the Logan Airport Parking Project, which proposes to build 5,000 new on-Airport commercial parking spaces at Logan Airport in two locations (on top of the existing Economy Garage and in the location of the existing Terminal E surface lot). On May 5, 2017, the Secretary of EEA issued his Certificate on the ENF establishing the Scope for the required Draft EIR for the Parking Garages Project. The Draft EIR will further evaluate the environmental impacts of the Logan Airport Parking Project in accordance with the Secretary's Certificate. The construction of additional commercial parking spaces at Logan Airport was predicated on a regulatory change, by the Massachusetts Department of Environmental Protection (MassDEP), whereby MassDEP would need to amend the existing Logan Airport Parking Freeze to allow for some additional commercial parking spaces at Logan Airport. In response to Massport's 2016 request to consider an amendment to the Logan Airport Parking Freeze (to increase the commercial parking freeze limit by 5,000 spaces), MassDEP conducted a stakeholder process, which was followed by a public process to amend the Parking Freeze regulation. MassDEP issued the amended regulation on June 30, 2017 approving the requested parking increase. On March 6, 2018, U.S. Environmental Protection Agency (EPA) formally amended the Massachusetts State Implementation Plan (SIP) to accommodate an increase of 5,000 spaces in the Logan Airport Parking Freeze.

Comment ID	Author	Topic	Comment	Response
1-4	Aaron M. Toffler, Esq. Airport Impact Relief, Inc.	Ground Access, Terminal E Modernization Project	An EIR should be required so that viable regional transportation alternatives can be considered.	The Terminal E Modernization Project has completed the environmental review process under NEPA and MEPA. Massport prepared a Draft and Final EA/EIR for the project. Chapter 5, *Ground Access to and from Logan Airport* of this *2016 EDR* provides details of Massport's overall ground access and parking strategy that strives to increase HOV mode share and enhance accessibility to the Airport through promoting use of alternative modes of transportation than single occupant vehicles and trip reduction. Massport has considered the provision of additional international service at regional airports numerous times during the analysis of Terminal E operations, both historically during previous airport improvement projects and during the conceptual design phase. Alternatives that consider provision of international service at regional airports such as T.F. Green Airport (Rhode Island) or Manchester-Boston Regional (New Hampshire) airports were not developed further for a number of reasons. First, international air carriers choose to fly in and out of Logan Airport to satisfy passenger demand. The demand for international travel to these regional locations is considerably lower than that of Boston. Connecting international flights to and from these regional airports are limited when compared to the services already found at Logan Airport. Supporting infrastructure such as Customs and Border Protection facilities, are also limited at these airports and would require additional staffing by the Transportation Security Administration and Homeland Security agencies. Regional Airports such as Manchester-Boston Regional Airport , T.F. Green Airport, and Worcester Regional Airport provide critical alternatives to local passengers that otherwise would be driving to Logan Airport for the same service. For the most part, the air service from the regional airports is focused on short haul and medium haul nonstop, jet service to business and leisure destinations as well as to air carrier hubs to access longer haul options. Manchester-Boston Regional Airport and T.F. Green Airport have added new terminals, extended runways, and enhanced bad weather capabilities (Category III Instrument Landing System) that provide critical infrastructure to attract and sustain dependable, jet air service. Massport is currently upgrading Worcester Regional Airport's bad weather technology to Category III, as well as airfield taxiway improvements to bring Worcester Regional Airport up-to-par with the other regional airports. For more information see Chapter 4, *Regional Transportation* .

Comment ID	Author	Topic	Comment	Response
1-5	Aaron M. Toffler, Esq. Airport Impact Relief, Inc.	Air Quality/ Emissions	It is clear that more study needs to be done to assess the impact of Logan's operations on public health.	Chapter 7, *Air Quality/Emissions Reduction* reports on the status of the Massachusetts Department of Public Health (MassDPH) Study. Massport provides an update on the status and findings of the MassDPH Logan Airport Health Study and Massport's air quality studies in the annual EDRs and ESPRs. The results of the health studies are also available online at http://www.mass.gov/eohhs/docs/dph/environmental/investigations/logan/logan-airport-health-study-final.pdf. MassDPH conducted the Logan Airport Health Study in May 2014. The study area consisted of areas surrounding the Airport including Milton. The study concluded that "Air dispersion modeling of airport related emissions using a state-of-the-art model indicates that the highest predicted pollutant concentrations associated with airport related operations are near the perimeter of Logan Airport and fall off rapidly with increased distance." The study categorized surrounding communities by "high," "medium," and "low" exposure; In response to the study recommendations, Massport has: • Entered into an agreement to provide funding to the East Boston Neighborhood Health Center to help expand the efforts of their Asthma and Chronic Obstructive Pulmonary Disease (COPD) Prevention and Treatment Program in East Boston and launch a program in Winthrop including screening children, providing asthma kits, and home visits, among others. • Entered into an agreement with the Massachusetts League of Community Health Centers for the evaluation and assessment of the Asthma and COPD Prevention and Treatment Program, and engagement of community health centers in the North End, Charlestown, Chelsea, and South Boston. The East Boston Neighborhood Health Center will conduct the same evaluations for the East Boston and Winthrop community programs. • Massport entered into an agreement with the MassDPH to expand or establish the Asthma and COPD Prevention and Treatment Program in South Boston, the North End, Chelsea, and Charlestown in collaboration with the Massachusetts General Hospital, South Boston Neighborhood Health Center, and conduct training on the Community Health Worker assessments.

Comment ID	Author	Topic	Comment	Response
1-6	Aaron M. Toffler, Esq. Airport Impact Relief, Inc.	Terminal E Modernization /Air Quality/ Emissions	This project [Terminal E Modernization], responding to an increased induced demand for international travel, should be studied for its contribution to adverse public health outcomes, particularly in light of the impending request to lift the parking freeze.	The Terminal E Modernization Project is intended to more efficiently accommodate international passengers. The historic growth at Logan Airport that occurred without additional gates demonstrates that demand at Logan Airport is driven by economic and market factors, not airport improvements. Thus, Logan Airport will handle the same level of increased international passenger activity whether or not Terminal E is modernized. Since the same number of passengers will be accommodated with or without the Terminal E Modernization Project, the parking demand will be the same. For additional information on Massport's support of study of health effects, see response to Comment 1-5 above.
1-7	Aaron M. Toffler, Esq. Airport Impact Relief, Inc.	Air Quality/ Emissions	In order to fully understand the impact of airport pollution on these communities, a comprehensive monitoring program should be put in place and the data made available to researchers across the state. An EIR should include a proposed monitoring and evaluation program that would support the protection of public health.	The Terminal E Modernization Project has completed the environmental review process under NEPA and the MEPA. The Secretary of EEA issued a Certificate of Adequacy for the Terminal E Modernization Project thus completing the state environmental review process; the Federal Aviation Administration (FAA) issued a Finding of No Significant Impact/Record of Decision (FONSI/ROD) on the project, thereby completing the federal environmental review of the project. The intent of the EDR is to provide a review of environmental conditions for the reporting year compared to previous years. Chapter 5, *Ground Access to and from Logan Airport* , Chapter 6, *Noise Abatement* , and Chapter 7, *Air Quality/Emissions Reduction* each include management plans that report on Massport's environmental goals and progress towards meeting those goals. In addition, Massport undertakes several initiatives that are reported in EDRs and ESPRs such as the Boston-Logan International Airport Sustainability Management Plan, Massport's Air Quality Initiative, and Massport's Environmental Management Policy. For additional information on Massport's health effects study support, see Comment 1-5 above.
1-8	Aaron M. Toffler, Esq. Airport Impact Relief, Inc.	Air Quality/ Emissions	With respect to the EDR itself, we note that there continues to be no discussion or measurement of ultrafine particulate matter, despite it being potentially the most damaging of the particulate matter. We request that this pollutant be included in future analyses.	The EDR provides information on ultrafine particles (UFPs) in Chapter 7, *Air Quality/Emissions Reduction* . At this time, there are no state or federal air quality standards for outdoor levels of UFPs. Massport is actively tracking the research and regulatory status of this pollutant and will comply with future UFP standards if promulgated by EPA. In Chapter 7, Massport has added a section that discusses Black Carbon to address concerns voiced by the community. Massport will also track the research and regulatory status of this pollutant.
1-9	Aaron M. Toffler, Esq. Airport Impact Relief, Inc.	Air Quality/ Emissions	Massport should also develop a plan to address what looks like a dramatic increase in PM10 and PM2.5 emissions over the past five years (see Table 7-7).	The estimated increase in $PM_{10}/PM_{2.5}$ emissions from 2012 to 2013 is mostly attributable to changes in the FAA's emissions model from EDMS 5.1.3 to EDMS 5.1.4.1 and the EPA's MOBILE 6.2.03 to MOVES 2010b. Annual emissions of $PM_{10}/PM_{2.5}$ from 2013 (92 kilograms/day) to 2016 (96 kilograms/day) represents an approximately 4 percent increase. Chapter 7, *Air Quality/Emissions Reduction* discusses 2016 PM results, which are presented using both the legacy Emissions and Dispersion Modeling System (EDMS) and the Aviation Environmental Design Tool (AEDT).

Comment ID	Author	Topic	Comment	Response
1-10	Aaron M. Toffler, Esq. Airport Impact Relief, Inc.	Environmental Justice	Also not included in the EDR is an EJ/Title VI analysis. This should be included in the annual EDRs going forward, as well as in next year's ESPR.	Massport is mindful of its neighbors and has prepared summaries of the EDR and other environmental documentation in Spanish, to provide information to the community. Recently completed Spanish language documents can be found on Massport's website at http://www.massport.com/massport/about-massport/project-environmental-filings/logan-airport/. This *2016 EDR* includes a Spanish translation of Chapter 1, *Introduction/Executive Summary*.
1-11	Aaron M. Toffler, Esq. Airport Impact Relief, Inc.	Air Quality/ Emissions, Logan Airport Parking Project	Finally, we would request that the raw data upon which the conclusion that 5,000 new parking spaces are both warranted and will lead to a DECREASE in air pollution for the community be shared with the community so that it can be independently evaluated. This would include the surveys that are referenced in the EDR (2013 Logan Airport Passenger Ground Access Survey) as well as any analysis thereof done by Massport. Ideally, such information would form the basis of a joint Massport/community planning session to identify ways to achieve Massport's objectives of reducing trips to the airport in a mutually beneficial way.	Massport periodically administers an extensive survey of air passengers to better understand access characteristics of air passengers traveling to and from Logan Airport and to track historical trends of these characteristics. Since the late 1970s, the *Logan Airport Air Passenger Ground Access Survey* has been Massport's primary tool for understanding the changes in air passenger travel behavior, including ground access mode choices, travel patterns, and market characteristics. The survey is a tool that assists Massport in evaluating the effectiveness of its transportation policies and services, and the impacts on the regional transportation system. The survey also shapes the direction of Massport's planning efforts to encourage Logan Airport travelers to use HOV and shared-ride modes instead of single-occupancy vehicle (SOV) modes. Chapter 5, *Ground Access to and from Logan Airport* presents the results from the *2016 Logan Airport Air Passenger Ground Access Survey.* Table 5-12 presents the HOV mode share. Additional findings from the survey are presented in the chapter, as are comparisons to the results from past surveys. Traveling in a private vehicle and being dropped-off at the curb is still the predominant way that air passengers get to Logan Airport; this mode is used by approximately 21 percent of travelers. The use of TNCs (such as Uber and Lyft) to access the Airport is the second most common mode, at a 14.3-percent share. Public transit modes (including the MBTA's services, Logan Express, and similar scheduled bus services) account for approximately 16.3 percent of air passengers traveling to the Airport. Driving and parking at the Airport is the mode used by 11.4 percent of air passengers and taxis are now used by 9.8 percent. According to the 2016 survey, if parking was not an option for passengers who parked on-Airport, 81 percent of survey respondents indicated that they would use drop-off/pick-up modes (i.e., dropped off or picked up by private vehicles, taxi, TNC, or black car/limousine service). On March 31, 2017, Massport filed an ENF for the Logan Airport Parking Project, which proposes to build 5,000 new on-Airport commercial parking spaces at Logan Airport in two locations (on top of the existing Economy Garage and in the location of the existing Terminal E surface lot). On May 5, 2017, the EEA issued its Certificate on the ENF establishing the Scope for the required Draft EIR. The Draft EIR will further evaluate the environmental impacts of the Logan Airport Parking Project in accordance with the Secretary's Certificate. Massport will evaluate the potential for the Logan Airport Parking Project to have an effect on air quality in the Draft EIR for the Logan Airport Parking Project. Massport will continue to reach out to the community in many formal and informal settings to keep updating the public on planning activities and upcoming projects.

15 State Street, Suite 1100
Boston, MA 02109
617.223.8671
bostonharbornow.org

January 20, 2017

Via email to: anne.cannaday@state.ma.us

Secretary Matthew A. Beaton
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Ste 900 (9th Floor)
Boston, MA 02114

Attn: Ann Canaday, EEA #3247

Re: Boston-Logan International Airport 2015 Environmental Data Report

Dear Secretary Beaton,

On behalf of Boston Harbor Now, thank you for the opportunity to comment on the Boston-Logan 2015 Environmental Data Report (EDR) submitted on December 15, 2016.

Our staff attended the consultation session held on January 11, 2017, at which time Massport staff and partners responded to questions and comments submitted by our policy staff. We were encouraged by the presence of Spanish translators at the public meeting and the availability of translated copies of the EDR Executive Summary. This is a great initiative and we encourage Massport to work with members of the community to expand translation services to include additional languages. 2-1

Our comments for the 2015 EDR focus on transportation to and from Logan, specifically as it relates to water transportation.

Airport Activity Levels
Logan Airport is New England's primary domestic airport, a major international gateway, a regional connecting hub, and the busiest air cargo center in New England. In 2015, a record high 33.4 million air travelers passed through Logan Airport—the highest passenger traffic levels since 2008. As projected in earlier environmental data reports, international travel demands increased at a faster rate than the domestic passenger market with international passenger numbers growing from 5 million to 5.5 million, a 10.9% jump.

In our comments submitted November 6, 2015, Boston Harbor Now suggested surveying international passenger ground transportation preferences to understand how the use of HOV, shared-rides and public transportation could be optimized for this growing group of travelers. 2-2
With the exponential growth in international travelers, we continue to see this study as a valuable addition to the proposed scope of the 2016 Environmental Status and Planning Report (ESPR). (Appendix C, Page C-1 of the 2015 EDR).

Access to and from Logan Airport
Since 1998, HOV mode shares at Logan Airport have increased 2.5 times and rank among the top for U.S. airports. Even so, as Logan Airport air traveler numbers continue to rise, Massport's HOV mode shares percentages have not increased significantly and pick up/drop off vehicle trips have gradually ticked up.

We know that enhancing passenger access continues to be a top priority for Massport. To increase the number of passengers and employees arriving by transit or other HOV modes, Massport should continue to encourage public transit use by maintaining free access to the Silver Line at Logan Airport, Back Bay Logan Express service, Framingham Express service, 2-3
increased airport parking rates, and support of private coach/van operators.

Ground Access
As presented in the EDR, the 2015 daily parking demands at Logan frequently approached the upper limit set by the Airport Parking Freeze. (Page 5-12 of the 2015 EDR). To address the parking shortage, Massport plans to request that MassDEP amend the terms of the parking freeze. (Page 5-13 of the 2015 EDR). Boston Harbor Now is open to revisiting the parking freeze cap but would first prefer to work with Massport to explore alternate modes of transit and 2-4
enhance existing options like the MBTA ferries.

During the January consultation session, our team inquired about ride-for-hire services like Uber, Lyft, and Fasten as travel options from Logan airport. According to Massport staff, these services are only allowed to operate within Logan Airport on a very limited basis and must depart from a designated lot. During the Summer of 2016, the State of Massachusetts approved the "Uber bill" which allows ride-for-hire services to not only drop-off travelers but also pick-up riders from Logan Airport.[1] By allowing ride-for-hire vehicles that would otherwise leave the airport empty to pick up passengers, Massport would be reducing the number of pick-up vehicles traveling through Logan. Due to the increasing popularity and affordability of ride-for-hire services, we believe that if implemented, the new share-ride rules can reduce the need to build 5,000 additional parking spaces. 2-5

Water Transportation

As presented in the EDR, 2015 annual ridership and activity levels on the MBTA Harbor Express ferries fell to 7,748, a 60% drop from 2014. (Table 5-8, Environmental Data Report). Currently, the Harbor Express F2/F2H serves Hingham/Hull-Logan and Long Wharf. The significant decline in ferry ridership warrants a more detailed analysis in future data reports. We would be particularly interested in understanding the factors contributing to the steep decline in water transportation use to and from Logan Airport. 2-6

We understand that maintaining a successful ferry system to the airport is not solely a Massport concern. Massport should continue to work with MBTA officials to improve reliable and efficient ferry service to Logan Airport. Boston Harbor Now is taking a harborwide comprehensive look at water transportation and working to develop recommendations for a viable business and implementation plan for a water transportation system that expands the scheduled harbor ferry system in Boston Harbor. We would be glad to collaborate with Massport to enhance water transportation options to and from Logan Airport moving forward. 2-7

We continue to be supportive of Massport's courtesy shuttle bus service between the Logan dock, the MBTA Airport Station and all terminals as well as the employee subsidy for those that commute by ferry. We urge Massport to consider not only maintaining the current ferry schedule but also to expand off-peak services, increase airport terminal marketing of water transportation, and generate additional water transit price motivators. 2-8 We continue to believe that a more robust water transportation system is an excellent opportunity for Massport to serve airport passengers better and contribute to the broader success of bringing water transportation to scale in Boston Harbor.

We look forward to reviewing a more detailed analysis of Massport's progress towards increasing HOV modes of travel to Logan Airport using the data collected via its upgraded

[1]http://www.masslive.com/politics/index.ssf/2016/08/gov_charlie_baker_signs_law_regulating_uber_and_lyft_in_massachusetts.html

Automated Traffic Monitoring Systems (ATMS) in the 2016 Environmental Status and Planning Report.

Park and Open Space Projects

To mitigate increased local traffic as a result of record high air travel demands and international passenger growth, we encourage Massport to continue its efforts to address not only the needs of airport passengers but also residents who will benefit from more robust public transit options and pedestrian connections. With increased airport traffic, it becomes increasingly important to take residents off the roads and onto protected, non-motorized walking and biking paths. 2-9

The Spring 2016 completion of the Narrow Gauge Connector brought together the final portion of the East Boston Greenway and the East Boston Greenway Connector. This project provides a crucial connection between Boston Harbor, the Bremen Street Dog Park, Bremen Street Park, and Constitution Beach. With increased car, truck, and bus traffic to and from the airport, this pedestrian link provides the safest walking, running, and biking connection to the network of East Boston Parks and the waterfront. As long time advocates of public waterfront spaces, Boston Harbor Now applauds Massport's efforts to construct new open spaces and airport buffer areas.

To that end, we encourage Massport to continue working with residents and advocates to ensure that the public spaces and buffer areas are well maintained and provide significant, high-quality spaces that benefit surrounding neighborhoods. Undoubtedly, Logan operations have an adverse impact on East Boston traffic congestion, noise, and air quality. We continue to be highly supportive of all efforts Massport engages in to increase benefits to the local community including but not limited to improved open spaces, better programming of open areas, enhanced Harborwalk sections, and innovative public amenities. 2-10

We look forward to reviewing the Logan Airport passenger and operations predictions through 2035 in the forthcoming 2016 Environmental Planning and Status Report. Thank you again for the opportunity to comment.

Sincerely,

Julie Wormser
VP of Policy

Jill Valdes Horwood
Director of Waterfront Policy

Comment ID	Author	Topic	Comment	Response
2-1	Boston Harbor Now	Spanish Translation	We were encouraged by the presence of Spanish Translators at the public meeting and the availability of translated copies of the EDR Executive Summary. This is a great initiative and we encourage Massport to work with members of the community to expand translation services to include additional languages.	Massport plans to continue to provide translators at public meetings for the Environmental Data Reports (EDRs) and Environmental Status and Planning Reports (ESPRs). Massport will continue to translate the Executive Summary of the EDRs and ESPRs into Spanish.
2-2	Boston Harbor Now	Ground Access	In our comments submitted November 6, 2015, Boston Harbor Now suggested surveying international passenger ground transportation preferences to understand how the use of HOV, shared---rides and public transportation could be optimized for this growing group of travelers. With the exponential growth in international travelers, we continue to see this study as a valuable addition to the proposed scope of the 2016 Environmental Status and Planning Report (ESPR). (Appendix C, Page C---1 of the 2015 EDR).	Massport periodically administers an extensive survey of air passengers to better understand access characteristics of air passengers traveling to and from Logan Airport and to track historical trends of these characteristics. Since the late 1970s, the *Logan Airport Air Passenger Ground Access Survey* has been Massport's primary tool for understanding the changes in air passenger travel behavior, including ground access mode choices, travel patterns, and market characteristics. The survey is a tool that assists Massport in evaluating the effectiveness of its transportation policies and services, and the impacts on the regional transportation system. The survey also shapes the direction of Massport's planning efforts to encourage Logan Airport travelers to use high-occupancy vehicle (HOV) and shared-ride modes instead of single-occupancy vehicle (SOV) modes. Chapter 5, Ground Access to and from Logan Airport presents the results from the *2016 Logan Airport Air Passenger Ground Access Survey*. Table 5-12 presents the HOV mode share. Additional findings from the survey are presented in the chapter, as are comparisons to the results from past surveys. The *2016 Logan Air Passenger Ground Access Survey* is available online at www.massport.com/media/2593/2016-logan-air-passenger-ground-access-survey.pdf.
2-3	Boston Harbor Now	Ground Access	Massport should continue to encourage public transit use by maintaining free access to the Silver Line at Logan Airport, Back Bay Logan Express service, Framingham Express service, increased airport parking rates, and support of private coach/van operators.	Massport continues to encourage public transportation to and from the Airport. Outbound Silver Line boardings continue to be free of charge and on-Airport parking rates increased in June 2016 (see Table 5-6 for details). The Back Bay Logan Express pilot program continued in 2016; ridership for Back Bay Logan Express totaled 216,329 passengers in 2016 or an average of about 600 riders per day. This *2016 EDR* discusses Massport's existing ground transportation initiatives in Chapter 5, *Ground Access to and from Logan Airport.* Ridership on Logan Express and public transportation increased in 2016 (Table 5-8). For more information, see the *Ground Transportation Ridership and Activity Levels in 2016* and *Ground Access Initiatives* sections in Chapter 5, *Ground Access to and from Logan Airport.*

Comment ID	Author	Topic	Comment	Response
2-4	Boston Harbor Now	Ground Access	Boston Harbor Now is open to revisiting the parking freeze cap but would first prefer to work with Massport to explore alternate modes of transit and enhance existing options like the MBTA ferries.	Massport's ground transportation strategy is designed to provide a broad range of HOV, transit, and shared-ride options for travel to and from Logan Airport and to minimize vehicle trips, by providing convenient transit, shuttle, bike, and pedestrian connections to the Airport. The strategy also aims to provide on-Airport parking for passengers choosing to drive or who have limited HOV options. Massport continues to manage parking supply, pricing, and operations to promote the use of transit, HOV, and shared-ride options. Increasing available on-Airport parking is one strategy Massport employs to minimize drop-off/pick-up trips. On March 31, 2017, Massport filed an Environmental Notification Form (ENF) for the Logan Airport Parking Project, which proposes to build 5,000 new on-Airport commercial parking spaces at Logan Airport in two locations (on top of the existing Economy Garage and in the location of the existing Terminal E surface lot). On May 5, 2017, the Executive Office of Energy and Environmental Affairs (EEA) issued its Certificate on the ENF establishing the Scope for the required Draft Environmental Impact Report (EIR). The Draft EIR will further evaluate the environmental impacts of the Logan Airport Parking Project in accordance with the Secretary's Certificate. The construction of additional commercial parking spaces at Logan Airport was predicated on a regulatory change, by the Massachusetts Department of Environmental Protection (MassDEP), whereby MassDEP would need to amend the existing Logan Airport Parking Freeze to allow for some additional commercial parking spaces at Logan Airport. In response to Massport's 2016 request to consider an amendment to the Logan Airport Parking Freeze (to increase the commercial parking freeze limit by 5,000 spaces), MassDEP conducted a stakeholder process, which was followed by a public process to amend the Parking Freeze regulation. MassDEP issued the amended regulation on June 30, 2017 approving the requested parking increase. On March 6, 2018, U.S. Environmental Protection Agency (EPA) formally amended the Massachusetts State Implementation Plan (SIP) to accommodate an increase of 5,000 spaces in the Logan Airport Parking Freeze.
2-5	Boston Harbor Now	Ground Access	By allowing ride-for-hire vehicles that would otherwise leave the airport empty to pick up passengers, Massport would be reducing the number of pick---up vehicles traveling through Logan. Due to the increasing popularity and affordability of ride-for-hire services, we believe that if implemented, the new share-ride rules can reduce the need to build 5,000 additional parking spaces.	Beginning in February 2017, Massport began allowing Transportation Network Companies (TNCs) to pick up arriving passengers via a TNC pool lot on the Airport. This is a service that is being tracked for reporting in the *2017 ESPR*. This is a national trend and Massport will be following how other U.S. airports are addressing TNCs and airport accessibility.

Comment ID	Author	Topic	Comment	Response
2-6	Boston Harbor Now	Ground Access	Currently, the Harbor Express F2/F2H serves Hingham/Hull---Logan and Long Wharf. The significant decline in ferry ridership warrants a more detailed analysis in future data reports. We would be particularly interested in understanding the factors contributing to the steep decline in water transportation use to and from Logan Airport.	Ferry Service is provided by the Massachusetts Bay Transportation Authority (MBTA). Massport participates in planning for water transportation in the Boston region as a member of state Water Transportation Advisory Council, convened by the Massachusetts Department of Transportation (MassDOT). Massport also participates in a comprehensive study of commuter, recreational, and landside access needs to support water transportation in Boston Harbor. Massport is a steering committee member for this study led by Boston Harbor Now with support from MassDOT and other stakeholders. The EDR provides information on current water transportation ridership in Table 5-8.
2-7	Boston Harbor Now	Ground Access	Massport should continue to work with MBTA officials to improve reliable and efficient ferry service to Logan Airport. Boston Harbor Now is taking a harborwide comprehensive look at water transportation and working to develop recommendations for a viable business and implementation plan for a water transportation system that expands the scheduled harbor ferry system in Boston Harbor. We would be glad to collaborate with Massport to enhance water transportation options to and from Logan Airport moving forward.	Ferry Service is provided by the MBTA. Massport participates in planning for water transportation in the Boston region as a member of state Water Transportation Advisory Council, convened by MassDOT. Massport also participates in a comprehensive study of commuter, recreational, and landside access needs to support water transportation in Boston Harbor. Massport is a steering committee member for this study led by Boston Harbor Now with support from MassDOT and other stakeholders.
2-8	Boston Harbor Now	Ground Access	We urge Massport to consider not only maintaining the current ferry schedule but also to expand off-peak services, increase airport terminal marketing of water transportation, and generate additional water transit price motivators.	Ferry Service is provided by the MBTA. Massport participates in planning for water transportation in the Boston region as a member of state Water Transportation Advisory Council, convened by MassDOT. Massport also participates in a comprehensive study of commuter, recreational, and landside access needs to support water transportation in Boston Harbor. Massport is a steering committee member for this study led by Boston Harbor Now with support from MassDOT and other stakeholders.
2-9	Boston Harbor Now	Ground Access	To mitigate increased local traffic as a result of record high air travel demands and international passenger growth, we encourage Massport to continue its efforts to address not only the needs of airport passengers but also residents who will benefit from more robust public transit options and pedestrian connections.	Massport's ground transportation strategy is designed to provide a broad range of HOV, transit, and shared-ride options for travel to and from Logan Airport and to minimize vehicle trips, by providing convenient transit, shuttle, bike, and pedestrian connections to the Airport. The strategy also aims to provide on-Airport parking for passengers choosing to drive or who have limited HOV options. Massport will continue its comprehensive strategy to promote use of HOV modes and to provide options to passengers and other airport users to access the Airport without the use of SOV modes. Chapter 5, *Ground Access to and from Logan Airport* of this *2016 EDR* describes the elements of the strategy and provides updates on HOV ridership and other initiatives.
2-10	Boston Harbor Now	Parks and Open Space	To that end, we encourage Massport to continue working with residents and advocates to ensure that the public spaces and buffer areas are well maintained and provide significant, high---quality spaces that benefit surrounding neighborhoods.	Massport will continue to collaborate with the community in enhancing the public spaces and buffer areas. Progress on the most recent efforts are documented in Chapter 3, *Airport Planning* in Table 3-1. Massport is planning a 4.2-acre greenspace addition to Piers Park. Piers Park Phase II will include a central lawn, basketball and volleyball courts, and bicycle and rollerblade tracks. A new 1,200-square foot community/sailing center, located on the waterfront, is designed to replace the existing Sailing Center building and provide additional meeting spaces for the community.

This Page Intentionally Left Blank.

City of Quincy, Massachusetts

OFFICE OF THE COUNCIL

BRIAN PALMUCCI
COUNCILLOR - WARD FOUR

Cell: (617) 376-1354
Office: (617) 376-1341
Fax: (617) 376-1345
Email: bpalmucci@quincyma.gov

January 26, 2017

The Honorable Matthew Beaton
Secretary
Executive Office of Energy and Environmental Affairs
Attn: MEPA Office
Anne Canaday, EEA 3247
100 Cambridge Street, Suite 900
Boston MA 02114

Re: Massport Boston Logan International Airport, 2015 Environmental

Dear Secretary Beaton:

As the City Councillor who represents West Quincy, which is significantly impacted in a negative way by Logan Airports noise, I write you to ask for your support of the Logan Airport Community Advisory Committee (Logan CAC) motions to improve noise reporting from Massport. 3-1
The neighborhoods impacted by Logan Airport's flight paths can experience extended periods of aircraft noise, raising concerns for health implications and negatively impacting the quality of life for local families. The reporting being requested by the Logan CAC is critical in understanding the impact of the increased daily flights and lower flight path have on the community.

I strongly request your support of this critical reporting.

Sincerely,

Bri Pal

Brian Palmucci
Ward Four Councillor

cc: Darryl Pomicter, President, Logan Airport Community Advisory Committee

City Hall, 1305 Hancock Street, Quincy, MA 02169-5102

This Page Intentionally Left Blank.

Comment ID	Author	Topic	Comment	Response
3-1	Brian Palmucci, Quincy City Council	Noise	I write you to ask for your support of the Logan Airport Community Advisory Committee (Logan CAC) motions to improve noise reporting from Massport.	Massport supports the Massport CAC as noted in this *2016 EDR* in Chapter 6, *Noise Abatement*. Massport regularly engages with the Massport CAC to discuss improvements to data reporting. The Massport CAC is a state legislated body and is the official forum for the community and Massport to discuss noise related issues. The Environmental Data Reports (EDRs) and Environmental Status and Planning Reports (ESPRs) provide over three decades of reporting on noise conditions at Logan Airport. In addition to the standard annual reporting of day-night average sound level contours, Massport provides several supplemental metrics on noise to enhance the public's understanding of noise conditions in the vicinity of the Airport. This reporting year, Massport is modeling noise using the Federal Aviation Administration's (FAA) new and enhanced model - Airport Environmental Design Tool (AEDT) which jointly evaluates noise and air emissions. See Chapter 6, *Noise Abatement* for noise reporting and modeling results.

This Page Intentionally Left Blank.

January 31, 2017
Secretary Matthew Beaton
Executive Office of Environmental Affairs
Attn: Anne Canaday, EEA No. 3247
100 Cambridge Street, Suite 900
Boston, Ma. 02114

RE: EEA No. 3247

Dear Secretary Beaton,
2015 EDR data validates growing public concern over airport health impacts, showing that noise, traffic congestion and emissions are rising as the airport expands. EDR data show that growth of airport impacts due to higher passenger levels and more commercial jet operations is now quickly eroding noise and emissions reductions made through improvements in airplane and automotive technology over the past 30 years. Given the evidence that airport pollution threatens public health, 2015 EDR data informs the need for swift action to correct Massport's failed responses and creates the public expectation that <u>we will begin immediately</u> to make real progress toward achieving long-stalled health and environmental goals.

I am requesting that DEP conduct appropriate, independent analysis of the correlations between airport passenger and commercial operational growth year to year, between 2011 and 2015 and increases in noise, traffic congestion and emissions as reported in the 2015 EDR. 4-1

DEP refusal to allow dialogue of project-related impacts during the review of the Terminal E Modernization airport expansion project last fall, has impeded the intent of public environmental review processes, excused DEP from its important responsibility to guide transportation policy toward environmental leadership positions, and denied citizens due process. <u>EOEA must now take action to reverse its own enablement of Massport</u> and reverse this agency's failed policies of irresponsible, insular and exclusionary planning and management practices.

With MEPA acknowledgement of project-specific and cumulative airport impacts confined to comment on this EDR which provides such strong evidence of a direct relationship between increases in impacts with increases in airport operations, and no evidence of effort, capacity, or inclination on the part of Massport to reverse this trend, the public now has the right to expect the Secretary to create new, enforceable constraints upon airport impacts through effective safeguards against future impact expansion.

I am requesting that the Secretary impose conditions upon the Certification of the 2015 EDR which will cause Massport to produce the necessary scope of alternative ground access, operations levels, and environmental mitigations to achieve the needed improvements 4-2

The Port Authority has mishandled public relations, ignoring community offers of partnership in public education and the establishment of leadership through collaboration with the academic research community in the *Airport 101 Health Forum*, (November, 2016) which aimed at exploring relationships between chronic disease and airport impacts. This failure and 2015 EDR data ***discredit*** arguments that airport expansion is helpful to the region, its economy or its stakeholders, proving these to be self-serving means to pro-airport industry ends.

Continued failure by EOEA to manage this major point source polluter will result in critical losses in the public trust. To restore the credibility of MEPA, response to this EDR must set forward regulatory structure that will advance long-overdue transportation policy reforms, reverse negative health and quality of life trends in our communities which are reported in the EDR, and correct Massport's organizational disregard for the health and safety of stakeholders on the ground.

I am requesting the the Secretary recognize 2015 EDR data evidence that expanding HOV ground access via Back Bay Logan Express has worked immediately to turn around alarming impact trends and require Massport, to create more such beneficial and health-conscious responses. 4-3

The 2015 EDR Certificate should include conditions that require:

1. *Analysis and reporting of changes in HOV mode share, parking demand, tunnel traffic, and air pollution attainable through expanded and improved Logan Express Pilot service. Massport should be required to model and or otherwise research the market share effect of adding a minimum of 5 additional locations with regular service (every 20 minutes) throughout metro-Boston region, creating a network of fast, convenient, clean and affordable HOV airport access at mass transit price points. Massport should be required to model and research the benefit of improving service by implementing best practices in Bus Rapid Transit (BRT) such as offering free WiFi and electronic ticketing while also maintaining prices of all express airport bus service expansions at the $5, (free with a valid MBTA pass) levels established prior to the implementation of increased pricing in 6/1/2016.* 4-4

2. *Analysis and reporting of changes in HOV mode share, parking demand, tunnel traffic, and air pollution associated with a variety of pricing disincentives for passenger car airport ground access modes via increasing on-airport parking rates at Logan to position all forms of short-term airport parking (including in-garage, cell phone lot and curbside options) at higher price points than MBTA and Logan Express options* 4-5

3. *Analysis and reporting of changes in HOV mode share, parking demand, tunnel traffic, and air pollution associated with reducing suburban Logan Express Service price points to attract a greater share of drop-off and pick up mode travellers. This initiative would work in conjunction with increases in the cost structure of on-airport short term parking options.* 4-6

4. *Analysis and reporting of changes in mass transit mode share increases, parking capacity, tunnel traffic, and air pollution attainable through corrections to the pricing of on-airport parking and Logan Express options, through improvement of the MBTA system, specifically through development of a direct connection between the Red and Blue Lines, and extension of the Blue Line to Lynn* 4-7

Based on the success of the Back Bay Logan Express, which piloted reduced-price HOV mode service extensions, and increased the four above-listed HOV-related pricing and service adjustments can be expected to provide Massport with available and immediate opportunities to reduce traffic and ground transportation-related pollution on a year to year basis over the upcoming 2 – 3 year period. Based upon the mode share achieved in the BBLE pilot, the combination of these efforts could be expected to produce as much as a 10% increase in HOV modes' share of ground transportation to Logan airport over the short term, helping Massport finally move toward, meet and exceed its multi-decades old goal of achieving 35% HOV mode share levels.

5. *Set caps on pollution, noise, and traffic at current levels. Massport has proven incapable of slowing expansion of these public-health-damaging impacts.* 4-8

6. *Require Massport to create specific year to year impact reduction target goals and to provide specific plans, supported by appropriate modeling and a robust public comment process developed specifically to engage the public (including in Environmental Justice Communities) in the review and ratification on these plans. The fact that Massport not even have annual noise reduction goals tells the public all it needs to know about Massport's intentions.* 4-9

7. *Establish an enforcement plan to incentivize Massport to achieve their impact reduction targets* 4-10

8. *Require Massport to provide reporting and analyses on increases in traffic, noise and pollution <u>relative to recent historic low impact levels</u> to focus public and agency attention on the important need to reverse the alarming trends in the growth of negative impacts, in understanding trends in airport pollution, and to assist the public in assessing current policies' capacity to create the needed public health gains.* 4-11

9. *The Secretary should require Massport to create specific and credible plans and gather public comment on significant corrective plans to reduce passenger car modes through these tunnels and improvement in mass transit travel modes to Logan.* 4-12

The EDR reports *incredible increases* in the 65DNL decibel sound level which HUD and FAA say is unacceptable for residential land uses. To hold Massport accountable for Logan's noise impacts, development of modeling of noise levels reflecting alternative operational levels inclusive of attainable shifts of flight operations to other viable New England airports, specifically including target off-loading goals to TF Green and Manchester Boston. Therefore:

10. *The Secretary should require Massport to model noise impacts at reduced operational levels in low, mid and high target reduction goal scenarios which could be achieved through aggressive diversion of flights to all New England airports via regional collaborations. The Secretary should also require that Massport model noise reductions attainable through a night time noise curfew. International travel may be important to our economy, but our sleep and well-being is essential. International flights' convenience should be secondary to the health of the residents of the Boston region. If our health impedes their business, too bad.* 4-13

The 2015 EDR provides ample evidence that Massport is supporting automotive travel modes to Logan. The Lexus Gold Plus parking produces convenience for heavy users in the business community, the cell phone parking lot makes it more convenient to drop off and pick up travelers, Logans' short term parking rates are attractively low, encouraging passenger car modes for drop off and pick up and the curbside is free! If Massport is unwilling and unable to produce the policies and initiatives that are needed to protect the public interest, EOEA must take immediate action to achieve this important goal.

Thank You for your time.

Chris Marchi
161 Saratoga St.

This Page Intentionally Left Blank.

Comment ID	Author	Topic	Comment	Response
4-1	Chris Marchi	Activity Levels/ Noise/Air Quality/ Ground Access	I am requesting that DEP conduct appropriate, independent analysis of the correlations between airport passenger and commercial operational growth year to year, between 2011 and 2015 and increases in noise, traffic congestion and emissions as reported in the 2015 EDR.	Massport continues to prepare Environmental Data Reports (EDRs) and Environmental Status and Planning Reports (ESPRs) in accordance with the Secretary of the Executive Office of Energy and Environmental Affairs (EEA) direction and will continue to provide requested information. Massport continues to collaborate with the Massachusetts Environmental Policy Act (MEPA) Office on an ongoing basis.
4-2	Chris Marchi	Ground Access/Activity Levels/Mitigation	I am requesting that the Secretary impose conditions upon the Certification of the 2015 EDR which will cause Massport to produce the necessary scope of alternative ground access, operations levels, and environmental mitigations to achieve the needed improvements.	The *2016 EDR* provides information on Massport's cumulative environmental impacts, including ground access and operation levels in Chapter 5, *Ground Transportation to and from Logan Airport* and Chapter 2, *Activity Levels*. Chapter 9, *Project Mitigation Tracking* describes and tracks Massport's Section 61 mitigation commitments. Individual projects are subject to separate environmental review processes under MEPA and/or the National Environmental Policy Act (NEPA).
4-3	Chris Marchi	Ground Access	I am requesting the Secretary recognize 2015 EDR data evidence that expanding HOV ground access via Back Bay Logan Express has worked immediately to turn around alarming impact trends and require Massport, to create more such beneficial and health-conscious responses.	Massport is committed to increasing high occupancy vehicle (HOV) mode share and has a comprehensive, strategy to enhance HOV ridership. Ridership on Logan Express and public transportation increased in 2016 (see Table 5-8). Massport will continue its strategy to provide a broad range of HOV, transit, and shared-ride options for travel to and from Logan Airport and to minimize vehicle trips, by providing convenient transit, shuttle, bike, and pedestrian connections to the Airport. The strategy also aims to provide on-Airport parking for passengers choosing to drive or who have limited HOV options. Table 5-9 provides monthly ridership for Back Bay Logan Express in 2016, which totaled 216,329 passengers, or an average of about 600 riders per day. This document provides information on ground access modes, including HOV, in Chapter 5, *Ground Access to and from Logan Airport.*
4-4	Chris Marchi	Ground Access	The 2015 EDR Certificate should include conditions that require: 1. Analysis and reporting of changes in HOV mode share, parking demand, tunnel traffic, and air pollution attainable through expanded and improved Logan Express Pilot service. Massport should be required to model and or otherwise research the market share effect of adding a minimum of 5 additional locations with regular service (every 20 minutes) throughout metro-Boston region, creating a network of fast, convenient, clean and affordable HOV airport access at mass transit price points. Massport should be required to model and research the benefit of improving service by implementing best practices in Bus Rapid Transit (BRT) such as offering free WiFi and electronic ticketing while also maintaining prices of all express airport bus service expansions at the $5, (free with a valid MBTA pass) levels established prior to the implementation of increased pricing in 6/1/2016.	The EDR continues to report on HOV mode share, parking demand, and air quality in Chapter 5, *Ground Access to and from Logan Airport* and Chapter 6, *Air Quality/Emissions Reduction*. Massport continues to look at ways to improve HOV access to the Airport, including Logan Express improvements. In 2015, Massport acquired the property on which the Braintree Logan Express site is located, furthering its commitment to providing HOV access from key regional nodes (see Chapter 5, *Ground Access to and from Logan Airport* for additional information). Massport is currently evaluating the feasibility and effectiveness of potential measures to improve HOV access to Logan Airport. This study will include possible improvements to Logan Express bus service, feasibility of additional Logan Express sites, and the benefit of improvements to the Silver Line bus service to Logan Airport. Massport is also studying parking pricing strategies and their effect on customer behavior and vehicle miles traveled (VMT).

Comment ID	Author	Topic	Comment	Response
4-5	Chris Marchi	Ground Access	The 2015 EDR Certificate should include conditions that require: 2. Analysis and reporting of changes in HOV mode share, parking demand, tunnel traffic, and air pollution associated with a variety of pricing disincentives for passenger car airport ground access modes via increasing on-airport parking rates at Logan to position all forms of short-term airport parking (including in-garage, cell phone lot and curbside options) at higher price points than MBTA and Logan Express options	The EDR continues to report on HOV mode share, parking demand, and air quality. Massport increased on-Airport commercial parking rates in June 2016 (see Table 5-6). Massport is currently studying parking pricing strategies and their effect on customer behavior and VMT.
4-6	Chris Marchi	Ground Access	The 2015 EDR Certificate should include conditions that require: 3. Analysis and reporting of changes in HOV mode share, parking demand, tunnel traffic, and air pollution associated with reducing suburban Logan Express Service price points to attract a greater share of drop-off and pick up mode travelers. This initiative would work in conjunction with increases in the cost structure of on-airport short term parking options.	The EDR continues to report on HOV mode share, parking demand, and air quality as documented in this EDR. Massport is currently evaluating the feasibility and effectiveness of potential measures to improve HOV access to Logan Airport. This study will include possible improvements to Logan Express bus service, feasibility of additional Logan Express sites, and the benefit of improvements to the Silver Line bus service to Logan Airport. Massport is also studying parking pricing strategies and their effect on customer behavior and VMT.
4-7	Chris Marchi	Ground Access/Air Quality	The 2015 EDR certificate should include conditions that require: 4. Analysis and reporting of changes in mass transit mode share increases, parking capacity, tunnel traffic, and air pollution attainable through corrections to the pricing of on-airport parking and Logan Express options, through improvement of the MBTA system, specifically through development of a direct connection between the Red and Blue Lines, and extension of the Blue Line to Lynn	The EDR continues to report on HOV mode share, parking demand, and air quality. Massport continues to look at ways to improve HOV access to the Airport, including Logan Express improvements. In 2015, Massport acquired the property on which the Braintree Logan Express site is located, furthering its commitment to providing HOV access from key regional nodes (see Chapter 5, *Ground Access to and from Logan Airport* for additional information). Massport is currently evaluating the feasibility and effectiveness of potential measures to improve HOV access to Logan Airport. This study will include possible improvements to Logan Express bus service, feasibility of additional Logan Express sites, and the benefit of improvements to the Silver Line bus service to Logan Airport. Massport is also studying parking pricing strategies and their effect on customer behavior and VMT. Massport evaluated a potential connection between the Massachusetts Bay Transportation Authority (MBTA) Red Line and Blue Line in the Environmental Assessment/Environmental Impact Report (EA/EIR) for the Terminal E Modernization Project. The assessment included an analysis of the existing capacity on the MBTA Blue Line. A review of ridership and trainset capacity on the Blue Line indicated that there is significant reserve capacity (passenger space available within the trainset) remaining on the Blue Line during the peak hour in the peak direction. Even with a doubling of Blue Line use by air passengers, there is still significant Blue Line capacity available. Massport will continue to work with MBTA on the status and the potential design of the pedestrian connector to the Blue Line Airport Station.

Comment ID	Author	Topic	Comment	Response
4-8	Chris Marchi	Air Quality/Noise/ Ground Access	The 2015 EDR certificate should include conditions that require: 5. Set caps on pollution, noise, and traffic at current levels. Massport has proven incapable of slowing expansion of these public-health-damaging impacts.	The EDR provides current and historical information on air quality in Chapter 7, *Air Quality/Emissions Reduction* , noise in Chapter 6, *Noise Abatement* , and traffic in Chapter 5, *Ground Access to and from Logan Airport* . Following federal regulation of airlines in the 1970s, airlines were authorized to set their own routes, service frequency, and type of aircraft. Massport does not have the authority to limit or otherwise cap the number of flights at an airport; only the Federal Aviation Administration (FAA) has this authority. Massport seeks to effectively manage the expansion of aircraft operations at Logan Airport by providing appropriate capacity to ensure safety and efficiency. Massport does encourage the use of newer, more efficient technology at Logan Airport. For example, 97 percent of the 2016 commercial jet operations met the strictest Stage IV noise limits. See Table 6-3 in the EDR for percentage of commercial jet operations by Part 36 stage category. Key environmental impacts of Airport-wide activities have decreased significantly in the past 15 years, even while passenger levels and other measures of activity have increased. In 2005, Massport established a demand management program designed to prevent air carriers from over-scheduling Logan Airport's ability to accommodate demand. Based on pre-determined aircraft schedule thresholds, Massport implements a peak-period surcharge designed to shift operations out of the daily peak operating periods. When needed, this reduces airfield congestion and delay and associated noise and air emissions. 740 CMR 27.00 provides the basis for Massport to monitor published air carrier schedules and non-scheduled demand, and request that aircraft operators, with assistance from the FAA if appropriate, voluntarily adjust their schedules or intended use of the Airport to avoid runway use delays. The regulation also provides the basis upon which peak period conditions can be declared based upon the projected level of runway use delays at the Airport, and for the establishment of a peak period surcharge payable by aircraft operators. Under the regulation, Massport regularly monitors and projects aircraft operational demand based upon published schedules and other information. Annual Peak Period Monitoring Reports are published by Massport in the EDR/ESPR filings with the MEPA Office.

Comment ID	Author	Topic	Comment	Response
4-9	Chris Marchi	Emissions Reduction/Public Comments	The 2015 EDR certificate should include conditions that require: 6. Require Massport to create specific year to year impact reduction target goals and to provide specific plans, supported by appropriate modeling and a robust public comment process developed specifically to engage the public (including in Environmental Justice Communities) in the review and ratification on these plans. The fact that Massport not even have annual noise reduction goals tells the public all it needs to know about Massport's intentions.	The intent of the EDR is to provide a review of environmental conditions for the reporting year compared to previous years. Chapter 5, *Ground Access to and from Logan Airport* , Chapter 6, *Noise Abatement,* and Chapter 7, *Air Quality/Emissions Reduction* each include management plans that report on Massport's environmental goals and progress towards meeting those goals. In addition, Massport undertakes several initiatives that are reported in EDRs and ESPRs such as the Logan Airport Sustainability Management Plan, Massport's Air Quality Initiative, and Massport's Environmental Management Policy. Massport also engages with the Massport Community Advisory Committee on an ongoing basis on a variety of topics.
4-10	Chris Marchi	Emissions Reduction	The 2015 EDR certificate should include conditions that require: 7. Establish an enforcement plan to incentivize Massport to achieve their impact reduction targets	The intent of the EDR is to provide a review of environmental conditions for the reporting year compared to previous years. Chapter 5, *Ground Access to and from Logan Airport* , Chapter 6, *Noise Abatement,* and Chapter 7, *Air Quality/Emissions Reduction* each include management plans that report on Massport's environmental goals and progress towards meeting those goals. In addition, Massport undertakes several initiatives that are reported in EDRs and ESPRs such as the Logan Airport Sustainability Management Plan, Massport's Air Quality Initiative, and Massport's Environmental Management Policy. Massport also engages with the Massport Community Advisory Committee on an ongoing basis on a variety of topics.
4-11	Chris Marchi	Ground Access/ Noise/Air Quality	The 2015 EDR certificate should include conditions that require: 8. Require Massport to provide reporting and analyses on increases in traffic, noise and pollution relative to recent historic low impact levels to focus public and agency attention on the important need to reverse the alarming trends in the growth of negative impacts, in understanding trends in airport pollution, and to assist the public in assessing current policies' capacity to create the needed public health gains.	The annual EDRs and ESPRs continue to report and assess changes in environmental conditions, including traffic, noise, and air quality. The EDRs and ESPRs also report on Massport's strategies to mitigate airport environmental impacts. For detailed information see Chapter 5, *Ground Access to and from Logan Airport,* Chapter 6, *Noise Abatement,* and Chapter 7, *Air Quality/Emissions Reduction* . These sections include information on historical environmental conditions.
4-12	Chris Marchi	Ground Access	The 2015 EDR certificate should include conditions that require: 9. The Secretary should require Massport to create specific and credible plans and gather public comment on significant corrective plans to reduce passenger car modes through these tunnels and improvement in mass transit travel modes to Logan.	As described in Chapter 5, *Ground Access to and from Logan Airport,* Massport has in place a robust ground access and parking management strategy. Massport's comprehensive ground access strategy for Logan Airport includes promotion of HOV use through a blend of initiatives related to pricing (incentives and disincentives), service availability, service quality, marketing, and traveler information. Massport's ground access strategy for HOV includes public transit (Blue Line, rapid transit, Silver Line rapid transit, MBTA bus, and water transportation), Logan Express scheduled bus service, scheduled vans and buses, courtesy shuttle buses, charter buses, and unscheduled private limousines and vans. Additional elements of the ground access strategy include accommodations for private vehicles (pick-up, drop-off, cell phone waiting lot, and parking), taxis, rental cars, and Transportation Network Companies (TNCs). Massport continues to prepare EDRs and ESPRs in accordance with the Secretary's Certificate.

Comment ID	Author	Topic	Comment	Response
4-13	Chris Marchi	Noise	The Secretary should require Massport to model noise impacts at reduced operational levels in low, mid and high target reduction goal scenarios which could be achieved through aggressive diversion of flights to all New England airports via regional collaborations. The Secretary should also require that Massport model noise reductions attainable through a night time noise curfew. International travel may be important to our economy, but our sleep and well-being is essential. International flights' convenience should be secondary to the health of the residents of the Boston region. If our health impedes their business, too bad.	The EDR provides current and historical information on air quality in Chapter 7, *Air Quality/Emissions Reduction* , noise in Chapter 6, *Noise Abatement* , and traffic in Chapter 5, *Ground Access to and from Logan Airport* . Following federal deregulation of airlines in the 1970s, airlines were authorized to set their own routes, service frequency, and type of aircraft. Massport does not have the authority to limit or otherwise cap the number of flights at an airport; only the FAA has this authority. Massport seeks to effectively manage the expansion of aircraft operations at Logan Airport by providing appropriate capacity to ensure safety and efficiency. Massport does encourage the use of newer, more efficient technology at Logan Airport. For example, 97 percent of the 2016 commercial jet operations met the strictest Stage IV noise limits. See Table 6-3 in the 2016 EDR for percentage of commercial jet operations by Part 36 stage category. Key environmental impacts of Airport-wide activities have decreased significantly in the past 15 years, even while passenger levels and other measures of activity have increased. In 2005, Massport established a demand management program designed to prevent air carriers from over-scheduling Logan Airport's ability to accommodate demand. Based on pre-determined aircraft schedule thresholds, Massport implements a peak-period surcharge designed to shift operations out of the daily peak operating periods. When needed, this reduces airfield congestion and delay and associated noise and air emissions. 740 CMR 27.00 provides the basis for Massport to monitor published air carrier schedules and non-scheduled demand, and request that aircraft operators, with assistance from the FAA if appropriate, voluntarily adjust their schedules or intended use of the Airport to avoid runway use delays. The regulation also provides the basis upon which peak period conditions can be declared based upon the projected level of runway use delays at the Airport, and for the establishment of a peak period surcharge payable by aircraft operators.

This Page Intentionally Left Blank.

January 31, 2016

The Honorable Matthew Beaton, Secretary
Executive Office of Energy and Environmental Affairs
Attn: Massachusetts Environmental Policy Act ("MEPA") Office
Anne Canaday, EEA No. 3247
100 Cambridge Street, Suite 900
Boston, MA 02114

Comments on the Boston-Logan International Airport 2015 Environmental Data Report (2015 EDR) EOEA #3247

Dear Secretary Beaton:

I think there are several very serious problems with some of Massport's statements, data, analyses, and presentation of results in this and prior EDRs. I have commented with specific examples of these problems for several years now and nothing is done. I don't know how to bring this to your attention – should I write in ALL CAPS, **in bold**, highlighted text, write in red, or perhaps underline the most critical concerns in order to get the MEPA office to pay attention to these comments and those of others, most of whom also write year after year with the same concerns with nothing being done? I am a doctoral level statistician and this clumsiness and distortion of data is of great concern to me because there are decisions being made from this information, decisions that often have very negative consequences for people and communities affected by Massport's noise and air pollution. I think that it is imperative to have an external data audit and analysis done. Please require this now and in the future. 5-1

Please also require release of all data reports from the AEDT software. It is extremely biased and goes against all scientific integrity to analyze data, look at the results, decide that one does not like those results and then do something else so that the results one wants can be reported. I don't care if the previous tweaks to the INM software are not part of the currently FAA-required AEDT software. Last year Massport wrote that they would use AEDT software for the 2015 report; the FAA requires that noise and pollution analyses now use the AEDT software. Massport used the software but they didn't like the results and so they left them out of the EDR. The public has the right to see those results – your office should want them too. 5-2

Here is **one untruthful statement in the 2015 EDR**. "Airlines serving Logan Airport continue to upgrade their fleets with newer and larger aircraft with improved environmental performance and operational efficiencies." In reality, there was an increase in Stage 3 aircraft operations at Logan. Why is Massport allowed to be untruthful?

Here is another untruthful statement from the 2015 EDR: "As described throughout the *2015 EDR*, Massport remains fully committed to minimizing the effects of Airport operations over which it has control and to a continued collaboration with the community." I am a member of the Logan CAC and Massport has worked diligently not to be collaborative with that community committee and were so successful with their efforts that the BLANS 3 project was not completely. It took well over a year to get Massport to provide something as simple but critical as flight track maps. I asked for documentation on runway restrictions; this also took more than a year to get.

The 2015 EDR reports that "The *2015 EDR* responds fully to the Secretary's Certificate on the *Boston-Logan International Airport 2014 Environmental Data Report,* <u>including responding to all comments."</u> Is there a quality-level requirement for these responses? If so, does anyone check to see if Massport's responses reach that quality level?

Here is an observation that needs to be clarified. On page 6-34, why is the contour that points to the NE so much longer than the one that points SW, especially considering reported runway use? 5-3

The EDR lists these tweaks used in the INM software but not in the AEDT software. 5-4

- 1996 – Overwater adjustment approved for INM model
- 1999 – Hill Effects adjustment approved for the INM model
- 2004 – All radar tracks used for modeling - RealContours & RealProfiles
    - Stagelength selected by Profile match
    - Custom Profile developed for each flight
- 2007 Incorporation of daily weather averages for modeling

Which of these has the greatest impact on the DNL estimates?
Why is there a Hill Effect in only one location? Should the DNL estimates be tweaked for other hills in the Boston area, e.g., Fairmont Hill, Milton Hill, the Blue Hills?

This is a very important question. Why were about 95% of the RealProfiles available in 2014 yet only 55% were available in 2015 for this report? What is the expected effect on the DNL estimates because of this omission? 5-5

On page 6-46, it shows that there were 389 fewer jets to 4R in 2014 compared to 2015 yet there as a 0.3 point drop in DNL at the location of the noise monitor closest to the 4R arrival path in Milton. That doesn't make sense. Please explain how these numbers can be right. 5-6

On the same page, it is reported that Lynn's DNL decreased. How can that be correct given the runway use reports? 5-7

On page 6-49, what are the cut off levels and times required for an operation to register at the noise monitors? If they are different by monitor, why? 5-8

In 2014 Dorchester's DNL at the monitor location is estimated to be 54.3 but Milton's estimate was 54.5. How does that happen? 5-9

In the first paragraph on page 6-67, what are the three new arrival RNAV procedures that were implemented 12/14/11? Also, in that same paragraph it mentions "modeled flight tracks". I thought the RealProfile allowed for actual, not modeled flight tracks. Please explain. 5-10

Page 6-68 in the section about the RNAV studies, why is Massport only concerned about "noise" when they know, and the MEPA office knows (from my comments over the last 2 years and from many others who have written with similar concerns), that there is strong scientific evidence of contamination of the air for those who live, work, and go to school under these concentrated flight paths? 5-11 Shouldn't this Office require that Massport include pollution measurement as far as 10 miles from runway ends, especially under the RNAV arrival paths? 5-12

Page h21 uses the word "recent" for a nighttime noise study from 2008, 9 years ago. That is misleading. 5-13

On page H 41, why are the arrivals to runway 22L so high and why are the departures from runway 9 so low. We know that departures use runway 9 when the arrivals are going to 4R and 4L so these numbers are not consistent. 5-14

This final comment is **a significant concern.** Table 6-15 covers two pages and doesn't give totals, but I entered the data so I could easily calculate the 2014 and 2015 totals. I understand that this won't match some of the other totals for a variety of reasons, but here is my concern

sum of jet flights 2014 Table 6-15 = 314,171
sum of jet flights 2015 Table 6-15 = 297,800

How can this be correct? More jet flights in 2014 than in 2015 even though the rest of the EDR reports otherwise? 5-15 To try to make sense of it, I went to the Jets only data from Table 2-2 and found that 2014 Passenger Jets is **40,252** and 2015 is **54,250** - must be wrong so I checked in the 2014 EDR. It shows the # passenger jets is **240,252**, so the leading 2 must have been dropped somehow. Assuming the same is true for 2015, there must have been 254,250 jets in 2015 and not 54,250 and here are the totals:

sum of jet flights 2014 Table 2-2 = 310,267, not 314,171 but in the ballpark I guess
sum of jet flights 2015 Table 2-2 = 318,673, not 297,800 and not in the ballpark, and greater than the number of jet flights in 2014, as expected and stated in the EDR.

Please explain this significant inconsistency in Table 6-15. Also, if any of these numbers are found to be wrong, what other parts of the report, calculation of DNL, pollution, also are incorrect?

Thank you,

Cindy L. Christiansen, Ph.D.
Massport and Logan CAC Representative, Milton
And Resident of the Town of Milton

Comment ID	Author	Topic	Comment	Response
5-1	Cindy L. Christiansen, Ph.D.	Data and Analysis	I think that it is imperative to have an external data audit and analysis done. Please require this now and in the future.	Massport regularly engages with the Massport Community Advisory Committee (CAC) to discuss improvements to data reporting. The Massport CAC is a state legislated body and is the official forum for the community and Massport to discuss noise related issues. The Environmental Data Reports (EDRs) and Environmental Status and Planning Reports (ESPRs) provide over three decades of reporting on noise conditions at Logan Airport. In addition to the standard annual reporting of day-night average sound level contours, Massport provides several supplemental metrics on noise to enhance the public's understanding of noise conditions in the vicinity of the Airport. This reporting year, Massport is modeling noise using the Federal Aviation Administration's (FAA) new and enhanced model - Airport Environmental Design Tool (AEDT) which jointly evaluates noise and air emissions. See Chapter 6, *Noise Abatement* for noise reporting and modeling results.
5-2	Cindy L. Christiansen, Ph.D.	Data Availability	Please also require release of all data reports from the AEDT software.	The Federal Aviation Administration (FAA) has responded to Massport's request, not approving two adjustments (overwater noise propagation and hill effects). The FAA did concur with the use of 2016 weather data and Logan-specific aircraft stage length adjustments. Consistent with previous practice, Massport presents AEDT modeling results as the primary model in this *2016 EDR*. Integrated Noise Model (INM) results are provided for comparison only for 2016 and future filings will present only AEDT results. Research efforts are underway or recently concluded that address potential improvements in AEDT modeling of terrain and acoustically reflective surfaces. The results of these studies, if and when they are implemented in AEDT, will add capabilities previously addressed by Logan Airport's over water and hill effect adjustments. Further details regarding the implementation of AEDT are provided in the section *Noise Modeling Process* later in Chapter 6, *Noise Abatement*. Details of FAA's guidance with respect to Logan Airport specific adjustments when using AEDT can be found in Chapter 6, *Noise Abatement* and Appendix H, *Noise Abatement.* Massport has provided 2016 results using both the legacy noise and air quality models and the new AEDT model.
5-3	Cindy L. Christiansen, Ph.D.	Noise	Here is an observation that needs to be clarified. On page 6-34, why is the contour that points to the NE so much longer than the one that points SW, especially considering reported runway use?	Departures from Runway 22L immediately turn to the southeast, and therefore do not affect the contour to the southwest beyond Pleasure Bay. Runway 4R departures remain on runway heading along the Revere coastline and therefore contribute to the northeast portion of the contour.

Comment ID	Author	Topic	Comment	Response
5-4	Cindy L. Christiansen, Ph.D.	Noise	The EDR lists these tweaks used in the INM software but not in the AEDT software. -1996- Overwater adjustment approved for INM model -1999- Hill Effects adjustment approved for the INM model -2004- All radar tracks used for modeling - RealContours & RealProfiles - Stagelength selected by Profile match - Custom Profile developed for each flight -2007- Incorporation of daily weather averages for modeling Which of these has the greatest impact on the DNL estimates? Why is there a Hill Effect in only one location? Should the DNL estimates be tweaked for other hills in the Boston area, e.g., Fairmont Hill, Milton Hill, the Blue Hills?	For this *2016 EDR*, for assessing the effects of aircraft activities, Massport has transitioned from using the legacy modeling software, INM for noise and EDMS for air quality, to FAA's next-generation software, AEDT. For past noise studies, Massport implemented a series of FAA-approved adjustments to the INM model. These adjustments were developed to address specific terrain concerns unique to Logan Airport; which included an over-water and hill-effect adjustment (see Chapter 6, *Noise Abatement* for more information). These Logan Airport-specific adjustments were carried over from one version of INM to the next. Massport has been working with the FAA since 2015 to implement equivalent adjustments in AEDT. After their review, the FAA did not approve the two significant adjustments (overwater noise propagation and hill effects) to the contours. The FAA did concur with the use of 2016 weather data and Logan-specific aircraft stage length adjustments. Consistent with previous practice, Massport presents AEDT modeling results as the primary model in this *2016 EDR*. INM results are provided for comparison only for 2016 and future filings will present only AEDT results. Research efforts are underway or recently concluded that address potential improvements in AEDT modeling of terrain and acoustically reflective surfaces. The results of these studies, if and when they are implemented in AEDT, will add capabilities previously addressed by Logan Airport's overwater and hill effect adjustments. Further details regarding the implementation of AEDT are provided in the section *Noise Modeling Process* later in Chapter 6, *Noise Abatement*. Details of FAA's guidance with respect to Logan Airport specific adjustments when using AEDT can be found in Chapter 6, *Noise Abatement* and Appendix H, *Noise Abatement*. Massport has provided 2016 results using both the legacy noise and air quality models and the new AEDT model.
5-5	Cindy L. Christiansen, Ph.D.	Noise	Why were about 95% of the RealProfiles available in 2014 yet only 55% were available in 2015 for this report? What is the expected effect on the DNL estimates because of this omission?	RealProfiles analyzes each radar trace and automatically produces custom aircraft performance profiles using the INM aircraft database. INM typically uses pre-defined profiles to "fly" each aircraft along the ground track. The custom profiles are designed to follow the actual flight of each aircraft allowing INM to model each flight at its actual location on the ground and in the sky. RealProfiles evaluates each radar track to determine if a standard profile is appropriate. If so, the standard profile is used, with no loss in fidelity. If not, a custom profile is constructed. More radar tracks matched standard profiles in 2015 than 2014, therefore fewer custom profiles were required.
5-6	Cindy L. Christiansen, Ph.D.	Noise	On page 6-46, it shows that there were 389 fewer jets to 4R in 2014 compared to 2015 yet there as a 0.3 point drop in DNL at the location of the noise monitor closest to the 4R arrival path in Milton. That doesn't make sense. Please explain how these numbers can be right.	The day-night average sound level (DNL) is affected not only by the number of aircraft, but by the noise generated by the aircraft and the proximity to the receiver location. Aircraft continue to be quieter on average, and this may have a greater effect overall than an increase in operations of about 0.5 percent.
5-7	Cindy L. Christiansen, Ph.D.	Noise	On the same page, it is reported that Lynn's DNL decreased. How can that be correct given the runway use reports?	DNL is affected not only by the number of aircraft, but by the noise generated by the aircraft and the proximity to the receiver location. Aircraft continue to be quieter on average, and this may have a greater effect overall than an increase in operations.

Comment ID	Author	Topic	Comment	Response
5-8	Cindy L. Christiansen, Ph.D.	Noise	On page 6-49, what are the cut off levels and times required for an operation to register at the noise monitors? If they are different by monitor, why?	The monitors have a threshold of 65 dBA that must be exceeded for an event to be registered, in order to distinguish aircraft events from ambient noise.
5-9	Cindy L. Christiansen, Ph.D.	Noise	In 2014 Dorchester's DNL at the monitor location is estimated to be 54.3 but Milton's estimate was 54.5. How does that happen?	Aircraft altitude changes very little between these locations.
5-10	Cindy L. Christiansen, Ph.D.	Activity Levels	In the first paragraph on page 6-67, what are the three new arrival RNAV procedures that were implemented 12/14/11? Also, in that same paragraph it mentions "modeled flight tracks". I thought the RealProfile allowed for actual, not modeled flight tracks. Please explain.	These are three RNAV Standard Terminal Arrival routes which bring traffic into the local Logan Airport airspace. They are currently called JFUND, OOSHN, and ROBUC. The flight tracks shown in the graphics were converted into model tracks and used in the model.
5-11	Cindy L. Christiansen, Ph.D.	Air Quality	Page 6-68 in the section about the RNAV studies, why is Massport only concerned about "noise" when they know, and the MEPA office knows (from my comments over the last 2 years and from many others who have written with similar concerns), that there is strong scientific evidence of contamination of the air for those who live, work, and go to school under these concentrated flight paths?	The FAA NextGen initiative is a national effort to improve the daily operations of the entire National Airspace System. This has resulted in changes in flight track and airspace around the country with resultant changes in the noise environment. FAA conducted its own environmental review process under the National Environmental Policy Act (NEPA) that studied the change in RNAV, which enables aircraft to fly on any desired flight path within the coverage of ground- or space-based navigation aids, within the limits of the capability of the self-contained systems, or a combination of both capabilities. RNAV aircraft have better access and flexibility for point-to-point operations. Public response to RNAV implementation has overwhelmingly been related to noise effects, caused by the concentrated flight paths. Massport and the FAA recently signed a Memorandum of Understanding (MOU) to frame a process for analyzing opportunities to incrementally reduce noise through changes or amendments to Performance Based Navigation (PBN), including RNAV procedures.
5-12	Cindy L. Christiansen, Ph.D.	Air Quality	Shouldn't this Office require that Massport include pollution measurement as far as 10 miles from runway ends, especially under the RNAV arrival paths?	Massport uses FAA approved models and standards for noise and air quality analyses. Emission estimates associated with Logan Airport include both on- and off-airport emissions. Off-site, aircraft emissions are modeled up to 3,000 feet in altitude or typically less than five miles from the airport (FAA standard). Most airport emission inventories only include on-site motor vehicle emissions. Other studies have reported airport-related impacts extending only short distances from the airport.

Comment ID	Author	Topic	Comment	Response
5-13	Cindy L. Christiansen, Ph.D.	Noise	Page h21 uses the word “recent” for a nighttime noise study from 2008, 9 years ago. That is misleading.	ANSI S12.9-2008 Part 6 is the most current standard, so while more recent research may exist, this is the research community's accepted knowledge at present. As new standards are adopted, Massport will update and track information based on the latest standards.
5-14	Cindy L. Christiansen, Ph.D.	Activity Levels	On page H 41, why are the arrivals to runway 22L so high and why are the departures from runway 9 so low. We know that departures use runway 9 when the arrivals are going to 4R and 4L so these numbers are not consistent.	Runway 9 is not used exclusively for departures when Runways 4R/L are used for arrivals; Runways 4R and 15R are often used as well, leading to differences in the number of arrivals and departures.
5-15	Cindy L. Christiansen, Ph.D.	Activity Levels	Table 6-15 covers two pages and doesn’t give totals, but I entered the data so I could easily calculate the 2014 and 2015 totals. I understand that this won’t match some of the other totals for a variety of reasons, but here is my concern sum of jet flights 2014 Table 6-15 = 314,171 sum of jet flights 2015 Table 6-15 = 297,800 How can this be correct? More jet flights in 2014 than in 2015 even though the rest of the EDR reports otherwise? To try to make sense of it, I went to the Jets only data from Table 2-2 and found that 2014 Passenger Jets is 40,252 and 2015 is 54,250 - must be wrong so I checked in the 2014 EDR. It shows the # passenger jets is 240,252, so the leading 2 must have been dropped somehow. Assuming the same is true for 2015, there must have been 254,250 jets in 2015 and not 54,250 and here are the totals: sum of jet flights 2014 Table 2-2 = 310,267, not 314,171 but in the ballpark I guess sum of jet flights 2015 Table 2-2 = 318,673, not 297,800 and not in the ballpark, and greater than the number of jet flights in 2014, as expected and stated in the EDR. Please explain this significant inconsistency in Table 6-15.	The numbers in Table 6-15 are derived from the cumulative noise index (CNI) analysis. An error in this analysis for 2014 resulted in double-counting some operations from some carriers. This error did not recur in the 2015 analysis. The total from Table 6-15 is smaller than the total from Table 2-2 because only carriers with 100 or more operations appear in this table. Smaller carriers and general aviation jets are not included. The 2014 CNI analysis has been corrected and 2014 numbers are correct where they appear in the *2016 EDR*.

From: Jim Linthwaite
To: Canaday, Anne (EEA)
Cc: mayor@boston.gov; joseph.boncore@masenate.gov; adrian.madaro@mahouse.gov; Salvatore.LaMattina@boston.gov; michelle.wu@boston.gov; michael.f.flaherty@boston.gov; a.e.george@boston.gov; ayanna.pressley@boston.gov
Subject: 2015 EDR & Logan Airport
Date: Monday, January 30, 2017 5:12:14 PM

January 30, 2017
Secretary Matthew Beaton
Executive Office of Environmental Affairs
Attn: Anne Canaday, Environmental Analyst
100 Cambridge Street, Suite 900
Boston, Ma. 02114

RE: EEA No. 3247

Dear Secretary Beaton,

The 2015 EDR points out Logan's positive economic impact, but it doesn't count its economic, health and environmental costs. The state has let the airport pollute for decades, watching as noise, traffic and pollution hurt our way of life, making Boston a harder city to get around, slowing our economy and increasing asthma, COPD, stroke, heart disease and sleep interruption throughout the region.
Instead of protecting surrounding communities which feel strong airport impacts, EOEA protected Massport, again last year by approving even more airport expansion without making them tell the truth about the extra harmful noise, traffic and pollution impacts that it would cause. Although this is unfair, the state promised to deal with the public's concerns in this EDR report.

Now the 2015 EDR shows emissions growing along with expansion, and huge increases in areas where airport noise is too loud for people to live (according to the federal government), EOEA needs to stop protecting Massport and start protecting public health.

Beginning with setting new goals for Massport, EOEA should ensure that Massport takes public health seriously by outlining a plan to reduce impacts by:

1. Setting caps on pollution, noise, and traffic at current levels 6-1
2. Set annual reduction goals and work openly to establish plans to accomplish them 6-2
3. Shifting 30% of flights to Green, Manchester and other airports over the next 10 years 6-3
4. Adding 5 Logan Express Boston-area locations with service every 20 minutes at MBTA prices 6-4
5. Improving Logan Express by reducing parking rates and adding WiFi and electronic ticketing 6-5
6. Increasing use of suburban Logan Express Service by reducing the costs of the service 6-6
7. Promoting MBTA and Logan Express by raising the cost of driving to and parking at Logan 6-7
8. Improving the MBTA Red to Blue Line connection and extending the Blue Line to Lynn 6-8
9. Establishing enforcement plans to assure that Massport meets impact reduction promises 6-9
10. Stop comparisons to 30 years ago and confusing PR tactics and focus on current impacts 6-10

Airport expansion causes negative impacts and negative impacts cause health, safety, and economic losses. The state needs to act right now to preserve public health, safety, quality of life and trust all across the region. It is time to hold Massport accountable! Make them take real action to control harmful airport impacts! And make them stop adding to our already serious traffic, noise and emissions problems!

Sincerely,

James Linthwaite
Concerned East Boston Resident

This Page Intentionally Left Blank.

Comment ID	Author	Topic	Comment	Response
6-5	James Linthwaite	Ground Access	EOEA should ensure that Massport takes public health seriously by outlining a plan to reduce impacts by: Increasing use of suburban Logan Express Service by reducing the costs of the service	The EDR analyzes and reports performance in HOV mode share, parking demand, and other ground access and air quality statistics under the existing EDR/ESPR process. Massport continues to look at ways to improve HOV access to the Airport, including Logan Express improvements. Massport's ground transportation strategy is designed to provide a broad range of HOV, transit, and shared-ride options for travel to and from Logan Airport and to minimize vehicle trips, by providing convenient transit, shuttle, bike, and pedestrian connections to the Airport. The strategy also aims to provide on-Airport parking for passengers choosing to drive or who have limited HOV options. Massport also offers free ground transportation from Logan Airport to two MBTA stations. Shuttle service from terminals to Airport Station (MBTA Blue Line) and South Station (via Silver line). This offers ground transportation at no-cost as part of regional network. South Station is a major transit center in the City of Boston, with subway, bus, and commuter rail service. Massport continues to manage parking supply, pricing, and operations to promote the use of transit, HOV, and shared-ride options. Increasing available on-airport parking is one strategy Massport employs to minimize drop-off/pick-up trips. In 2015, Massport acquired the property on which the Braintree Logan Express site is located, furthering its commitment to providing HOV access from key regional nodes (see Chapter 5, *Ground Access to and from Logan Airport* for additional information). Massport is currently evaluating the feasibility and effectiveness of potential measures to improve HOV access to Logan Airport. This study will include possible improvements to Logan Express bus service, feasibility of additional Logan Express sites, and the benefit of improvements to the Silver Line bus service to Logan Airport. Massport is also studying parking pricing strategies and their effect on customer behavior and VMT.

Comment ID	Author	Topic	Comment	Response
6-6	James Linthwaite	Ground Access	EOEA should ensure that Massport takes public health seriously by outlining a plan to reduce impacts by: Improving Logan Express by reducing parking rates and adding WiFi and electronic ticketing	The EDR analyzes and reports performance in HOV mode share, parking demand, and other ground access modes under Chapter 5, *Ground Access to and from Logan Airport* . Massport continues to look at ways to improve high occupancy vehicle (HOV) access to the Airport, including Logan Express improvements. Massport's ground transportation strategy is designed to provide a broad range of HOV, transit, and shared-ride options for travel to and from Logan Airport and to minimize vehicle trips, by providing convenient transit, shuttle, bike, and pedestrian connections to the Airport. The strategy also aims to provide on-Airport parking for passengers choosing to drive or who have limited HOV options. Massport also offers free ground transportation from Logan Airport to two MBTA stations. Shuttle service from terminals to Airport Station (MBTA Blue Line) and South Station (via Silver line). This offers ground transportation at no-cost as part of regional network. South Station is a major transit center in the City of Boston, with subway, bus, and commuter rail service. Massport continues to manage parking supply, pricing, and operations to promote the use of transit/HOV/shared-ride options. Increasing available on-airport parking is one strategy Massport employs to minimize drop-off/pick-up trips In 2015, Massport acquired the property on which the Braintree Logan Express site is located, furthering its commitment to providing HOV access from key regional nodes (see Chapter 5, *Ground Access to and from Logan Airport* for additional information). Massport is currently evaluating the feasibility and effectiveness of potential measures to improve HOV access to Logan Airport. This study will include possible improvements to Logan Express bus service, feasibility of additional Logan Express sites, and the benefit of improvements to the Silver Line bus service to Logan Airport. Massport is also studying parking pricing strategies and their effect on customer behavior and VMT.

Comment ID	Author	Topic	Comment	Response
6-7	James Linthwaite	Ground Access	EOEA should ensure that Massport takes public health seriously by outlining a plan to reduce impacts by: Promoting MBTA and Logan Express by raising the cost of driving to and parking at Logan	The EDR analyzes and reports performance in HOV mode share, parking demand, and other ground access modes under Chapter 5, *Ground Access to and from Logan Airport* . Massport continues to look at ways to improve HOV access to the Airport, including Logan Express improvements. Massport's ground transportation strategy is designed to provide a broad range of HOV, transit, and shared-ride options for travel to and from Logan Airport and to minimize vehicle trips, by providing convenient transit, shuttle, bike, and pedestrian connections to the Airport. The strategy also aims to provide on-Airport parking for passengers choosing to drive or who have limited HOV options. Massport continues to manage parking supply, pricing, and operations to promote the use of transit, HOV, and shared-ride options. Increasing available on-Airport parking is one strategy Massport employs to minimize drop-off/pick-up trips. In 2015, Massport acquired the property on which the Braintree Logan Express site is located, furthering its commitment to providing HOV access from key regional nodes (see Chapter 5, *Ground Access to and from Logan Airport* for additional information). Massport is currently evaluating the feasibility and effectiveness of potential measures to improve HOV access to Logan Airport. This study will include possible improvements to Logan Express bus service, feasibility of additional Logan Express sites, and the benefit of improvements to the Silver Line bus service to Logan Airport. Massport is also studying parking pricing strategies and their effect on customer behavior and VMT.
6-8	James Linthwaite	Ground Access	EOEA should ensure that Massport takes public health seriously by outlining a plan to reduce impacts by: Improving the MBTA Red to Blue Line connection and extending the Blue Line to Lynn	Massport evaluated a potential connection between the MBTA Red Line and Blue Line in the Environmental Assessment (EA)/Environmental Impact Report (EIR) for the Terminal E Modernization Project. The assessment included an analysis of the existing capacity on the Massachusetts Bay Transportation Authority (MBTA) Blue Line. A review of ridership and trainset capacity on the Blue Line indicated that there is significant reserve capacity (passenger space available within the trainset) remaining on the Blue Line during the peak hour in the peak direction. Even with a doubling of Blue Line use by air passengers, there is still significant Blue Line capacity available. Massport will continue to work with MBTA on the status and the potential design of the pedestrian connector to the Blue Line Airport Station.
6-9	James Linthwaite	Ground Access/Noise/ Air Quality	EOEA should ensure that Massport takes public health seriously by outlining a plan to reduce impacts by: Establishing enforcement plans to assure that Massport meets impact reduction promises	The EDR provides information on existing and past air quality in Chapter 7, *Air Quality/Emissions Reduction* , noise in Chapter 6, *Noise Abatement,* and traffic in Chapter 5, *Ground Access to and from Logan Airport* . The chapters outline a management plan that describes Massport's goals for reducing airport impacts and progress towards meeting those goals.

Comment ID	Author	Topic	Comment	Response
6-10	James Linthwaite	Ground Access/Noise/ Air Quality	EOEA should ensure that Massport takes public health seriously by outlining a plan to reduce impacts by: Stop comparisons to 30 years ago and confusing PR tactics and focus on current impacts	The EDR consistently reports on environmental conditions for the reporting year compared to the previous year. The EDR also provides historical data because it is critical context information to understand the long term performance trends at Logan Airport. This *2016 EDR* provides 1990, 2000, and 2010-2016 data as available in each chapter. Including data from 1990 and 2000, and in some cases 1998 (the year of peak operations at Logan Airport), provides a historical benchmark of progress over the last few decades. The technical appendices contain all available historical data. Massport is the only Airport Authority in the nation that has provided consistent and comprehensive environmental reporting for over 30 years. It publishes annual data on Logan Airport going back to 1990 and discusses trends and provides forecasts of anticipated future environmental conditions.

From:	James Roberts
To:	Canaday, Anne (EEA)
Date:	Monday, January 30, 2017 5:20:20 PM

January 30, 2017

Secretary Matthew Beaton
Executive Office of Environmental Affairs

Attn: Anne Canaday, Environmental Analyst
100 Cambridge Street, Suite 900

Boston, Ma. 02114

RE: EEA No. 3247

Dear Secretary Beaton,

The 2015 EDR points out Logan's positive economic impact, but it doesn't count its economic, health and environmental costs. The state has let the airport pollute for decades, watching as noise, traffic and pollution hurt our way of life, making Boston a harder city to get around, slowing our economy and increasing asthma, COPD, stroke, heart disease and sleep interruption throughout the region.
Instead of protecting surrounding communities which feel strong airport impacts, EOEA protected Massport, again last year by approving even more airport expansion without making them tell the truth about the extra harmful noise, traffic and pollution impacts that it would cause. Although this is unfair, the state promised to deal with the public's concerns in this EDR report.

Now the 2015 EDR shows emissions growing along with expansion, and huge increases in areas where airport noise is too loud for people to live (according to the federal government), EOEA needs to stop protecting Massport and start protecting public health.

Beginning with setting new goals for Massport, EOEA should ensure that Massport takes public health seriously by outlining a plan to reduce impacts by:
1. Setting caps on pollution, noise, and traffic at current levels 7-1
2. Set annual reduction goals and work openly to establish plans to accomplish them 7-2
3. Shifting 30% of flights to Green, Manchester and other airports over the next 10 years 7-3
4. Adding 5 Logan Express Boston-area locations with service every 20 minutes at MBTA prices 7-4
5. Improving Logan Express by reducing parking rates and adding WiFi and electronic 7-5

ticketing
6. Increasing use of suburban Logan Express Service by reducing the costs of the service 7-6
7. Promoting MBTA and Logan Express by raising the cost of driving to and parking at Logan 7-7
8. Improving the MBTA Red to Blue Line connection and extending the Blue Line to Lynn 7-8
9. Establishing enforcement plans to assure that Massport meets impact reduction promises 7-9
10. Stop comparisons to 30 years ago and confusing PR tactics and focus on current impacts 7-10

Airport expansion causes negative impacts and negative impacts cause health, safety, and economic losses. The state needs to act right now to preserve public health, safety, quality of life and trust all across the region. It is time to hold Massport accountable! Make them take real action to control harmful airport impacts! And make them stop adding to our already serious traffic, noise and emissions problems!

Sincerely,

James Roberts
59 Magazine Street
Cambridge MA 02139

Comment ID	Author	Topic	Comment	Response
7-1	James Roberts	Ground Access/ Noise/Air Quality	EOEA should ensure that Massport takes public health seriously by outlining a plan to reduce impacts by: Setting caps on pollution, noise, and traffic at current levels	Outlined in the Environmental Data Reports (EDRs) and Environmental Status and Planning Reports (ESPRs) are Massport's programs to reduce emissions at Logan Airport, which have been decreasing in the long-term. Specific information on long-term goals, management plans, reports and initiatives are provided in Chapter 7, *Air Quality/Emissions Reduction*, noise in Chapter 6, *Noise Abatement,* and traffic in Chapter 5, *Ground Access to and from Logan Airport*.
7-2	James Roberts	Ground Access/Noise/ Air Quality	EOEA should ensure that Massport takes public health seriously by outlining a plan to reduce impacts by: Set annual reduction goals and work openly to establish plans to accomplish them	The EDR provides information on existing and past air quality in Chapter 7, *Air Quality*, noise in Chapter 6, *Noise Abatement,* and in Chapter 5, *Ground Access to and from Logan Airport*. The chapters outline a management plan that describes Massport's goals for reducing airport impacts and progress towards meeting those goals.
7-3	James Roberts	Activity Levels	EOEA should ensure that Massport takes public health seriously by outlining a plan to reduce impacts by: Shifting 30% of flights to Green, Manchester and other airports over the next 10 years	Following federal deregulation of airlines in the 1970s, airlines were authorized to set their own routes, service frequency, and type of aircraft. Massport does not have the authority to limit or otherwise cap the number of flights at an airport; only the Federal Aviation Administration (FAA) has this authority. Massport seeks to effectively manage the expansion of aircraft operations at Logan Airport by providing appropriate capacity to ensure safety and efficiency. Massport has considered provision of additional international service at regional airports numerous times, both historically during previous airport improvement projects and more recently, during the development of the Terminal E Modernization Project. International air carriers choose to fly in and out of Logan Airport to satisfy passenger demand. The demand for international travel to regional locations like T.F. Green Airport and Manchester-Boston Regional Airport is considerably lower than that of Boston. Connecting international flights to and from these airports are limited when compared to the services already found at Logan Airport. Supporting infrastructure such as Customs and Border Protection facilities, are also limited at these airports and would require additional staffing by the Transportation Security Administration and Homeland Security agencies to support. Regional Airports such as Manchester-Boston Regional Airport, T.F. Green Airport, and Worcester Regional Airport provide critical alternatives to local passengers that otherwise would be driving to Logan Airport for the same service. For the most part, the air service from the regional airports is focused on short haul and medium haul nonstop, jet service to business and leisure destinations as well as to air carrier hubs to access longer haul options. Manchester-Boston Regional Airport and T.F. Green Airport have added new terminals, extended runways, and enhanced bad weather capabilities (Category III Instrument Landing System) that provide critical infrastructure to attract and sustain dependable, jet air service. Massport is currently upgrading Worcester Regional Airport's bad weather technology to Category III as well as airfield taxiway improvements to bring Worcester Regional Airport up-to-par with the other regional airports.

Comment ID	Author	Topic	Comment	Response
7-4	James Roberts	Ground Access	EOEA should ensure that Massport takes public health seriously by outlining a plan to reduce impacts by: Adding 5 Logan Express Boston-area locations with service every 20 minutes at MBTA prices	The EDR analyzes and reports performance in high-occupancy vehicle (HOV) mode share, parking demand, and other ground access and air quality statistics under the existing EDR/ESPR program. Massport continues to look at ways to improve HOV access to the Airport, including Logan Express improvements. Massport's ground transportation strategy is designed to provide a broad range of HOV, transit, and shared-ride options for travel to and from Logan Airport and to minimize vehicle trips, by providing convenient transit, shuttle, bike, and pedestrian connections to the Airport. The strategy also aims to provide on-Airport parking for passengers choosing to drive or who have limited HOV options. Massport continues to manage parking supply, pricing, and operations to promote the use of transit/HOV/shared-ride options. Increasing available on-airport parking is one strategy Massport employs to minimize drop-off/pick-up trips. In 2015, Massport acquired the property on which the Braintree Logan Express site is located, furthering its commitment to providing HOV access from key regional nodes (see Chapter 5, *Ground Access to and from Logan Airport* for additional information). Massport is currently evaluating the feasibility and effectiveness of potential measures to improve HOV access to Logan Airport. This study will include possible improvements to Logan Express bus service, feasibility of additional Logan Express sites, and the benefit of improvements to the Silver Line bus service to Logan Airport. Massport is also studying parking pricing strategies and their effect on customer behavior and vehicle miles traveled (VMT).
7-5	James Roberts	Ground Access	EOEA should ensure that Massport takes public health seriously by outlining a plan to reduce impacts by: Increasing use of suburban Logan Express Service by reducing the costs of the service	The EDR analyzes and reports performance in HOV mode share, parking demand, and other ground access and air quality statistics under the existing EDR/ESPR program. Massport continues to look at ways to improve HOV access to the Airport, including Logan Express improvements. Massport's ground transportation strategy is designed to provide a broad range of HOV, transit, and shared-ride options for travel to and from Logan Airport and to minimize vehicle trips, by providing convenient transit, shuttle, bike, and pedestrian connections to the Airport. The strategy also aims to provide on-Airport parking for passengers choosing to drive or who have limited HOV options. Massport continues to manage parking supply, pricing, and operations to promote the use of transit/HOV/shared-ride options. Increasing available on-airport parking is one strategy Massport employs to minimize drop-off/pick-up trips. In 2015, Massport acquired the property on which the Braintree Logan Express site is located, furthering its commitment to providing HOV access from key regional nodes (see Chapter 5, *Ground Access to and from Logan Airport* for additional information). Massport is currently evaluating the feasibility and effectiveness of potential measures to improve HOV access to Logan Airport. This study will include possible improvements to Logan Express bus service, feasibility of additional Logan Express sites, and the benefit of improvements to the Silver Line bus service to Logan Airport. Massport is also studying parking pricing strategies and their effect on customer behavior and VMT.

Comment ID	Author	Topic	Comment	Response
7-6	James Roberts	Ground Access	EOEA should ensure that Massport takes public health seriously by outlining a plan to reduce impacts by: Improving Logan Express by reducing parking rates and adding WiFi and electronic ticketing	The EDR analyzes and reports performance in HOV mode share, parking demand, and other ground access and air quality statistics under the existing EDR/ESPR program. Massport continues to look at ways to improve HOV access to the Airport, including Logan Express improvements. Massport's ground transportation strategy is designed to provide a broad range of HOV, transit, and shared-ride options for travel to and from Logan Airport and to minimize vehicle trips, by providing convenient transit, shuttle, bike, and pedestrian connections to the Airport. The strategy also aims to provide on-Airport parking for passengers choosing to drive or who have limited HOV options. Massport continues to manage parking supply, pricing, and operations to promote the use of transit/HOV/shared-ride options. Increasing available on-airport parking is one strategy Massport employs to minimize drop-off/pick-up trips. In 2015, Massport acquired the property on which the Braintree Logan Express site is located, furthering its commitment to providing HOV access from key regional nodes (see Chapter 5, *Ground Access to and from Logan Airport* for additional information). Massport is currently evaluating the feasibility and effectiveness of potential measures to improve HOV access to Logan Airport. This study will include possible improvements to Logan Express bus service, feasibility of additional Logan Express sites, and the benefit of improvements to the Silver Line bus service to Logan Airport. Massport is also studying parking pricing strategies and their effect on customer behavior and VMT.
7-7	James Roberts	Ground Access	EOEA should ensure that Massport takes public health seriously by outlining a plan to reduce impacts by: Promoting MBTA and Logan Express by raising the cost of driving to and parking at Logan	The EDR analyzes and reports performance in HOV mode share, parking demand, and other ground access and air quality statistics under the existing EDR/ESPR program. Massport continues to look at ways to improve HOV access to the Airport, including Logan Express improvements. Massport's ground transportation strategy is designed to provide a broad range of HOV, transit, and shared-ride options for travel to and from Logan Airport and to minimize vehicle trips, by providing convenient transit, shuttle, bike, and pedestrian connections to the Airport. The strategy also aims to provide on-Airport parking for passengers choosing to drive or who have limited HOV options. Massport continues to manage parking supply, pricing, and operations to promote the use of transit/HOV/shared-ride options. Increasing available on-airport parking is one strategy Massport employs to minimize drop-off/pick-up trips. In 2015, Massport acquired the property on which the Braintree Logan Express site is located, furthering its commitment to providing HOV access from key regional nodes (see Chapter 5, *Ground Access to and from Logan Airport* for additional information). Massport is currently evaluating the feasibility and effectiveness of potential measures to improve HOV access to Logan Airport. This study will include possible improvements to Logan Express bus service, feasibility of additional Logan Express sites, and the benefit of improvements to the Silver Line bus service to Logan Airport. Massport is also studying parking pricing strategies and their effect on customer behavior and VMT.

Comment ID	Author	Topic	Comment	Response
7-8	James Roberts	Ground Access	EOEA should ensure that Massport takes public health seriously by outlining a plan to reduce impacts by: Improving the MBTA Red to Blue Line connection and extending the Blue Line to Lynn	Massport evaluated a potential connection between the Massachusetts Bay Transportation Authority (MBTA) Red Line and Blue Line in the Environmental Assessment (EA)/Environmental Impact Report (EIR) for the Terminal E Modernization Project. The assessment included an analysis of the existing capacity on the MBTA Blue Line. A review of ridership and trainset capacity on the Blue Line indicated that there is significant reserve capacity (passenger space available within the trainset) remaining on the Blue Line during the peak hour in the peak direction. Even with a doubling of Blue Line use by air passengers, there is still significant Blue Line capacity available. Massport will continue to work with MBTA on the status and the potential design of the pedestrian connector to the Blue Line Airport Station.
7-9	James Roberts	Ground Access/ Noise/Air Quality	EOEA should ensure that Massport takes public health seriously by outlining a plan to reduce impacts by: Establishing enforcement plans to assure that Massport meets impact reduction promises	The EDR provides information on existing and past air quality in Chapter 7, *Air Quality/Emissions Reduction* , noise in Chapter 6, *Noise Abatement,* and traffic in Chapter 5, *Ground Access to and from Logan Airport* . The chapters outline a management plan that describes Massport's goals for reducing airport impacts and progress towards meeting those goals.
7-10	James Roberts	Ground Access/ Noise/Air Quality	EOEA should ensure that Massport takes public health seriously by outlining a plan to reduce impacts by: Stop comparisons to 30 years ago and confusing PR tactics and focus on current impacts	The EDR consistently reports on environmental conditions for the reporting year compared to the previous year. The EDR also provides historical data because it is critical context information to understand the long term performance trends at Logan Airport. This *2016 EDR* provides 1990, 2000, and 2010-2016 data as available in each chapter. Including data from 1990 and 2000, and in some cases 1998 (the year of peak operations at Logan Airport), provides a historical benchmark of progress over the last few decades. The technical appendices contain all available historical data. Massport is the only Airport Authority in the nation that has provided consistent and comprehensive environmental reporting for over 30 years. It publishes annual data on Logan Airport going back to the 1990 and before and discusses trends and provides forecasts of anticipated future environmental conditions.

LOGAN AIRPORT COMMUNITY ADVISORY COMMITTEE
"WE'RE STRONGER TOGETHER"

By Email and USPS

January 18, 2017

The Honorable Matthew Beaton, Secretary
Executive Office of Energy and Environmental Affairs
Attn: MEPA Office
Anne Canaday, EEA 3247
100 Cambridge Street, Suite 900
Boston, MA 02114

RE: Massport Boston Logan International Airport, 2015 Environmental Data Report (2015 EDR)
EOEA #3247

Dear Secretary Beaton:

The Logan Airport Community Advisory Committee (Logan CAC) requests your support of the following four motions, for improved noise reporting from Massport (adopted at their December 1, 2016 and January 12, 2017 meetings, as the Boston Logan Airport Noise Study (BLANS) is being ended):

> The Logan CAC requests and recommends Massport improve their annual MEPA Environmental Data Report. Including expanding their noise analysis study area to match the larger BLANS study area, 20 NM. Including Public download availability at massport.com/noise before the end of the first quarter following every calendar year. [https://www.massport.com/environment/environmental-reporting/] 8-1

> The Logan CAC requests and recommends Massport implement the monthly Flight Tracks Report which they have developed with the Logan CAC. Including Public download availability at massport.com/noise before the end of each month for the prior month. And, that Massport implement remaining Logan CAC requests for improvements and further refinements with use. Including a Public review session at least quarterly. [http://www.bostonoverflightnoisestudy.com/docs/Flight-Track-Graphics-August-2016.pdf] 8-2

> The Logan CAC requests and recommends Massport complete the BOS Noise Abatement Report being developed by the Logan CAC. Addressing the punch list to complete the draft. Including Public download availability at massport.com/noise of Runway Use, Persistence, and Dwell by Runway End before the end of each month for the prior 12 months. Including an annual report with Aircraft Flight Operations, Community Noise Exposures, and Population Noise Impacts before the end of the first quarter following every calendar year. Including a Public review session at least quarterly. [Version 11 and punch list comments being posted: http://www.bostonoverflightnoisestudy.com/phase3_documents.aspx] 8-3

The Logan CAC requests and recommends Massport complete and implement the BOS Night Flights Report developed by the Logan CAC. Following the Version 2 structure and formatting to complete the draft. Including Public download availability at massport.com/noise before the end of the first quarter following every calendar year. [http://www.bostonoverflightnoisestudy.com/docs/bos-logan-night-flights-report-v2-20161226.xlsx] 8-4

To further substantiate our requests and your actions for Massport to improve the Environmental Data Report, implement the developed Flight Tracks Report, complete and implement the developed Noise Abatement Report, and complete and implement the drafted Night Flights Report, please consider Massport's 2001 Logan Airside Improvements Planning Project, EOEA #10458, MEPA Section 61 Finding (emphasis added):

10.0 Preferential Runway Advisory System (PRAS) Monitoring and Reporting 8-5

The Authority will develop and implement a PRAS Monitoring System and will implement a new distribution system for reports. The Massport Quarterly Noise Reports will be expanded to include a number of new reports, and the distribution list will be expanded to include interested parties, including the Logan Citizens Advisory Committee (CAC). In addition, the annual reports on runway utilization, dwell and persistence will also be included as part of the Environmental Status and Planning Report (ESPR) (formerly GEIR) filings made with the Executive Office of Environmental Affairs. Over the longer term, the Authority will work with the FAA to design additional reports that could help enhance the attainment of PRAS. In addition, the Authority will begin working with the CAC to update the PRAS program, with the understanding that the current PRAS system will remain in place until superseded.

There have been ZERO Massport Quarterly Noise Reports since the 2001 Finding. When questioned, Massport has responded that they believe they are in compliance. And, that they will consider further when BLANS recommendations are completed. As BLANS is ended, Massport now responds on the specific Logan CAC motions adopted for noise reporting:

> Regarding your previous email on next steps (12/31 appended below), as I've articulated verbally during PMT conversations, Massport is required to work with the legislated Massport CAC of which there is a significant overlap between Logan CAC and Massport CAC membership. The Massport CAC is now well underway. Massport staff has been attending meetings and engaging the organization. Updating and improving Massport's regular reporting on our website and in the annual EDR is one discussion item with the Massport CAC. The Massport CAC may want to utilize the work done and the recommendations made in Phase 3 of the BLANS including the Logan CAC proposed data reporting to inform our discussions.
>
> Regarding your request that Massport continue to update the reports including the flight tracks graphics, these data reports require significant resources- both internal staff and consultants time. Therefore, Massport will not be providing further updates until we have an opportunity to discuss and finalized the reporting with the Massport CAC. Once finalized, Massport will then have an opportunity to spend additional resources to re-tool our reporting related to Boston Logan activity and community overflights including the type and timing of the reports both on our website and the EDR.

The Section 61 Finding is for Massport to develop and implement Quarterly Noise Reports from 2001, expanded and additional over time. Massport should not be able to continue to avoid compliance—further awaiting any group to (possibly) agree on something for Massport to consider. Massport, airport proprietor, is responsible for noise abatement. Massport is responsible for Quarterly Noise Reports, expanded and additional. Now, long overdue.

Massport is also responsible for a new Runway Use Program to supersede the Preferential Runway Advisory System (PRAS), continuously failed since 1982 and inactive since 2007. The reporting requested is critical to understand noise created by airplanes, noise exposures on Communities, and Noise Impacts on Population. Both longer-term, annual and shorter-term, monthly. It is needed to determine a new Runway Use Program. To enable better decisions—more equitable overall, justifiable and defensible. And, to monitor implementation to achieve and maintain effectiveness.

We would be happy to provide additional details on the extreme importance of this reporting to better understand and manage noise impacts. Please act for Massport compliance.

Sincerely,

Darryl Pomicter, President
Logan Airport Community Advisory Committee

136 Myrtle St
Boston, MA 02114-4447
email: dpomic@aol.com
cell: (617) 755-0151

PS Annual Reports with audited financial statements are required within five months of the end of the year. These annual EDR (with no forecast or audit) and five-year Environmental Status and Planning Report (ESPR) (with no audit) should not take longer. (Particularly if there is consistent interim period reporting, monthly and quarterly through the year.)

PPS Massport and the FAA have ended the Boston Logan Airport Noise Study, December 31, 2016. Prematurely (with more than $100,000 funding not expended). (After the Independent Consultant for the Logan CAC stopped work from December 2015-June 2016, awaiting Massport Phase 3 contract authorization and payment for hours more than a year earlier.) (And, wiith Massport 2015 EDR noise modeling results delayed from July until December 2016.)

Without the intended results. After 15 years, >$8 million to consultants, and many tens-of-thousands of hours all around. No new Runway Use Program to replace the current Preferential Runway Advisory System (continuously failed since 1982 and inactive since 2007). No agreement on noise abatement in Phase 2 (begun in 2007) or in Phase 3 (begun in 2013)—nothing since Phase 1 ended in 2007. No Monitoring Program for implementation and effectiveness. With Massport withdrawing their commitment with the Logan CAC for an ongoing Noise Abatement Committee for monitoring, for implementation and effectiveness, including reporting to achieve and maintain compliance. And, without the Massport Quarterly Noise Reports, expanded and additional, required by the 2001 MEPA Section 61 Finding.

This Page Intentionally Left Blank.

Comment ID	Author	Topic	Comment	Response
8-1	Logan Airport Community Advisory Committee	Noise	The Logan CAC requests and recommends Massport improve their annual MEPA Environmental Data Report. Including expanding their noise analysis study area to match the larger BLANS study area, 20 NM. Including Public download availability at massport.com/noise before the end of the first quarter following every calendar year.	The Environmental Data Reports (EDRs) and Environmental Status and Planning Reports (ESPRs) have always focused on the day-night average sound level (DNL) 65 dB contour consistent with Federal Aviation Administration (FAA) airport noise studies. Logan Airport completes an extensive noise analysis, being one of the few airports that also publishes average sound level 60 dB contour data. Noise analysis data by census block is included in Appendix H, *Noise Abatement*.
8-2	Logan Airport Community Advisory Committee	Noise	The Logan CAC requests and recommends Massport implement the monthly Flight Tracks Report which they have developed with the Logan CAC. Including Public download availability at massport.com/noise before the end of each month for the prior month. And, that Massport implement remaining Logan CAC requests for improvements and further refinements with use. Including a Public review session at least quarterly.	Massport regularly engages with the Massport Community Advisory Committee (CAC) to discuss improvements to data reporting. The Massport CAC is a state legislated body and is the official forum for the community and Massport to discuss noise related issues. The EDRs and ESPRs provide over three decades of reporting on noise conditions at Logan Airport. In addition to the standard reporting of average annual day-night contours, Massport provides several supplemental metrics on noise to enhance the public's understanding of noise conditions in the vicinity of the Airport. See Massport's website for more information: http://www.massport.com/logan-airport/about-logan/noise-abatement/.
8-3	Logan Airport Community Advisory Committee	Noise	The Logan CAC requests and recommends Massport complete the BOS Noise Abatement Report being developed by the Logan CAC. Addressing the punch list to complete the draft. Including Public download availability at massport.com/noise of Runway Use, Persistence, and Dwell by Runway End before the end of each month for the prior 12 months. Including an annual report with Aircraft Flight Operations, Community Noise Exposures, and Population Noise Impacts before the end of the first quarter following every calendar year. Including a Public review session at least quarterly. [Version 11 and punch list comments being posted:	Massport regularly engages with the Massport CAC to discuss improvements to data reporting. The Massport CAC is a state legislated body and is the official forum for the community and Massport to discuss noise related issues. The EDRs and ESPRs provide over three decades of reporting on noise conditions at Logan Airport. In addition to the standard reporting of average annual day-night contours, Massport provides several supplemental metrics on noise to enhance the public's understanding of noise conditions in the vicinity of the Airport. See Massport's website for more information: http://www.massport.com/logan-airport/about-logan/noise-abatement/.
8-4	Logan Airport Community Advisory Committee	Noise	The Logan CAC requests and recommends Massport complete and implement the BOS Night Flights Report developed by the Logan CAC. Following the Version 2 structure and formatting to complete the draft. Including Public download availability at massport.com/noise before the end of the first quarter following every calendar year.	Massport regularly engages with the Massport CAC to discuss improvements to data reporting. The Massport CAC is a state legislated body and is the official forum for the community and Massport to discuss noise related issues. The EDRs and ESPRs provide over three decades of reporting on noise conditions at Logan Airport. In addition to the standard reporting of average annual day-night contours, Massport provides several supplemental metrics on noise to enhance the public's understanding of noise conditions in the vicinity of the Airport. See Massport's website for more information: http://www.massport.com/logan-airport/about-logan/noise-abatement/.

Comment ID	Author	Topic	Comment	Response
8-5	Logan Airport Community Advisory Committee	Noise	To further substantiate our requests and your actions for Massport to improve the Environmental Data Report, implement the developed Flight Tracks Report, complete and implement the developed Noise Abatement Report, and complete and implement the drafted Night Flights Report, please consider Massport's 2001 Logan Airside Improvements Planning Project, EOEA #10458 , MEPA Section 61 Finding (emphasis added): The Authority will develop and implement a PRAS Monitoring System and will implement a new distribution system for reports. The Massport Quarterly Noise Reports will be expanded to include a number of new reports, and the distribution list will be expanded to include interested parties, including the Logan Citizens Advisory Committee (CAC). In addition, the annual reports on runway utilization, dwell and persistence will also be included as part of the Environmental Status and Planning Report (ESPR) (formerly GEIR) filings made with the Executive Office of Environmental Affairs. Over the longer term, the Authority will work with the FM to design additional reports that could help enhance the attainment of PRAS. In addition, the Authority will begin working with the CAC to update the PRAS program, with the understanding that the current PRAS system will remain in place until superseded.	Massport includes many tables and sets of data in the EDR. The EDR has continued to include the Preferential Runway Advisory System (PRAS) evaluation and reporting of the PRAS goals. Under Phase 3 of the Boston Logan Airport Noise Study (BLANS), a runway use plan was studied and tested by the FAA. The Logan CAC did not support implementation of a new runway use plan before this study was complete. Massport continues to engage with the Massport CAC on issues related to noise and overflights.

Nancy S. Timmerman, P.E.
Consultant in Acoustics and Noise Control
25 Upton Street
Boston, MA 02118-1609
(617)-266-2595 (Phone & FAX) ; (617)-645-0703 (Cell)
nancy.timmerman@alum.mit.edu
nancy_timmerman@comcast.net

January 20, 2017

The Honorable Matthew A. Beaton, Secretary
Executive Office of Energy and Environmental Affairs
Attn: MEPA Office
Anne Canaday, EEA No. 3247
100 Cambridge Street, Suite 900
Boston, MA 02114

Subject: EOEA No. 3247 – Boston-Logan Airport 2015 Environmental Data Report (EDR)

Dear Secretary Beaton:

These comments are being transmitted by email. I have reviewed the 2015 Environmental Data Report (EDR), EOEA #3247 and offer the following comments and questions.

On pages 1-19 and 6-5, paragraph 1 discusses population increases inside the 65 DNL contour. In particular, it states "the contour increased in East Boston and slightly in South Boston due to an increase in Runway 22R departures in 2015." However, Table 6-7 on page 6-40 shows that there has been no impacted population in South Boston since before 2010. Under these circumstances, the reference to South Boston should have been omitted. 9-1

Figures 6-5 and 6-7 show arrivals from the north and west (for Runway 4R) consistently flying over Melrose, Revere, and Winthrop. Are these flights included in the computations for the noise monitors in Revere, Winthrop, and Hull? 9-2

Table 6-9 compares the measured noise levels with those predicted by the noise model. Locations which are farther from the airport are designate as aircraft fewer events than are counted in the model. Reporting the total measured levels at these locations would give an upper bound on the aircraft component. 9-3

Thank you for the opportunity to comment on this report.

Sincerely,

Nancy S. Timmerman, P.E.

Cc: S. Dalzell, MPA

This Page Intentionally Left Blank.

Comment ID	Author	Topic	Comment	Response
9-1	Nancy S. Timmerman, P.E.	General	On pages 1-19 and 6-5, paragraph 1 discusses population increases inside the 65 DNL contour. In particular, it states "the contour increased in East Boston and slightly in South Boston due to an increase in Runway 22R departures in 2015." However, Table 6-7 on page 6-40 shows that there has been no impacted population in South Boston since before 2010. Under these circumstances, the reference to South Boston should have been omitted.	Clarification. This language was meant to describe the extent of the contour itself, not the impact on population.
9-2	Nancy S. Timmerman, P.E.	Activity Levels	Figures 6-5 and 6-7 show arrivals from the north and west (for Runway 4R) consistently flying over Melrose, Revere, and Winthrop. Are these flights included in the computations for the noise monitors in Revere, Winthrop, and Hull?	All operations, including arrivals from the north and west for Runway 4R, are included in the modeled results. Measured results include all events that satisfy the threshold for inclusion.
9-3	Nancy S. Timmerman, P.E.	Noise	Table 6-9 compares the measured noise levels with those predicted by the noise model. Locations which are farther from the airport are designate as aircraft fewer events than are counted in the model. Reporting the total measured levels at these locations would give an upper bound on the aircraft component.	The total day-night average sound level (DNL) for most locations is much higher than the aircraft-only DNL. The measured vs. modeled differences are typically less than 1 dB, whereas the difference between total measured DNL and aircraft-only measured DNL is less than 5 dB at only a few locations, and can be as large as 31 dB. Massport is investigating floating thresholds for event identification, to better capture events with low sound levels.

This Page Intentionally Left Blank.

Stephen H. Kaiser
191 Hamilton St.
Cambridge Mass. 02139

To : Mathew A. Beaton, Secretary, Executive Office of Energy and Environment
Attention : Anne Canaday, MEPA Unit

From : Stephen H. Kaiser

Environmental Data Report 2015 Massport EEA 3247

The annual record that Massport prepares in the form of an Environmental Data Report provide a unique picture into the status of Logan Airport and its operations, with extensive trend data. Future prospects and planning at Massport can benefit from this wealth of historical data.

One oddity of the EDF is that our review in January 2017 applies to the calendar year 2015 activities at Massport. This time lag may take some getting used to -- but is compensated by the regularity of the annual reporting on a predictable schedule and in a familiar format.

Ideally, this look back could go beyond a decade and include some of Massport's rich history. I am thinking of the late 1960s and early 1970s when Edward J. King was Executive Director and was the demon of community organizers. He seemed like an airport version of Donald Trump with his vigor, outspokenness, hard driving schemes, and a polarized assortment of friends and enemies. Our modern MassPort is much less confrontational, but it does have its critics. Some today see the Port Authority as too distant, and not recognizing its potential for error.

Another large Authority with a record for considerable infrastructure achievement is the Water Resources Authority. The MWRA in its court-ordered quest to clean up Boston Harbor has achieved its Harbor cleanup goals, but along the way learned some crucial lessons. Its biggest single mistake was to try to locate a Sewage Sludge storage facility in the town of Walpole.

MWRA had no training to confront a rural community which also had a large state prison within its borders. Many Walpole residents felt that was enough of a contribution to society, without also having a regional sludge facility as part of the town alleged assets. A relatively unassuming housewife led the charge, rallied the citizens and effectively handed the MWRA its head on a plate.

The defeat was so stunning and unexpected, that Authority officials decided to go back to the drawing boards and develop an entirely new outreach office to relate better to its member communities. The goal was to seek outreach for positive accommodations with communities wherever possible, rather than getting blindsided by angry citizens intent on derailing the agency. Even with a Federal Court backing them up, MWRA could not safely proceed if they took citizen feelings for granted.

NOISE

Massport may wish to reconsider its approach to aircraft noise. In recent years, new runway construction has allowed for the possibility of East-West takeoffs and landings, rather than larger sweeps out over the ocean. Airlines are powerful entities. Their preference for East-West operations and reality as a powerful advocate for their own interests, means that citizens may feel somewhat defenseless and isolated.

However, I note the noise complaints that have come from Norwood over the years and still can be heard, and how they combined with new complaints coming from Cambridge and especially from Somerville. The EDR is a useful document, but Massport may need to have better outreach, dialogue and informational presentations if the Authority wants to deal more effectively with noise issues. 10-1

It is a good reminder to hear it repeated : that decibels are a very difficult concept for many citizens to grasp. Even when people are not crippled by the common disease of math-phobia, they may have a difficult time understanding decibels and its logarithmic scale. Massport needs a more linear scale to describe noise. They need to give a better understanding of how noise affects people. 10-2

The EPA has not had good noise expertise since the early 1980s, and technical knowledge of noise is highest in the transportation agencies such as the Federal Aviation Agency and Massport. I was at a state transportation presentation yesterday, and a noise consultant droned on for far too long -- leaving everyone half-asleep, yet to some degree angry that a public meeting was chewing up the clock this way.

I urge Massport to devise new methods of explaining noise, how to measure it, and why it is so annoying to people. Those methods could be transplanted into new ways of explaining noise info in the EDR. I suggest that Massport think very carefully about how it can do a better job of "doing the noise thing" rather than being fixated on decibel charts ... tables .... and maps. 10-3

Test the methods on your own workforce. I doubt that not more than a tiny fraction of Massport's workforce has much more than a vague awareness of noise : its generation and effects. When next year we see EDR 2016, I hope the document can be significantly rewritten to present a better way of understanding how noise affects us all.

But please -- no PowerPoint. It is the worst form of communication out there, and many private companies are banning its internal use. When I hear that PowerPoint is slowly invading our court system, I worry very much for the future of our nation.

TRANSPORTATION

My primary area of expertise is in transportation, and I have been following closely the progress of the revival of the MBTA as directed by the Fiscal and Management Control Board. The scope of problems for the five member board to deal with immense and they have been meeting three times a month for a year and a half.

My recollection is that they have not had a single presentation from anyone on the overall operations at Logan ... the implications for future passenger growth ... the plans for more parking garages ... and the stated priorities to improve transit access to Logan.

Given that the Board has been able to give no more than minimal attention to Logan access, I urge that Massport begin to make serious efforts to look into Logan ground access, 10-4 first by assessing the airport loop bus and Blue Line service. All rail line and most buses show evidence of bunching -- with slow, late crowded trains followed by closely spaced and partially filled trains. 10-4 Cont.

The result is a loss of capacity and longer trip times. This bunching of buses and trains can plague transit operators in every corner of the civilized world. By running trains on time, how much of a capacity benefit could be achieved simply by even loading of trains? Could even-spacing have a secondary effect of higher average train speeds and thus increase train capacities from speed alone?

No one in state government appears to be studying this issue. The Blue Line is a fairly well-run branch with uniform fleet of newer cars. Experiments might be arranged on the Blue Line to release trains from terminals almost exactly on-time and keep the trains on-time throughout their daily runs. The option for significant performance benefits for minimal expenditure appears a credible one.

Another look needs to be made of improving service on the existing Silver Line between South Station and the airport.   Several questions might be asked :

1. What will be the possible effect of extending Silver Line service to Chelsea? Will airport access by negatively affected? 10-5

2. How can existing Silver Line service be made more regular and efficient, again by considering ways to achieve more even-spacing between buses? 10-6

3. Some people have deplored the ride quality on the Silver Line buses. What can be done to about the thumping, rattling, and hard ride caused by chuckholes and expansion plates? Why so interstate buses have such a much better ride that MBTA buses? 10-7

4. Can traffic lights be better timed to allow for low-delay bus operations on the surface? Could signal cycles be cut in half? That would reduce waiting delay by up to half. 10-8

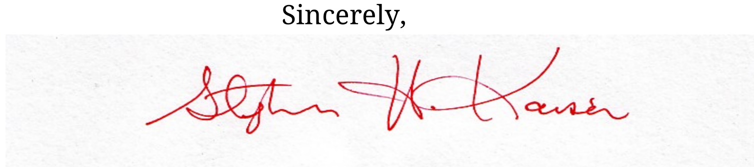
PARKING

How can Massport rationalize building more parking garages? The road system in Boston is already congested and is likely to get worse in coming years as more development occurs in downtown Boston and the suburbs. There is no more room for cars on the roadways, so why is Massport proposing to build more garages? We should not be reading any more headlines as the one in the Boston Globe last November -- "Massport picks sites for Logan garages." From a traffic viewpoint, Massport may be fouling its own nest.

I urge Massport to ask its traffic consultants VHB and the main writers of the EIR, "Does it make transportation sense to build more garages when the roads are jammed by key bottlenecks, and no one is proposing any solutions (other than a better MBTA)?" Ask your traffic engineers to give you a straight and honest appraisal, and do not accept mushy status quo assurances. They may ultimately tell you the truth.

Finally, I urge that Massport attend the Monday noon meetings of the MBTA Control Board, to see some of the transit issues under discussion, and even to participate by public comment. The Board has already programmed a complete replacement of the Orange and Red Line fleets, with capacity increases of 50% The expectation is that on the Red Line today's headways of 4.5 minutes will be trimmed to 3 minutes. We need to expand that way of thinking to include all forms of transit, including access to Logan Airport. 10-9

Sincerely,



Stephen H. Kaiser, PhD

This Page Intentionally Left Blank.

Comment ID	Author	Topic	Comment	Response
10-1	Stephen H. Kaiser	Noise	The EDR is a useful document, but Massport may need to have better outreach, dialogue and informational presentations if the Authority wants to deal more effectively with noise issues.	Massport engages directly with the community on noise and other issues through the Massport Community Advisory Committee (CAC). Massport also publishes and welcomes public comments on the Environmental Data Reports (EDRs) and Environmental Status and Planning Reports (ESPRs), which report on noise issues. Massport also seeks continual engagement with the public on specific projects to provide information and gather feedback.
10-2	Stephen H. Kaiser	Noise	Even when people are not crippled by the common disease of math-phobia, they may have a difficult time understanding decibels and its logarithmic scale. Massport needs a more linear scale to describe noise. They need to give a better understanding of how noise affects people.	The EDR reports noise conditions at Logan Airport in accordance with the Federal Aviation Administration (FAA) standards. The details of the modeling process are described in Chapter 6, *Noise Abatement* under the *Noise Modeling Process* section. FAA directs airports to report noise modeling in terms of decibels through the day-night average sound level (DNL) noise contours, described under 14 CFR Part 150, Appendix A to Part 150 Noise Exposure Maps. To assist the community in understanding noise effects, in addition to the standard reporting of average annual day-night contours, Massport provides several supplemental metrics on noise to enhance the public's knowledge of noise conditions in the vicinity of the Airport. This reporting year, Massport is modeling noise using the FAA's new and enhanced model - Airport Environmental Design Tool (AEDT) - which jointly evaluates noise and air emissions. See Chapter 6, *Noise Abatement* for noise reporting and modeling results.
10-3	Stephen H. Kaiser	Noise	I urge Massport to devise new methods of explaining noise, how to measure it, and why it is so annoying to people.	The EDR reports noise conditions at Logan Airport in accordance with the Federal Aviation Administration (FAA) standards. The details of the modeling process are described in Chapter 6, *Noise Abatement* under the Noise Modeling Process section. FAA directs airports to report noise modeling in terms of decibels through the day-night average sound level (DNL) noise contours, described under 14 CFR Part 150, Appendix A to Part 150 Noise Exposure Maps. To assist the community in understanding noise effects, in addition to the standard reporting of average annual day-night contours, Massport provides several supplemental metrics on noise to enhance the public's knowledge of noise conditions in the vicinity of the Airport. This reporting year, Massport is modeling aircraft related noise using the FAA's new and enhanced model - Airport Environmental Design Tool (AEDT) - which jointly evaluates noise and air emissions. See Chapter 6, *Noise Abatement* for noise reporting and modeling results.

Comment ID	Author	Topic	Comment	Response
10-4	Stephen H. Kaiser	Ground Access	Given that the Board has been able to give no more than minimal attention to Logan access, I urge that Massport begin to make serious efforts to look into Logan ground access, first by assessing the airport loop bus and Blue Line service. All rail line and most buses show evidence of bunching - with slow, late crowded trains followed by closely spaced and partially filled trains.	Massport continues to implement a comprehensive ground transportation strategy designed to maximize transit and shared-ride options for travel to and from Logan Airport and minimize vehicle trips by providing convenient transit, shuttle, and pedestrian connections at the Airport. Massport invests in and operates Logan Airport with a goal of increasing the number of passengers arriving by transit or other high-occupancy vehicle (HOV)/shared-ride modes. Logan Airport continues to rank at the top of U.S. airports in terms of HOV/transit mode share. Programs include Logan Express bus service, free outbound Silver Line boardings, water shuttle service, and free, frequent shuttle bus service to and from the Blue Line subway station. Massport provides priority, designated curb areas at all Airport terminals, to support the use of HOV/transit modes, including privately-operated scheduled buses and shared-ride vans. Massport will share this comment with the Massachusetts Bay Transportation Authority (MBTA), responsible for operating the Blue Line.
10-5	Stephen H. Kaiser	Ground Access	What will be the possible effect of extending Silver Line service to Chelsea? Will airport access by negatively affected?	Massport is currently evaluating the feasibility and effectiveness of potential measures to improve HOV access to Logan Airport. This study will include possible improvements to Logan Express bus service, feasibility of additional Logan Express sites, and the benefit of improvements to the Silver Line bus service to Logan Airport.
10-6	Stephen H. Kaiser	Ground Access	How can existing Silver Line service be made more regular and efficient, again by considering ways to achieve more even-spacing between buses?	Comment noted. Massport will share this comment with the MBTA.
10-7	Stephen H. Kaiser	Ground Access	Some people have deplored the ride quality on the Silver Line buses. What can be done to about the thumping, rattling, and hard ride caused by chuckholes and expansion plates? Why so interstate buses have such a much better ride that MBTA buses?	Eight Silver Line buses, connecting the Airport to South Station, are owned by Massport and are operated by the MBTA with Massport paying operating costs for the Silver Line route SL1. In 2016, Massport funded an approximate $6 million mid-life rebuild of these eight buses. The mid-life rebuild will extend the useful life of each vehicle by approximately eight years. This will allow the MBTA to maintain reliability and quality of operations along the Silver Line today while starting the procurement process to acquire new vehicles in the future.
10-8	Stephen H. Kaiser	Ground Access	Can traffic lights be better timed to allow for low-delay bus operations on the surface? Could signal cycles be cut in half? That would reduce waiting delay by up to half.	Massport uses its Automated Traffic Monitoring System (ATMS) to provide accurate data on traffic patterns and to inform airport planning. All of the Airport's gateway roadways are equipped with permanent traffic count stations as part of the Airport-wide ATMS. Massport continues to invest in and maintain the ATMS to improve data and analytics on ground transportation through the Airport.
10-9	Stephen H. Kaiser	Ground Access	Finally, I urge that Massport attend the Monday noon meetings of the MBTA Control Board, to see some of the transit issues under discussion, and even to participate by public comment.	Massport collaborates on an ongoing basis with the Massachusetts Department of Transportation (MassDOT) and the MBTA regarding improvements to the ground access system to and from the Airport.

AC

COMMONWEALTH OF MASSACHUSETTS
TOWN OF MILTON
OFFICE OF SELECTMEN
525 CANTON AVENUE, MILTON, MA 02186
TEL. 617-898-4843
FAX 617-698-6741

MICHAEL D. DENNEHY
TOWN ADMINISTRATOR

SELECTMEN
KATHLEEN M. CONLON
CHAIRMAN
DAVID T. BURNES
SECRETARY
J. THOMAS HURLEY
MEMBER

January 18, 2017

The Honorable Matthew Beaton, Secretary
Executive Office of Energy and Environmental Affairs
Attn: Massachusetts Environmental Policy Act ("MEPA") Office
Anne Canaday, EEA No. 3247
100 Cambridge Street, Suite 900
Boston, MA 02114

Re: Comments of the Town of Milton on the Boston-Logan International Airport 2015 Environmental Data Report (2015 EDR)

Dear Secretary Beaton,

The Board of Selectmen of the Town of Milton ("Milton") is pleased to provide the following comments[1] in response to the Boston-Logan International Airport 2015 Environmental Data Report ("2015 EDR"):

1. Overall Themes of the 2015 EDR

Milton is surprised and frustrated at the theme of the 2015 EDR that both air and noise pollution are "substantially" better than the conditions reported during the 1990s and 2000. These statements, which occur throughout the Introduction/Executive Summary, fail to take into account the increased number of complaints from Milton and other surrounding communities that are overflown by certain RNAVs. The fact that disruption from the noise is growing should be acknowledged within the 2015 EDR and Massport should have a plan to provide relief from this disruption to the affected communities. To date, after almost three years of attempting to get 11-1

[1] In Milton's comments on the 2014 EDR, we provided some background on the demographics of Milton, which we repeat here for context. Milton is a predominantly residential community with a population of 27,000, which is racially diverse (71 % white, 20 % African American). Comprised of only 13.3 square miles, Milton bears the brunt of heavy air traffic arriving and departing Boston-Logan International Airport through three (3) RNAVs (designated as 4R, 27 and 33L), with two more RNAVs proposed by the FAA this year (4L visual and 4L instrument). Because it is mostly comprised of single-family homes with backyards, people often choose to live in Milton to raise their families. Thus, the tremendous amount of aircraft noise imposed on the town severely diminishes the quality and standard of living, as residents report they are unable to enjoy either their homes and properties, or Milton's recreational areas and open spaces.

Massport's attention on this issue, there has been little substantive progress by Massport that provides relief to the impacted Milton residents or the residents of other communities.

Further, we note that Massport continues to downplay the increased number of airline operations and passenger throughput at Logan, particularly by comparing aircraft operation numbers to pre-2000 data. We submit that comparison is no longer valid, as airlines have significantly changed their modes of operation in the intervening 15 years, by relying on progressively larger airplanes, with progressively larger, more powerful, and louder jet engines. Further, the implementation of the FAA's RNAV systems has also changed how aircraft arrive and depart over surrounding communities.

According to the 2015 EDR, Logan had a 5.7% increase in the number of passengers at Logan from 2014, and a 2.5% increase in aircraft operations from 2014. This increase in operations has resulted in increased noise and other impacts to the communities under the multiple RNAVs. Per page 6-66 of the 2015 EDR, as of 6/5/2013, there are 8 RNAV procedures in use on Runways 4R, 9, 15R, 22R, 22L, 27 and 33L. Two additional RNAV procedures have been proposed for Runway 4L, which would further impact Milton, and which would allow for additional aircraft operations and passenger throughput.

Massport continues to lump all of these affected communities together, and still fails to acknowledge that certain communities, including Milton, which are overflown by multiple RNAVs are taking the brunt of the noise and environmental impact for the entire Boston-Logan area. Unless and until this situation is rectified, and Massport either provides a community by community analysis, or the RNAVs and overflights are distributed more fairly, the EDRs will continue to provide an inaccurate accounting of the real impacts of Logan operations on Milton and other communities. 11-2

We think it unlikely this demand will cease in the near future. We note that the entire New England region has a record high in passenger traffic (however that is defined). The impacts to Milton and other communities will only increase. While we understand and support Logan's role in the economic development of New England, we believe that development cannot come at the price of the right of citizens to peacefully co-exist within their homes. There needs to be a better balance, such that the economic success of the region, and of Logan and Massport, is not based on continuing impacts to its neighbors. Massport and the airline community have a duty and responsibility to protect the neighbors and communities underneath the publically owned airspace through which they travel.

2. Increased Noise Complaints Reported

Table 6-16 demonstrates that no single community makes as many complaints on the Noise Complaint Line as Milton, and both the number of complaints and the number of callers has increased. In Milton, the number of complaints increased from 2,669 reported in the 2014 EDR to 4,991reported in the 2015 EDR – an 87% increase in the number of complaints filed. The number of callers similarly increased by 81%. Complaints on the Massport complaint line from Milton have increased from an average of 9 per month in 2012, to an average of 160 per month in 2013, to an average of 416 per month in 2014. That represents a *46-fold increase in total noise complaints.*

As the report indicates, "noise annoyance is growing among a concentrated population." Milton is one of those concentrated populations where noise annoyance -- which includes lack of sleep, disrupted and interrupted sleep, interrupted conversation, and impacts on use of outside spaces such as decks and yards – is growing. This noise annoyance is not simple NIMBYism, as Massport seems to imply. These are real impacts, suffered by real people, who live in nearby communities. It is outrageous that Massport still has no plan in place to address impacts on these citizens. We request that the Secretary direct Massport to prepare a plan to address and mitigate the noise impacts from RNAVs within Milton, and to share it with Milton, within the next 3 months. 11-3

3. Increased Nighttime Operations

As in the 2014 EDR, the 2015 EDR acknowledges that nighttime operations at Logan – defined as from 10:00 P.M. to 7:00 A.M. – continue to increase. Total use during nighttime hours increased again, by almost 6% in 2015 compared to 2014, and has increased by almost 18% since 2010 (Table 6-3).

Although the noise complaint data is not broken down by time of day (either that the complaint was filed, or that the complaint concerned), it follows that some portion of the increase in complaints in Milton is driven by increased nighttime operations. Data continues to be developed which indicates airplane noise in overflown communities disrupts sleep patterns, which has been shown to result in adverse human health impacts. The noise from airplane overflights can also negatively impacts property values. Fewer buyers are willing to purchase a home in an area with known noise impacts, and prices can be suppressed.

Anecdotal data from Milton residents indicate that the noise from airplanes in Milton is clearly heard above background noise in both commercial and residential areas. As elected officials, we hear frequently from Milton residents who suffer from interrupted sleep, anxiety and a reduced quality of life because of the noise pollution caused by very frequent – and some days continuous – flights over Milton at low altitudes. We cannot overstate the seriousness of the health problems that these RNAVs cumulatively pose for Milton residents, and the adverse cumulative environmental impact that the RNAVs and the low flying planes have on our entire community.

We request that the Secretary work with Massport and Milton to implement additional late night aircraft restrictions, similar to those set forth in 740 CMR 24.04, which are more protective of Milton and its residents. In particular, it is important to discuss restrictions on RNAV usage and routes that overfly residential neighborhoods, including spreading the routes further so that the nighttime noise is less concentrated in residential neighborhoods, or moving routes over the ocean during certain periods of time. Specifically, as there are already nighttime restrictions on arrivals to runway 4L, we request the same restrictions (no arrivals between 11:00 PM and 6:00 AM) for on runway 4R. See Massachusetts Port Authority ("Massport") Noise Rules and Regulations I.1(b), Summary of Runway Use Restrictions, Boston Logan International Airport (May 2, 2016) (also referenced in FAA BOS ATCT Noise Abatement Order 7040.1H).

11-4

11-5

4. Memorandum of Understanding ("MOU") and Massport and Logan Community Advisory Committees ("MCAC" and "LCAC")

Ultimately, Milton seeks fairness and equity in the distribution of airplane operations and the impacts of those operations. It is undisputed that Milton receives a disproportionate impact of airplane operations in the Boston-Logan area. The skies over Milton are already saturated with airplanes, often from very early morning until very late at night. Implementation of two new RNAVs over Milton (4L visual and 4L instrument) will increase the existing inequity.

We are very disappointed that the FAA, with Massport's concurrence, has discontinued funding the LCAC, and appears to have abandoned developing a replacement for the PRAS goals. The Preferential Runway Advisory System ("PRAS") is:

> a set of short-term and long-term runway use goals that include the use of a computer program that recommends to FAA air traffic controllers; the system recommends runway configurations that will meet weather and demand requirements while providing an **equitable distribution** of Logan Airport's noise impacts on surrounding communities. The two primary objectives of the PRAS goals are to distribute noise on an annual basis, and to provide short-term relief from continuous operations over the same neighborhoods at the ends of the runways.

2015 EDR, page 6-22 (emphasis added).

Because it was not meeting its goals, presumably because it was not functioning, the LCAC voted to abandon the PRAS goals in 2012. However, no other guidelines were put in its place, and Massport still reports runway usage with respect to the PRAS goals (Table 6-5). The PRAS goals offer at least some picture of what a fair distribution of aircraft traffic might look like using one particular tool, i.e. differential runways (being mindful that these PRAS goals were created well before RNAV concentrated flight routes were implemented). Thus, at this stage, only achieving balanced runway usage would not be sufficient to relieve those under the RNAVs, although it would be a step in the right direction.

We note that while the PRAS goal for arrivals on runways 4R/4L is 21.1%, the 2014 effective usage is reported at 25.1%. When added to the impacts from the southbound 27 departures (3.9% of all departures) and 33L departures (2.2% of all departures), Milton is impacted by much of the daily airline traffic moving in and out of Logan, and in a greater proportion than was initially planned or expected, based on the PRAS goals.

We are hopeful that the MOU signed between Massport and the FAA will develop a process and procedure to provide equitable distribution of the overflights in and out of Logan, with a particular eye to providing relief to the communities like Milton (and other communities like Boston, Belmont, Hull, Somerville, Medford, and Cambridge) who are especially burdened by the concentrated RNAV overflights. To be successful however, this process requires the full partnership of the impacted communities with Massport and the FAA, which has not yet been implemented despite multiple specific requests by Milton. Milton stands ready to work on these issues, either via the MCAC, or directly with these agencies. We request that the Secretary direct Massport and the MCAC to promptly develop a system for the fair and equitable distribution of aircraft overflights that provides real relief to the highly impacted surrounding communities 11-5

5. Air Pollution and Public Health.

Once again, the 2015 EDR only discussed air pollution from airport operations in the context of the actual operations of Logan airport, on Logan property. We repeat our earlier comments that this perspective is overly narrow. Recent studies at LAX (Hudda, et al., May 2014) found ultrafine particle counts as far as ten miles from heavily used arrival runways.

We request that the Secretary direct Massport, in conjunction with the Department of Public Health ("DPH") and the Department of Environmental Protection ("DEP"), conduct noise and air pollution studies in communities like Milton which receive a substantial number of low-flying arrival aircraft. This work would be consistent with the evolving science on this point, and 11-7
protective of the residents in these communities. We further request that the scope of the future EDRs (and ESPRs), beginning with the next EDR and ESPR, be expanded to consider the health impacts from increased and concentrated arrival and departure operations due to RNAVs, and that pollution data be measured for every community under any of the many Logan RNAVs. 11-8

6. Scope of the 2016 EPSR

Given the reliance of the Secretary and Massport on past ESPR documents in setting forth the scope of environmental review of Logan projects, we appreciate the opportunity to comment on the scope of the 2016 ESPR. Our comments on the scope reflect our previous comments on the 2015 EDR.

First, we believe it is important to consider the off-airport impacts of the growth of Logan itself, and the increased passenger throughput and increased aircraft operations at Logan. The increased demand for airport services impacts the surrounding communities by increasing the volume and concentration of overflights, and by increasing the amount of nighttime operations and nighttime overflights. Each of these impacts must be studied – from noise to pollution and more, to have a true assessment of the environmental impacts resulting from operations at Logan. The current approach, which only assesses on-airport pollution is wrong-headed and ineffectual. It ignores the robust science that demonstrates that airport operations can impacts communities as far as 10 miles beyond the airport location, particularly where those communities are overflown by multiple RNAVs and the aircraft traffic is concentrated and persistent. 11-9

Second, the scope must include analysis of the cumulative impacts from increasing numbers of RNAVs flown over surrounding communities. As noted, there are three RNAVs that overfly Milton, with two others proposed. Looking at these impacts in isolation does not provide an actual assessment of on-the-ground impacts – some of which are reflected in the increasing number of noise complaints filed in these communities. 11-10

Third, we urge Massport and the Secretary to move to a more updated method for noise assessment, and either discontinue using the DNL standard, or reduce the threshold at which noise impacts are considered significant. The DNL standard "masks" the acute impacts a succession of aircraft flying over a home has on the sleeping residents within, and also masks the acute impacts felt in a community when it is overflown for hours on end, with little break in the incoming aircraft. 11-11

Finally, we urge Massport and the Secretary to collaborate with the impacted communities, and to work with them directly, rather than just giving lip service to working with them. It is appropriate to acknowledge that multiple communities surrounding Logan (not just Milton) take the brunt of the impact of the operations of Logan. These communities should have direct and regular access to Massport and the Secretary, and both agencies should be willing to work on real and meaningful solutions to address the problems from airport operations – especially noise 11-12

and pollution -- occurring in those communities. While we understand some of that work must be done via the MCAC, the large size and the organization of the MCAC has the unintentional effect of diluting the voices of the most affected communities.
and pollution -- occurring in those communities. While we understand some of that work must be done via the MCAC, the large size and the organization of the MCAC has the unintentional effect of diluting the voices of the most affected communities.

7. Conclusion and Request for Assistance.

Thank you for your attention to and consideration of our comments on the 2015 EDR. We believe that there can be solutions available to remedy and mitigate the ongoing impact of Logan operations on the residents of Milton. We request that the Secretary work with Massport, 11-13
Milton, the MCAC, and other effected communities to help remedy the multiple impacts discussed above. Specifically, the requests made are as follows:

a. Direct Massport to prepare a plan to address and mitigate the noise impacts from the 11-14
RNAVs overflying Milton, and to share it with Milton, within the next three (3) months;
b. Work with Massport and Milton to develop and implement additional late night aircraft overflight restrictions which are more protective of Milton and its residents, including 11-15
consideration of an 11:00 PM to 6:00 AM landing prohibition on runway 4R;
c. Direct Massport and the MCAC to promptly develop a system for the fair and equitable distribution of aircraft overflights that provides real relief to the highly impacted 11-16
surrounding communities, especially those that are under multiple RNAVs;
d. Direct Massport to collaborate with DPH and DEP to develop and conduct noise and air pollution studies in highly impacted surrounding communities, especially those that are 11-17
under multiple RNAVs;
e. Direct Massport to consider off-airport noise and pollution impacts, including but not limited to the health impacts from increased and concentrated arrival and departure 11-18
operations due to RNAVs, in all communities under any RNAV, in all future EDRs
f. Direct Massport to include all of the points made above in the scope of the 2016 ESPR. This includes impacts to health from noise and pollution from: off-airport impacts of growth, cumulative impacts of RNAV overflights, increased nighttime operations, 11-19
moving to updated noise measurements which are more protective of human health and which account for acute impacts more realistically than the DNL standard; and working directly with impacted communities to more fully understand and evaluate the human health effects from Logan operations.

The Honorable Matthew Beaton, Secretary
Executive Office of Energy and Environmental Affairs
Page Eight

We would appreciate a time to meet with you and your staff to personally discuss the concerns we have outlined here, as well as our specific requests for assistance.

Sincerely,

Board of Selectmen of the Town of Milton

Kathleen M. Conlon

Kathleen M. Conlon, Chairman

David T. Burnes, Secretary

J. Thomas Hurley, Member

cc: Congressman Stephen F. Lynch
Congressman Michael E. Capuano
U.S. Senator Elizabeth A. Warren
U.S. Senator Edward J. Markey
State Senator Walter F. Timilty
State Representative William Driscoll
State Representative Daniel R. Cullinane
Milton Board of Health
Milton Airplane Noise Advisory Committee Chair Andrew Schmidt
LCAC/MCAC Representative Cindy L. Christiansen
LCAC Representative (Alternate) Michael Andresino
Karis L. North

Comment ID	Author	Topic	Comment	Response
11-1	Town of Milton	Noise	The fact that disruption from the noise is growing should be acknowledged within the 2015 EDR and Massport should have a plan to provide relief from this disruption to the affected communities.	The annual Environmental Data Reports (EDRs) and Environmental Status and Planning Reports (ESPRs) consistently report on environmental conditions for the reporting year compared to the previous year. The EDR also provides historical data because it is critical context information to understand the long term performance trends at Logan Airport. This *2016 EDR* provides 1990, 2000, and 2010-2016 data as available in each chapter. Including data from 1990 and 2000, and in some cases 1998 (the year of peak operations at Logan Airport), provides a historical benchmark of progress over the last few decades. The long-term downward trend in flights, as well as improvements in aircraft technology, has resulted in a long-term reduction in noise impacts to surrounding communities. The technical appendices contain all available historical data. Massport will continue to work with the Federal Aviation Administration (FAA) to soundproof eligible homes. As of 2015, FAA requires airports to use the Aviation Environmental Design Tool (AEDT) to establish eligibility. Massport has submitted the 2016 AEDT noise exposure map to FAA.
11-2	Town of Milton	Noise	Unless and until this situation is rectified, and Massport either provides a community by community analysis, or the RNAVs and overflights are distributed more fairly, the EDRs will continue to provide an inaccurate accounting of the real impacts of Logan operations on Milton and other communities.	Many aspects of the EDR reflect the impact on individual communities. Table H-26 lists day-night average sound level (DNL) by census block group. Tables 6-8, 6-9, 6-13, and 6-14 provide DNL and Time-Above metrics at noise monitor locations. Flight track graphics display the locations overflown by representative operations. Runway use and effective runway use can be used to quantify the relative impact of these operations.
11-3	Town of Milton	Noise	We request that the Secretary direct Massport to prepare a plan to address and mitigate the noise impacts from RNAVs within Milton, and to share it with Milton, within the next 3 months.	Massport along with MIT and FAA is participating in a pilot study to evaluate noise levels under certain routes. Massport is aware of the effects of RNAV procedures on the community, and has partnered with FAA to study these effects and analyze opportunities for mitigation of impacts. This partnership is the first in the nation between an airport operator and FAA on this topic. This work is ongoing and progress will continue to be reported in future EDR/ESPRs. Massport regularly engages with the Massport Community Advisory Committee (CAC) to discuss noise and other issues, of which the town of Milton is a member. The Massport CAC is a state legislated body and is the official forum for the community and Massport to discuss noise related issues. The EDRs and ESPRs provide over three decades of reporting on noise conditions at Logan Airport. In addition to the standard annual reporting of day-night average sound level contours, Massport provides several supplemental metrics on noise to enhance the public's understanding of noise conditions in the vicinity of the Airport.
11-4	Town of Milton	Noise	We request that the Secretary work with Massport and Milton to implement additional late night aircraft restrictions, similar to those set forth in 740 CMR 24.04, which are more protective of Milton and its residents.	Massport supports the Massport CAC of which the Town of Milton is member. Massport regularly engages with the Massport CAC to discuss improvements to discuss noise and other issues. The Massport CAC is a state legislated body and is the official forum for the community and Massport to discuss noise related issues. Massport will continue to engage with the Town of Milton through the Massport CAC.

Comment ID	Author	Topic	Comment	Response
11-5	Town of Milton	Noise	Specifically, as there are already nighttime restrictions on arrivals to runway 4L, we request the same restrictions (no arrivals between 11:00 PM and 6:00 AM) for on runway 4R.	Arrivals to Runway 4R were 29 percent of all arrivals in 2015, versus 4 percent for Runway 4L; therefore this restriction on 4R would have a much greater impact on airport operations than the same restriction on 4L. Prohibiting all arrivals from the south would almost certainly not be acceptable to FAA due to safety, weather, and airspace considerations. Any new access restrictions to Logan Airport unless grandfathered in, is prohibited by current federal laws.
11-6	Town of Milton	Noise	We request that the Secretary direct Massport and the MCAC to promptly develop a system for the fair and equitable distribution of aircraft overflights that provides real relief to the highly impacted surrounding communities	The FAA has been actively studying the noise and other environmental impacts of proposed flight path changes to Logan Airport's runways. Phase 3 of the Boston Logan Airport Noise Study (BLANS) focused on the development of an updated Runway Use Program. Operational tests of a new program began in November 2014 and continued through September 2016. The BLANS project ended in 2016 without the development of a new Runway Use Program. The Logan CAC, of which Milton was an active participant, could not agree on a recommended runway use program in time for the FAA to obtain NEPA approval and train staff before funding would expire. Therefore, the study ended without a recommendation and a final report on the BLANS program was issued in April 2017. Massport is aware of the effects of RNAV procedures on the community, and has partnered with FAA to study these effects and analyze opportunities for mitigation of impacts. On October 7, 2016, the FAA signed a Memorandum of Understanding (MOU) with Massport to frame the process for analyzing opportunities to reduce noise through changes or amendments to Performance Based Navigation (PBN), including RNAV. This partnership is the first in the nation between an airport operator and FAA on this topic. This work is ongoing and progress will continue to be reported in future EDR/ESPRs. Massport engages directly with the community on noise and other issues through the Massport CAC, which Milton is a part of. The Massport CAC is a state legislated body and is the official forum for the community and Massport to discuss noise related issues. Massport will continue to engage with the Town of Milton through the Massport CAC.

Comment ID	Author	Topic	Comment	Response
11-7	Town of Milton	Noise/Air Quality	We request that the Secretary direct Massport, in conjunction with the Department of Public Health ("DPH") and the Department of Environmental Protection ("DEP"), conduct noise and air pollution studies in communities like Milton which receive a substantial number of low-flying arrival aircraft. This work would be consistent with the evolving science on this point, and protective of the residents in these communities.	FAA has ongoing studies and research related to noise exposure and sound insulation. FAA is currently researching the noise exposure threshold. Massport will continue to follow FAA requirements and thresholds. Massport provides an update on the status and findings of the Massachusetts Department of Public Health (MassDPH) Logan Airport Health Study and Massport's air quality studies in the annual EDRs and ESPRs. The latest update on the health study is provided in Chapter 7, *Air Quality/Emissions Reduction* . The results of the health studies are also available online at: http://www.mass.gov/eohhs/docs/dph/environmental/investigations/logan/logan-airport-health-study-final.pdf. In response to the study recommendations, Massport has: • Entered into an agreement to provide funding to the East Boston Neighborhood Health Center to help expand the efforts of their Asthma and Chronic Obstructive Pulmonary Disease (COPD) Prevention and Treatment Program in East Boston and launch a program in Winthrop including screening children, providing asthma kits, and home visits, among others. • Entered into an agreement with the Massachusetts League of Community Health Centers for the evaluation and assessment of the Asthma and COPD Prevention and Treatment Program, and engagement of community health centers in the North End, Charlestown, Chelsea, and South Boston. The East Boston Neighborhood Health Center will conduct the same evaluations for the East Boston and Winthrop community programs. • Entered into an agreement with the MassDPH to expand or establish the Asthma and COPD Prevention and Treatment Program in South Boston, the North End, Chelsea, and Charlestown in collaboration with the Massachusetts General Hospital, South Boston Neighborhood Health Center, and conduct training on the Community Health Worker assessments. MassDPH conducted the Logan Airport Health Study in May 2014. The study area consisted of areas surrounding the airport including Milton. The study concluded that "Air dispersion modeling of airport related emissions using a state-of-the-art model indicates that the highest predicted pollutant concentrations associated with airport related operations are near the perimeter of Logan Airport and fall off rapidly with increased distance." The study categorized surrounding communities by "high," "medium," and "low" exposure; Milton was categorized as "low exposure" in Figure 4-5 of the health study.

Comment ID	Author	Topic	Comment	Response
11-8	Town of Milton	Activity Levels/Air Quality	We further request that the scope of the future EDRs (and ESPRs), beginning with the next EDR and ESPR, be expanded to consider the health impacts from increased and concentrated arrival and departure operations due to RNAVs, and that pollution data be measured for every community under any of the many Logan RNAVs.	The noise and air quality modeling conducted for the EDR considers the volume of aircraft operations and therefore the air quality modeling results account for any increases or decreases in the number of aircraft arrivals and departure operations. Noise modeling accounts for aircraft location and therefore reflects the concentration of noise impacts. The FAA NextGen initiative is a national effort to improve the daily operations of the entire National Airspace System. This has resulted in changes in flight track and airspace around the country with resultant changes in the noise environment. The FAA conducted its own environmental review process under the National Environmental Policy Act (NEPA) that studied the change in RNAV, which enables aircraft to fly on any desired flight path within the coverage of ground- or space-based navigation aids, within the limits of the capability of the self-contained systems, or a combination of both capabilities. RNAV aircraft have better access and flexibility for point-to-point operations.
11-9	Town of Milton	Activity Levels	Each of these impacts must be studied - from noise to pollution and more, to have a true assessment of the environmental impacts resulting from operations at Logan. The current approach, which only assesses on-airport pollution is wrong-headed and ineffectual. It ignores the robust science that demonstrates that airport operations can impacts communities as far as 10 miles beyond the airport location, particularly where those communities are overflown by multiple RNAVs and the aircraft traffic is concentrated and persistent.	Off-airport noise impacts are extensively reported in the EDR, through DNL contours, noise monitor measurements, and time-above modeling. Flight track analysis and runway use are also reported, with listings of communities impacted by specific operations. Massport uses FAA approved models and methodology for assessing environmental impacts at Logan Airport. Emission estimates associated with Logan Airport include both on- and off-airport emissions. Off-site, aircraft emissions are modeled up to 3,000 feet in altitude or typically less than five miles from the airport. Most airport emission inventories only include on-site motor vehicle emissions. Other studies have reported airport-related impacts extending only short distances from the airport. The FAA NextGen initiative is a national effort to improve the daily operations of the entire National Airspace System. This has resulted in changes in flight track and airspace around the country with resultant changes in the noise environment. The FAA conducted its own environmental review process under the National Environmental Policy Act (NEPA) that studied the change in RNAV, which enables aircraft to fly on any desired flight path within the coverage of ground- or space-based navigation aids, within the limits of the capability of the self-contained systems, or a combination of both capabilities. RNAV aircraft have better access and flexibility for point-to-point operations.
11-10	Town of Milton	Activity Levels/ Noise	Second, the scope must include analysis of the cumulative impacts from increasing numbers of RNAVs flown over surrounding communities. As noted, there are three RNAVs that overfly Milton, with two others proposed. Looking at these impacts in isolation does not provide an actual assessment of on-the-ground impacts - some of which are reflected in the increasing number of noise complaints filed in these communities.	Massport uses FAA approved models and methodology for assessing environmental impacts at Logan Airport. Massport is aware of the effects of RNAV procedures on the community, and has partnered with FAA to study these effects and analyze opportunities for mitigation of impacts. On October 7, 2016, the FAA signed a MOU with Massport to frame the process for analyzing opportunities to reduce noise through changes or amendments to PBN, including RNAV. This partnership is the first in the nation between an airport operator and FAA on this topic. This work is ongoing and progress will continue to be reported in future EDR/ESPRs.

Comment ID	Author	Topic	Comment	Response
11-11	Town of Milton	Noise	Third, we urge Massport and the Secretary to move to a more updated method for noise assessment, and either discontinue using the DNL standard, or reduce the threshold at which noise impacts are considered significant.	Logan Airport EDR and ESPRs have tracked noise conditions at Logan Airport, providing annual noise contours and the population located with FAA-defined noise level of DNL 65 dB which is considered to be incompatible with residential land use. FAA has ongoing studies and research related to noise exposure and sound insulation. FAA is currently researching the noise exposure threshold. Massport will continue to follow FAA requirements and use approved models to track these changes. Massport uses a variety of metrics to assess noise impacts. Please refer to the *Supplemental Metrics* section in Chapter 6, *Noise Abatement* .
11-12	Town of Milton	General	Finally, we urge Massport and the Secretary to collaborate with the impacted communities, and to work with them directly, rather than just giving lip service to working with them.	Massport engages directly with the community on noise and other issues through the Massport CAC, which Milton is an active member. Massport also publishes and welcomes public comments on the EDR and ESPR, which report on noise issues. Massport also seeks continual engagement with the public on specific projects to provide information and gather feedback.
11-13	Town of Milton	Noise/Air Quality	We request that the Secretary work with Massport, Milton, the MCAC, and other effected communities to help remedy the multiple impacts discussed above.	Massport engages directly with the community on noise and other issues through the Massport CAC, which Milton is an active member. Massport also publishes and welcomes public comments on the EDR and ESPR, which report on noise issues. Massport also seeks continual engagement with the public on specific projects to provide information and gather feedback.
11-14	Town of Milton	Noise	Direct Massport to prepare a plan to address and mitigate the noise impacts from the RNAVs overflying Milton, and to share it with Milton, within the next three (3) months	Massport engages directly with the community on noise and other issues through the Massport CAC, which Milton is an active member. The appropriate forum for further noise issues and discussions continues to be through the Massport CAC. Massport is aware of the effects of RNAV procedures on the community, and has partnered with FAA to study these effects and analyze opportunities for mitigation of impacts. On October 7, 2016, the FAA signed a MOU with Massport to frame the process for analyzing opportunities to reduce noise through changes or amendments to PBN, including RNAV. This partnership is the first in the nation between an airport operator and FAA on this topic. This work is ongoing and progress will continue to be reported in future EDR/ESPRs.
11-15	Town of Milton	Activity Levels/Noise	Work with Massport and Milton to develop and implement additional late night aircraft overflight restrictions which are more protective of Milton and its residents, including consideration of an 11 :00 PM to 6:00 AM landing prohibition on runway 4R	Offshore approaches are prioritized for nighttime arrivals when possible, including a recently-developed RNAV for quieter approach to Runway 33L. Runway 33L is the preferred runway for arrivals at night. Safety considerations preclude a permanent nighttime closure of any runway. Massport will continue to work with Milton, and other communities, through the Massport CAC. The appropriate forum for further noise issues and discussions continues to be through the Massport CAC. Any new access restrictions to Logan Airport unless grandfathered in, is prohibited by current federal laws.

Comment ID	Author	Topic	Comment	Response
11-16	Town of Milton	Activity Levels/Noise	Direct Massport and the MCAC to promptly develop a system for the fair and equitable distribution of aircraft overflights that provides real relief to the highly impacted surrounding communities, especially those that are under multiple RNAVs	The FAA has been actively studying the noise and other environmental impacts of proposed flight path changes to Logan Airport's runways. Phase 3 of BLANS focused on the development of an updated Runway Use Program. Operational tests of a new program began in November 2014 and continued through September 2016. The BLANS project ended in 2016 without the development of a new Runway Use Program. The Logan CAC, of which Milton was an active participant, could not agree on a recommended runway use program in time for the FAA to obtain NEPA approval and train staff before funding would expire. Therefore, the study ended without a recommendation and a final report on the BLANS program was issued in April 2017. Massport is aware of the effects of RNAV procedures on the community, and has partnered with FAA to study these effects and analyze opportunities for mitigation of impacts. On October 7, 2016, the FAA signed a MOU with Massport to frame the process for analyzing opportunities to reduce noise through changes or amendments to PBN, including RNAV. This partnership is the first in the nation between an airport operator and FAA on this topic. This work is ongoing and progress will continue to be reported in future EDR/ESPRs. Massport engages directly with the community on noise and other issues through the Massport CAC, which Milton is an active member. The Massport CAC is a state legislated body and is the official forum for the community and Massport to discuss noise related issues. Massport will continue to engage with the Town of Milton through the Massport CAC.

Comment ID	Author	Topic	Comment	Response
11-17	Town of Milton	Noise/Air Quality	Direct Massport to collaborate with DPH and DEP to develop and conduct noise and air pollution studies in highly impacted surrounding communities, especially those that are under multiple RNAVs	Massport provides an update on the status and findings of the MassDPH Logan Airport Health Study and Massport's air quality studies in the annual EDRs and ESPRs. The latest update on the health studies is provided in Chapter 7, *Air Quality/Emissions Reduction* . The results of the health studies are also available online at http://www.mass.gov/eohhs/docs/dph/environmental/investigations/logan/logan-airport-health-study-final.pdf. MassDPH conducted the Logan Airport Health Study in May 2014. The study area consisted of areas surrounding the airport including Milton. The study concluded that "Air dispersion modeling of airport related emissions using a state-of-the-art model indicates that the highest predicted pollutant concentrations associated with airport related operations are near the perimeter of Logan Airport and fall off rapidly with increased distance." The study categorized surrounding communities by "high," "medium," and "low" exposure; Milton was categorized as "low exposure" in Figure 4-5 of the health study. Massport is aware of the effects of RNAV procedures on the community, and has partnered with FAA to study these effects and analyze opportunities for mitigation of impacts. On October 7, 2016, the FAA signed a MOU with Massport to frame the process for analyzing opportunities to reduce noise through changes or amendments to PBN, including RNAV. This partnership is the first in the nation between an airport operator and FAA on this topic. This work is ongoing and progress will continue to be reported in future EDR/ESPRs. Massport engages directly with the community on noise and other issues through the Massport CAC, which Milton is an active member. The Massport CAC is a state legislated body and is the official forum for the community and Massport to discuss noise related issues. Massport will continue to engage with the Town of Milton through the Massport CAC.

Comment ID	Author	Topic	Comment	Response
11-18	Town of Milton	Activity Levels/Noise/Air Quality	Direct Massport to consider off-airport noise and pollution impacts, including but not limited to the health impacts from increased and concentrated arrival and departure operations due to RNAVs, in all communities under any RNAV, in all future EDRs	The EDR's noise and air quality modeling considers the volume of aircraft operations and therefore the air quality modeling results account for any increases or decreases in the number of arrivals and departure operations. Massport is aware of the effects of RNAV procedures on the community, and has partnered with FAA to study these effects and analyze opportunities for mitigation of impacts. This partnership is the first in the nation between an airport operator and FAA on this topic. This work is ongoing and progress will continue to be reported in future EDR/ESPRs. FAA NextGen initiative is a national effort to improve the daily operations of the entire National Airspace System. This has resulted in changes in flight track and airspace around the country with resultant changes in the noise environment. The FAA conducted its own environmental review process under NEPA to study the change in RNAV, which enables aircraft to fly on any desired flight path within the coverage of ground- or space-based navigation aids, within the limits of the capability of the self-contained systems, or a combination of both capabilities. RNAV aircraft have better access and flexibility for point-to-point operations.
11-19	Town of Milton	Activity Levels/Noise/Air Quality	Direct Massport to include all of the points made above in the scope of the 2016 ESPR. This includes impacts to health from noise and pollution from: off-airport impacts of growth, cumulative impacts of RNAV overflights, increased nighttime operations, moving to updated noise measurements which are more protective of human health and which account for acute impacts more realistically than the DNL standard; and working directly with impacted communities to more fully understand and evaluate the human health effects from Logan operations.	Massport will continue to prepare the EDRs and ESPRs in accordance with the Secretary's Certificate. Massport will continue to model environmental impacts, including noise, in accordance with FAA standard methodologies. Massport will continue to work with Milton, and other communities, through the Massport CAC. The appropriate forum for further noise and other environmental issues and discussions continues to be through the Massport CAC.

Wig Zamore
13 Highland Avenue #3
Somerville MA 02143
617-625-5630
wigzamore@gmail.com

January 31, 2017

Matthew Beaton, Secretary
Executive Office of Energy and Environmental Affairs
Attn: MEPA Office / MEPA Analyst Anne Canaday
100 Cambridge Street, Suite 900
Boston MA 02114

Via email to Ms. Anne Canaday: anne.canaday@state.ma.us

With copies to:

Stewart Dalzell, Deputy Director
Strategic & Business Planning
(617) 568-3524
sdalzell@massport.com

Michael Gove, Project Manager:
Strategic & Business Planning
(617) 568-3546
mgove@massport.com

Both at:
Massachusetts Port Authority
One Harborside Drive, Suite 200S
East Boston, MA 02128

RE: **EEA #3247, Logan International Airport 2015 Environmental Data Report (EDR)**

Dear Secretary Beaton,

Thank you for accepting these brief comments on the 2015 Logan EDR and on your Scope for the 2016 Logan ESPR. I want to start by noting and appreciating some significant local accomplishments of MassPort over the last years and decades, then move on in subsequent paragraphs to current and future concerns of note for those who work or live near Logan's impacts.

At and around Logan, MassPort has contributed significantly to the quality of local green space, both recreational and natural, as well as to connecting community greenways. These efforts help the people of East Boston and surrounding communities, help wildlife and flora, on land and in estuarine and marine habitats. These are important contributions, both nearby and regionally.

MassPort has also had some notable surface transportation successes, on and off Logan property. The consolidated rental car facility and much lower emission transport between the terminals and this facility are important achievements on campus, significant enough to show up in the air quality modelling. MassPort's continued support for the Silverline transit service between Logan and South

Station, with free transfers beyond, is another significant improvement to local surface transportation, and may help convince visitors to consider using public transit when in Boston. The new Back Bay shuttle is another contribution to lowering local vehicle miles travelled. All of these successes should inspire Massport to create and support additional clean high occupancy transport.

The 2015 Logan EDR text repeatedly compares 2015 jet volumes, noise and air pollution to similar categories with lower impacts in 1990 and 2000. By contrast there is very little text that dwells on more recent air and noise pollution trends which show significant backsliding in the last five years. With passenger volumes predicted to grow, this is a serious lapse in environmental stewardship.

US aviation has long used the Schultz curve, published in 1978 in JASA, and exposure to 65 DNL as the key metric of the number of airport neighbors severely impacted by noise. In 2010, Logan related noise of 65 DNL or more affected an estimated 3830 people. By 2015 that number had grown to 14,097. In the 2016 ESPR, Massport needs to show how it will mitigate this huge increase. 12-1

FAA and MassPort have signed an MOU to study precision-based navigation noise impacts, and potential mitigation, in communities affected by recent flight pattern changes. While the number of people highly annoyed is significant all the way down to aviation noise levels of 45 DNL, MassPort needs to most seriously consider its noise impacts in communities with much higher exposures. 12-2

The 2015 EDR and past reports have not responsibly considered differential noise impacts in affected Environmental Justice communities. MassPort has access to high quality noise model data down to the census block level and to socioeconomic data down to the census block group and tract levels. MassPort's 2016 ESPR should include a fine-grained, robust EJ focused noise analysis. 12-3

At higher levels, aviation noise affects blood pressure, which in turn can lead to premature mortality. Hypertension, which may be caused by both air and noise pollution, is one of the world's most serious health risks (Global Burden of Disease 2010 and 2013). High levels of transportation noise, unfortunately, may also impair cognitive function, in adults and children.

Like noise, Logan's air pollution trends have been moving in the wrong direction the last five years. Modeled VOCs were 1109 kilograms per day in 2011, and 1188 kilograms per day in 2015, with aircraft sources and fuel handling responsible. Over the same five years, modeled nitrogen oxides have increased from 4077 kilograms per day to 4262, with aircraft sources again responsible.

Similarly, estimated carbon monoxide emissions have increased from 6738 kilograms per day in 2012 to 7243 in 2015, with aircraft responsible. Most important of the NAAQS pollutants, regulated PM10 and PM2.5 have increased from 67 kilograms per day in 2011 to 98 in 2015. However, much of this increase seems due to the model software upgrade from MOBILE 6.2.03 to MOVES 2014a.

Over the last decade, ultrafine particles (less than 100 nanometers in diameter) from transportation sources have become a major human health concern. Those residing within 100 meters of major roadways can expect to have 50% greater risk of adult cardiovascular and lung cancer mortality, and childhood asthma, than less exposed populations in the same communities.

Ultrafine particles are suspected to be a driver of the most serious small area health disparities. Aviation activities, including jets, are major emitters of ultrafine particles. I am attaching 2 of 14 peer reviewed journal papers on ultrafine particles that I have co-authored. The first shows a significant relationship between traffic related ultrafine particles and biomarkers of cardiovascular risk in Caucasians living near I93 in Somerville and Boston. The second shows the influence of Logan activities on ultrafine particle levels in neighborhoods kilometers away from Logan Airport.

MassPort has apparently collected ultrafine particle data in the past, and promised to publish it. To my knowledge, MassPort has never released their ultrafine particle data and analyses. Given the health risks known to be associated with population exposures to high emission transportation facilities, Massport should both publish and explain its ultrafine particle findings in the 2016 ESPR. 12-4

MassPort models and publishes Greenhouse Gas emission information using a 3000-foot altitude cut-off, including annual million metric tons of CO2 equivalent values for CO2, N2O and CH4. The 2015 total is .63, up from .56 in 2009. This is less than 1 % of Massachusetts total. There are two problems with this approach, and both contribute to a sever underestimation of the true impacts.

The first problem is that Black Carbon has a large climate impact and is emitted in large volumes from transportation equipment which burns Diesel or Jet A. Jet A has a composition and emission characteristics similar to diesel. In AR5, the most recent climate assessment, Black Carbon's impact is considered to be four times as great as in previous assessments, with low uncertainty.

The second problem is that emissions due to Logan flights, on land and up to 3000 feet, represent a relatively small percent of the total trip emissions of aviation that originates or ends at Logan. Some jets that have a flight start or end at Logan travel half way around the Earth. Many travel across oceans or the continental US. Most of Logan's climate impact, above 3000 feet, is ignored.

Between the complete omission of Black Carbon and the failure to consider the emissions of flights when they are at altitudes higher than 3000 feet, the climate impacts of Logan are seriously underestimated in the 2015 EDR. The Boston area includes scientists who understand and can help model real aviation climate impacts. The 2016 Logan ESPR should disclose those full impacts. 12-5

Logan International Airport is an important asset to the Boston region and to our economy. That benefit comes paired with significant environmental costs imposed on many people and the natural environment. It is critically important that MassPort more clearly recognize those impacts and work as collaboratively as possible with citizens to minimize and equitably share future burdens.

With Best Regards,

Wig Zamore

This Page Intentionally Left Blank.

Comment ID	Author	Topic	Comment	Response
12-1	Wig Zamore	Noise	US aviation has long used the Schultz curve, published in 1978 in JASA, and exposure to 65 DNL as the key metric of the number of airport neighbors severely impacted by noise. In 2010, Logan related noise of 65 DNL or more affected an estimated 3830 people. By 2015 that number had grown to 14,097. In the 2016 ESPR, Massport needs to show how it will mitigate this huge increase.	Massport has been and continues to be concerned about noise impacts to communities with high day-night average sound level (DNL) exposures. The annual reporting in the Environmental Data Report (EDR) provides 1990s, 2000s, and 2010-2016 data as available in each chapter. This includes data from 1998 (the year of peak operations at Logan Airport), which shows the progress made over the last few decades. The decrease in flights indicates a long-term reduction in noise impacts and relief to affected communities since 1998, along with the development of noise abatement turns, mitigation plans developed by Massport, and technical developments in the airline industry (e.g., quieter engines). Logan Airport has an active Residential Sound Insulation Program (RSIP). All of the additional residential area within the DNL 65 dB contour for 2015 is within the program area. Massport will continue to work with the Federal Aviation Administration (FAA) to soundproof eligible homes, which fall within the DNL 65 dB contour. As of 2015, FAA requires airports to use the Aviation Environmental Design Tool (AEDT) to establish eligibility. Massport has submitted the 2016 AEDT-modeled noise exposure map to FAA to determine future eligibility. Massport will continue to work with neighboring communities through the Massport Community Advisory Committee (CAC).
12-2	Wig Zamore	Noise	FAA and MassPort have signed an MOU to study precision-based navigation noise impacts, and potential mitigation, in communities affected by recent flight pattern changes. While the number of people highly annoyed is significant all the way down to aviation noise levels of 45 DNL, MassPort needs to most seriously consider its noise impacts in communities with much higher exposures.	Massport has been and continues to be concerned about noise impacts to communities with high DNL exposures. The changes associated with RNAV mainly affect more distant locations, since flight tracks were already concentrated in areas near the Airport, but are now more concentrated at greater distances as well. Massport will continue to work with FAA to soundproof eligible homes, which fall within the DNL 65 dB contour. As of 2015, FAA requires airports to use AEDT to establish eligibility. Massport has submitted the 2016 AEDT-modeled noise exposure map to FAA to determine future eligibility. Massport will continue to work with neighboring communities through the Massport CAC.
12-3	Wig Zamore	Noise	MassPort's 2016 ESPR should include a fine-grained, robust EJ focused noise analysis.	The intent of the EDRs and Environmental Status and Planning Reports (ESPRs) is to provide a review of environmental conditions for the reporting year compared to previous years. Chapter 6, *Noise Abatement* , provides data on the noise conditions at Logan Airport, Massport has sought to improve EDR distribution through Spanish translators at the EDR public meeting and by providing translated copies of the EDR Executive Summary. As individual projects go through the federal review process, they are assessed for their potential impacts to Environmental Justice communities. Massport is mindful of its neighbors and has prepared summaries of the EDR and other environmental documentation in Spanish, to provide information to the community.
12-4	Wig Zamore	Air Quality	To my knowledge, MassPort has never released their ultrafine particle data and analyses. Given the health risks known to be associated with population exposures to high emission transportation facilities, Massport should both publish and explain its ultrafine particle findings in the 2016 ESPR.	The EDR provides information on ultrafine particles (UFPs) in Chapter 7, *Air Quality/Emissions Reduction* . At this time, there are no state or federal air quality standards for outdoor levels of UFPs. Massport is actively tracking the research and regulatory status of this pollutant and will comply with future UFP standards if promulgated by the U.S. Environmental Protection Agency (EPA).

Comment ID	Author	Topic	Comment	Response
12-5	Wig Zamore	Air Quality/Emissions	Between the complete omission of Black Carbon and the failure to consider the emissions of flights when they are at altitudes higher than 3000 feet, the climate impacts of Logan are seriously underestimated in the 2015 EDR. The Boston area includes scientists who understand and can help model real aviation climate impacts. The 2016 Logan ESPR should disclose those full impacts.	Massport has added a section in Chapter 7, *Air Quality/Emissions Reduction* that discusses Black Carbon to address concerns voiced by the community. At this time, there are no state or federal air quality standards for black carbon. As more information in known about this pollutant and standards are released, Massport will begin tracking and compliance programs. Massport has committed to several initiatives to lower GHG emissions, increase sustainability through design and guidelines, and improve resiliency at Logan Airport. Massport publishes its Annual Sustainability Reports online: http://massport.com/massport/business/capital-improvements/sustainability/sustainability-management/. The EDR reports on air quality performance from activities that are under the operational control of Massport. Massport assesses greenhouse gas emissions consistent with the Airport Cooperative Research Program (ACRP) Report 11, *Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories;* per the guidebook, Massport claims and reports emissions from aircraft up to 3,000 feet in elevation.

C

Proposed Scope for the *2017 ESPR*

PROJECT NAME: Logan Airport 2017 Environmental Status and Planning Report (ESPR)

PROJECT LOCATION: Logan International Airport, East Boston, Massachusetts

EOEA NUMBER: 3247

PROJECT PROPONENT: Massachusetts Port Authority (Massport)

Massport respectfully submits this proposed scope for the *Logan Airport 2017 Environmental Status and Planning Report (ESPR)* for public review and comment. The *2017 ESPR* would follow the *2016 Environmental Data Report (EDR),* which was filed in May 2018. As directed by the Secretary of the Executive Office of Energy and Environmental Affairs (EEA), Massport will continue to use this process to evaluate the cumulative impacts associated with Logan Airport activities through preparation of an ESPR approximately every five years with data updates annually through the EDRs. The *2017 ESPR* will provide the most recent passenger and operations forecasts for Logan Airport and compare them to historic trends. Massport will continue to post the full EDR/ESPR documents on the Massport website (http://massport.com/massport/about-massport/project-environmental-filings/).

Purpose of the Logan Airport *2017 ESPR*

For over three decades, the Logan Airport EDRs and ESPRs have provided information to agencies and the public on planning activities, aircraft operations and passenger activity levels, and Massport initiatives at Logan Airport. The *2017 ESPR* will provide an update on conditions at Logan Airport for calendar year 2017. The ESPR will continue to serve as a background/context against which projects at Logan Airport can be evaluated. It will also report on the cumulative effects of Logan Airport operations and activities, compared to previous years as appropriate, and to the future forecast timeframe.

The EDR/ESPR process was developed to allow individual projects at Logan Airport to be considered and analyzed in the broader, Airport-wide context. The EDRs and ESPRs serve as the baseline analyses for project-specific environmental reviews and provide a forum for updates on Massport's mitigation program. As stated in the introduction to the *1999 ESPR*, "while the Logan ESPR and EDRs provide the broad planning context for projects proposed for Logan Airport and future planning concepts under consideration by Massport, no specific projects can be built solely on the basis of inclusion and discussion in the *1999 ESPR.*" By providing the Airport-wide context for air quality, noise, ground transportation, and water quality, the EDRs/ESPRs help focus the review processes for state Environmental Notification Forms (ENFs) and, if necessary, Environmental Impacts Reports (EIRs). In this manner, Massport ensures that segmented project review does not occur in the context of Massachusetts Environmental Policy Act (MEPA) review of projects at Logan Airport. The EDRs/ESPRs also provide context for federal National Environmental Policy Act (NEPA) reviews by the Federal Aviation Administration (FAA) serving as the lead federal agency. In short, the EDRs/ESPRs provide a planning context which complements the individual project-specific filings. As directed in the Secretary's Certificate on the Terminal E Modernization Project ENF, the EDRs/ESPRs will continue to be the forum to address cumulative, Airport-wide impacts.

Contents of the *2017 ESPR*

Generally, the *2017 ESPR* will follow the format of the *2011 ESPR*, presenting an overview of the role of Logan Airport in the regional planning context. The *2017 ESPR* will report on 2017 passenger and aircraft operation activity levels. This will be followed by a status report on Massport's proposed planning initiatives, projects, and mitigation. In this way, Massport will provide necessary background information to allow the reviewer to understand the environmental policies and planning which form the context of the environmental reporting, technical studies, and environmental mitigation initiatives at Logan Airport.

In addition, the ESPR will report on updated passenger and operations activity forecasts for Logan Airport and Massport's other airports, Hanscom Field and Worcester Regional Airport. An updated Logan Airport forecast will be developed using 2017 as the base year and projected activity forecasts forward to the future timeframe. In addition, the *2017 ESPR* will use the results of the *2016 Logan Airport Air Passenger Ground Access Survey*, the Long-term Parking Management Plan and recent trends of transportation network companies (TNCs[1]) now operating at Logan Airport to inform future ground access planning.

The technical studies in the *2017 ESPR* will include reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, water quality and environmental management, and project mitigation tracking. Sustainability initiatives are included throughout the document. Each chapter's contents are described below.

Chapter 1. Introduction/Executive Summary

This chapter of the *2017 ESPR* will include:

- Highlights of 2017 planning and environmental conditions;
- Overview of Logan Airport and its environmental, geographic, and regulatory context;
- Overview of the EDRs/ESPRs cycle;
- Highlights of passenger activity levels and aircraft operations;
- Description of the analysis framework for the environmental reporting and technical studies to be conducted;

1 Examples of Transportation Network Companies include Uber and Lyft.

- Overview of the Logan Airport planning initiatives and projects;
- Overview of sustainability and resiliency initiatives at Logan Airport; and
- Organization of the *2017 ESPR*.

A Spanish version of the Executive Summary for the *2017 ESPR* will be prepared and included in the document.

Chapter 2. Activity Levels

The primary purpose of this chapter will be to report on airport activity levels for 2017 and present future forecasts for projected passenger, aircraft operations and cargo tonnages. Items to be included for 2017 are:

- Aircraft operations, including fleet mix and scheduled airline services at Logan Airport;
- Domestic and international passenger activity levels;
- Cargo and mail volumes;
- Comparison of 2017 aircraft operations, cargo/mail operations, and passenger activity levels to 2016 activity levels; and
- Report on current national aviation trends and compare to trends at Logan Airport.

This chapter will also report on Massport's most recent forecasts for Logan Airport that become the basis for the planning and impact sections that follow and for Massport's planning initiatives over the next few years. Future year analyses will be based on the updated forecast. This chapter will provide a discussion of analysis methodologies and assumptions, including anticipated fleet mix changes and other trends in the aviation industry. The section will report on the following:

- Comparison of 2017 operations to historic trends and forecasts for the future planning horizon;
- Updated forecasts of Logan Airport's passenger volume, aircraft operations, and fleet mix; and
- Comparison of forecast activity levels to historic trends, prior Logan Airport forecasts, and FAA forecasts for Logan Airport and the U.S. industry.

Chapter 3. Airport Planning

Massport continues to assess planning strategies for improving Logan Airport's operations and services in a safe, secure, more efficient, and environmentally sensitive manner. As owner and operator of Logan Airport, Massport also must accommodate and guide tenant development. This chapter will describe the status of planning initiatives for the following areas:

- Terminal Area;
- Airside Area;
- Service and Cargo Areas;

- Roadways and Airport Parking; and
- Airport Buffers and Landscaping.

Massport plans for the ongoing improvement of Logan Airport facilities as well as enhancing access to and from the Airport. The chapter will report on the status of projects implemented within the boundaries of Logan Airport either by Massport, its tenants, or other state entities. The chapter will also report on the status and effectiveness of the ground access related changes including roadway and parking projects, which consolidate and direct airport-related traffic to centralized locations and minimize airport-related traffic on external streets in adjacent neighborhoods.

Chapter 4. Regional Transportation

The *2017 ESPR* will describe Logan Airport's role in the region's intermodal transportation system by reporting on the following:

Regional Airports

- 2017 regional airport operations, passenger activity levels, and schedule data within an historical context;
- Status of plans and new improvements as provided by the regional airport entities;
- Ground access improvements to the regional airports; and
- The role that Worcester Regional Airport and Hanscom Field play in the regional aviation system and Massport's efforts to promote these airports. As available, Massport will include future forecasts for Worcester Regional Airport and Hanscom Field.

Regional Transportation System

- Massport's role in managing regional aviation facilities;
- Massport's cooperation with other transportation agencies to promote efficient regional highway and transit operations; and
- Report on metropolitan and regional rail initiatives and ridership.

Chapter 5. Ground Access to and from Logan Airport

The chapter will report on 2017 conditions and provide a comparison to those of 2016 for the following:

- Logan Airport Parking Freeze and Amendment;
- Trends of TNCs, such as Uber and Lyft, and their operations at Logan Airport;
- Logan Airport gateway volumes;
- Parking demand and management (including rates and duration statistics);

- High occupancy vehicle (HOV) ridership (including Blue Line, Silver Line, Scheduled, Unscheduled, Water Transportation, and Logan Express);
- Status of proposed ground access planning and the connection to the Airport Station associated with the planned Terminal E Modernization Project, anticipated Massachusetts Bay Transportation Authority (MBTA) ridership, and possible changes in HOV mode share;
- Status of long-range ground access management strategy planning;
- On-Airport traffic volumes/vehicle miles traveled (VMT); and
- Logan Airport Employee Transportation Management Association (Logan Airport TMA) services.

This chapter will also report on future year conditions for the future timeframe for the following ground transportation indicators:

- Traffic volumes;
- On-Airport VMT; and
- Parking demand.

This chapter will also present a discussion of the following topics:

- Impact of TNCs on Logan Airport landside operations;
- Update on parking conditions;
- Massport's cooperation with other transportation agencies to increase transit ridership to and from Logan Airport via the Blue Line and Silver Line;
- Report on Logan Express usage and efforts to increase capacity and usage;
- Report on water transportation to and from Logan Airport; and
- Report on results of ongoing ground access studies, as relevant.

Chapter 6. Noise Abatement

This chapter will provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, and the updates in noise modeling. Massport will use the FAA's Aviation Environmental Design Tool (AEDT) to model 2017 and future noise conditions.

The chapter will report on 2017 conditions and compare those conditions to those of 2016 for the following:

- Fleet Mix, including Stage II, Recertified (Hushkitted) Stage III, newly manufactured Stage III, and qualifying Stage IV aircraft;
- Nighttime operations;

- Runway utilization (report on aircraft and airline adherence with runway utilization goals); and
- Flight tracks.

This chapter will report on the following:

- Changes in annual noise contours and noise-impacted population;
- Measured versus modeled noise values, including reasons for differences and any improvements attributable to the models deployed;
- Cumulative Noise Index (CNI);
- Times-Above for 65, 75, and 85 dBA threshold values/Dwell and Persistence of noise levels; and
- Flight track monitoring noise reports.

This chapter will present a discussion of analysis methodologies and assumptions, including forecast fleet mix and runway use assumptions, and report on future year conditions for the future timeframe for the following noise indicators:

- Runway utilization;
- Day-Night Average Sound Level (DNL) noise contours; and
- Population counts.

The chapter will also report on noise abatement efforts, results from Boston-Logan Airport Noise Study (BLANS), and provide a status update on the noise and operations monitoring system. The chapter will report on the status of the RNAV Pilot Project, which will analyze the feasibility of changes to some of RNAV approaches and departures from Logan Airport.

Chapter 7. Air Quality/Emissions Reductions

This chapter will begin with an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, and the changes in air quality modeling. The chapter will provide discussion on progress on the national and international levels to decrease air emissions. The chapter will also discuss analysis methodologies and assumptions and report on 2017 conditions using the FAA's AEDT model. The Environmental Protection Agency (EPA) required motor vehicle emissions modeling tool (Motor Vehicle Emission Simulator (MOVES[2]) will continue to be used to assess vehicular emission on airport roadways. The chapter will include:

- Emissions inventory for carbon monoxide (CO);

2 MOVES replaces the previous model for deriving on-road mobile source emissions, MOBILE6.2; the Massachusetts Department of Environmental Protection (MassDEP) directed that MOVES should be used for the EDR analysis for consistency with the State Implementation Plan (SIP) and MassDEP's methodologies.

- Emissions inventory for oxides of nitrogen (NO_x);
- Emissions inventory for volatile organic compounds (VOCs);
- Emissions inventory for particulate matter (PM); and
- NO_x emissions by airline.

This chapter will also report on the following ongoing air quality efforts for 2017:

- Massport's and tenant's alternative fuel vehicle programs; and
- The status of Logan Airport air quality studies undertaken by Massport or others, as available.

This chapter will include Massport's voluntary inventory of greenhouse gas (GHG) emissions from Logan Airport in 2017. GHG emissions will be quantified for aircraft, ground service equipment (GSE), motor vehicles and stationary sources using emission factors and methodologies outlined in EEA's *Greenhouse Gas Emissions Policy and Protocol*, and the Transportation Research Board's *Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories* (Airport Cooperative Research Program (ACRP) Report 11, Project 02-06). The results of the 2017 GHG emissions inventory will be compared to the 2016 results.

In collaboration with EEA and the Massachusetts Department of Energy Resources (DOER), the *2016 EDR* introduced several new GHG metrics in an effort to more clearly document the effectiveness of the various Massport emission reduction initiatives. These include GHG emissions per passenger, building energy use intensity and building GHG emissions. The *2017 ESPR* will update the 2016 information and discuss changes, where appropriate.

This chapter will present a discussion of analysis methodologies and assumptions and report on future year condition for the future timeframe for the following air quality indicators:

- Emissions inventory for CO;
- Emissions inventory for NO_x;
- Emissions inventory for VOCs;
- Emissions inventory for PM; and
- Emissions Inventory for GHGs.

This chapter will also include an update on Massport's efforts to encourage the use of single engine taxiing under safe conditions. This chapter will also provide an update on the feasibility of combined heat and power (CHP) use for Terminal E and updates to progress made in designing the energy systems for the facility. The *2017 ESPR,* like the *2016 EDR,* will report on the research and regulatory status of Ultrafine Particles (UFPs) and Black Carbon.

Chapter 8. Water Quality/Environmental Compliance and Management

This chapter will report on the 2017 status of:

- National Pollutant Discharge Elimination System (NPDES) Permit and monitoring results for Logan Airport's outfalls and the Fire Training Facility;
- Jet fuel usage and spills;
- Massachusetts Contingency Plan (MCP) activities;
- Tank management;
- Update on the environmental management plan; and
- Fuel spill prevention.

The chapter will also present a discussion of the following topics:

- Future stormwater management improvements (if any); and
- Future MCP and tank management activities.

Chapter 9. Project Mitigation Tracking

This chapter will report on the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have undergone MEPA review and other commitments and have commenced construction. The status of mitigation commitments made in the Section 61 Findings for the following projects will be reported:

- West Garage/Central Garage (EOEA 9790);
- International Gateway (EOEA 9791);
- Logan Airside Improvements Planning Project (EOEA 10458);
- Terminal A Replacement Project (EOEA 12096);
- Southwest Service Area Redevelopment Program/Rental Car Center (EOEA 14137);
- Logan Runway Safety Area Improvements Project (EOEA 14442); and
- Terminal E Modernization Project (EEA 15434).

This chapter will update the status of Massport's mitigation commitments, and also identify projects for which mitigation is complete.

Appendices

MEPA Documentation

These appendices will include a copy of the Secretary's Certificate and comment letters received on the *2016 EDR*. Individual responses to items raised in the Secretary's Certificate on the *2016 EDR* and comments in reviewers' letters will be provided. A distribution list for the *2017 ESPR* (indicating those receiving documents or CDs) will be provided. The document will also contain copies of any MEPA Certificates or documentation issued for projects at Logan Airport that refer to the EDR/ESPR documentation.

Supporting Technical Documentation

Supporting technical appendices will be provided as necessary.

This Page Intentionally Left Blank.

D

Distribution

This *2016 Environmental Data Report (EDR)* has been distributed to federal, state, and city agencies and to parties listed in this appendix. The list includes those entities that the Massachusetts Environmental Policy Act (MEPA) requires as part of the review of the document, representatives of governmental agencies, commenters on the *2015 EDR*, and community groups concerned with Airport activities. **The 'N' indicates that Massport sent a Notice of Availability and the 'P' indicates that Massport sent a printed copy.**

The *2016 EDR* is also available on Massport's website at www.massport.com. Limited copies of the *2016 EDR* may be requested from Michael Gove, Massport, Logan Office Center, One Harborside Drive, Suite 200S, East Boston, MA 02128, telephone (617) 568-3546, email: mgove@massport.com. Printed copies of this report are available for review at the following public libraries:

	Library	Address		Library	Address
P	Boston Public Library Main Branch	700 Boylston Street Boston, MA 02116	P	Boston Public Library Charlestown Branch	179 Main Street Charlestown, MA 02129
P	Boston Public Library Connolly Branch	433 Centre Street Jamaica Plain, MA 02130	P	Boston Public Library East Boston Branch	365 Bremen Street East Boston, MA 02128
P	Bedford Public Library	7 Mudge Way Bedford, MA 01730	P	Boston Public Library South Boston Branch	646 East Broadway South Boston, MA 02127
P	Chelsea Public Library	569 Broadway Chelsea, MA 02150	P	Cary Memorial Library	1874 Massachusetts Ave. Lexington, MA 02420
P	Lincoln Public Library	3 Bedford Road Lincoln, MA 01773	P	Concord Public Library	129 Main Street Concord, MA 01742
P	Quincy Public Library Thomas Crane Branch	40 Washington Street Quincy, MA 02169	P	Milton Public Library Main Branch	476 Canton Avenue Milton, MA 02186
P	Winthrop Public Library	2 Metcalf Square Winthrop, MA 02151	P	Revere Public Library	179 Beach Street Revere, MA 02151
P	Medford Public Library	111 High Street Medford, MA 02155	P	State Transportation Library	10 Park Plaza, Suite 4160 Boston, MA 02116
P	Somerville Public Library	79 Highland Avenue Somerville, MA 02143	P	Everett Public Library	410 Broadway Everett, MA 02149
P	Cambridge Main Library	449 Broadway Cambridge, MA 02138			

Some parties listed below have been provided a hard copy of the document along with a CD of the complete document. A second group of parties have been provided with a CD only.

Commenters on the *2015 EDR*

N	Cindy L Christiansen, PhD. 59 Collamore Street Milton, MA 02186	N	Kathleen M. Conlon, Chair Milton Board of Selectmen 42 Reedsdale Road Milton, MA 02186	N	David T. Burnes, Secretary Milton Board of Selectmen 24 Garfield Road Milton, MA 02186
N	J. Thomas Hurley 714 Blue Hill Avenue Milton, MA 02186	N	Jill Valdes Horwood Boston Harbor Now 15 State Street, Suite 1100 Boston, MA 02109	N	Aaron M. Toffler, Esq. Airport Impact Relief, Inc. 34 Kimball Street Needham, MA 02492
N	Stephen H. Kaiser, PhD. 191 Hamilton Street Cambridge, MA 02139	N	Nancy S. Timmerman, P.E. Consultant in Acoustics and Noise Control 25 Upton Street Boston, MA 02118	N	Brian Palmucci Ward Four Councilor - City of Quincy 1305 Hancock Street Quincy, MA 02169
N	Chris Marchi 161 Saratoga Street East Boston, MA 02128	N	James Roberts 59 Magazine Street Cambridge, MA 02139	N	James Linthwaite 155 Cowper Street East Boston, MA 02128
N	Darryl Pomicter 136 Myrtle Street Boston, MA 02114	N	Wig Zamore 13 Highland Avenue, #3 Somerville, MA 02143		

Federal Government

- **United States Senators and Representatives**

P	The Honorable Niki S. Tsongas U.S. House of Representatives 126 John Street, Suite 12 Lowell, MA 01852	P	The Honorable Michael E. Capuano U.S. House of Representatives 110 First Street Cambridge, MA 02141	P	The Honorable Katherine Clark U.S. Representatives 701 Concord Avenue, Suite 101 Cambridge, MA 02138
P	The Honorable Richard E. Neal U.S. House of Representatives 300 State Street, Suite 200 Springfield MA, 01105	P	The Honorable Seth Moulton U.S. House of Representatives 21 Front Street Salem, MA 01970	P	The Honorable William R. Keating U.S. House of Representatives Two Court Street Plymouth, MA 02360
P	The Honorable Joseph P. Kennedy III U.S. House of Representatives 29 Crafts Street, Suite 375 Newton, MA 02458	P	The Honorable Stephen F. Lynch U.S. House of Representatives One Harbor Street, Suite 304 Boston, MA 02210	P	The Honorable James P. McGovern U.S. House of Representatives 12 East Worcester Street, Suite 1 Worcester, MA 010604
P	The Honorable Elizabeth Warren 2400 JFK Federal Building 15 New Sudbury Street Boston, MA 02203	P	The Honorable Edward J. Markey JFK Federal Building, Suite 975 15 New Sudbury Street Boston, MA 02203		

- **Environmental Protection Agency**

P Susan Studlien, Director Office of Environmental Stewardship U.S. Environmental Protection Agency - New England Region 5 Post Office Square – Suite 100 Boston, MA 02109	P Lucy Edmondson Chief of Operations U.S. Environmental Protection Agency - New England Region 5 Post Office Square – Suite 100 Mail Code OEP 06-5 Boston, MA 02109-3912	P Tim Timmerman U.S. Environmental Protection Agency - New England Region 5 Post Office Square – Suite 100 Mail Code ORA 17-1 Boston, MA 02109-3912

- **Federal Aviation Administration**

P Kerry B. Long New England Regional Administrator Department of Transportation FAA - New England Region 12 New England Executive Park, Box 510 Burlington, MA 01803	P Andrew Hale Tower Manager Department of Transportation Federal Aviation Administration Logan International Airport 600 Control Tower, 19th Floor East Boston, MA 02128	P Gail Latrell Department of Transportation FAA - New England Region Airports Division 12 New England Executive Park, Box 510 Burlington, MA 01803
P Ralph Nicosia-Rusin, Planner Department of Transportation FAA - New England Region, Airports Division 12 New England Executive Park, Box 510 Burlington, MA 01803	P Richard Doucette Manager, Environmental Programs Department of Transportation FAA - New England Region, Airports Division 12 New England Executive Park, Box 510 Burlington, MA 01803	

- **United States Army Corps of Engineers**

P Colonel Christopher Barron
Commander and District Engineer
U.S. Army Corps of Engineers
New England District
696 Virginia Road
Concord, MA 01742-2751

- **United States Fish and Wildlife Service**

P Wendi Weber Northeast Regional Director U.S. Fish and Wildlife Service Department of the Interior 300 Westgate Center Drive Hadley, MA 01035-9589	P NE Field Office U.S. Fish and Wildlife Service Department of the Interior 70 Commercial St., Suite 300 Concord, NH 03301-5087

State Government

- **Senate/House of Representatives**

P Senate President Harriette L. Chandler Massachusetts State House 24 Beacon Street, Room 332 Boston, MA 02133	P Representative Adrian Madaro Massachusetts State House, 24 Beacon Street, Room 473B Boston, MA 02133	P Senator Sal DiDomenico Massachusetts State House 24 Beacon Street, Room 208 Boston, MA 02133

■ **Senate/House of Representatives Continued**		
P Joint Committee on Transportation Chair, Senator Joseph Boncore Massachusetts State House 24 Beacon Street, Room 112 Boston, MA 02133	P Speaker of the House, Representative Robert DeLeo Massachusetts State House 24 Beacon Street, Room 356 Boston, MA 02133	P Representative RoseLee Vincent Massachusetts State House 24 Beacon Street, Room 473F Boston, MA 02133
P Representative Daniel Ryan Massachusetts State House, 24 Beacon Street, Room 33 Boston, MA 02133	P Representative William Straus Chair, Joint Committee on Transportation Massachusetts State House 24 Beacon Street, Room 134 Boston, MA 02133	P Senator Nick Collins Massachusetts State House 24 Beacon Street, Room 39 Boston, MA 02133
■ **Executive Office of Energy and Environmental Affairs**		
P Secretary Matthew Beaton Executive Office of Energy and Environmental Affairs 100 Cambridge Street, Suite 900 Boston, MA 02114	P Deirdre Buckley, Director Executive Office of Energy and Environmental Affairs 100 Cambridge Street, Suite 900 Boston, MA 02114	P Anne Canaday Environmental Analyst Executive Office of Energy and Environmental Affairs 100 Cambridge Street, Suite 900 Boston, MA 02114
■ **Department of Environmental Protection**		
N Commissioner Martin Suuberg Department of Environmental Protection One Winter Street Boston, MA 02108	N MEPA Coordinator MassDEP - Northeast Regional Office 205B Lowell Street Wilmington, MA 01887	N Rachel Freed Section Chief, Wetlands and Waterways MassDEP – Northeast Regional Office 205B Lowell Street Wilmington, MA 01887
N Christine Kirby Director, Air and Climate Division Department of Environmental Protection One Winter Street, 9th Floor Boston, MA 02108	N Jerome Grafe Water Resources, Northeast Region Department of Environmental Protection One Winter Street, 10th Floor Boston, MA 02108	
■ **Department of Public Health**		
N Monica Bharel, MD, MPH Commissioner, Department of Public Health Department of Public health 250 Washington Street Boston, MA 02108	N Margaret Round Environmental Analyst Center for Environmental Health 250 Washington Street, 7th Floor Boston, MA 02108	

- **Department of Conservation and Recreation**

N Commissioner Leo Roy
Department of Conservation and Recreation
251 Causeway Street, Suite 600
Boston, MA 02114

■ Department of Fisheries, Wildlife and Environmental Law Enforcement	**■ Department of Housing and Community Development**	**■ Massachusetts Water Resources Authority**
N Environmental Reviewer Mass Wildlife Field Headquarters 1 Rabbit Hill Road Westborough, MA 01581	N Chrystal Kornegay Undersecretary, Department of Housing and Community Development 100 Cambridge Street #330 Boston, MA 02114	N Frederick A. Laskey Executive Director, Massachusetts Water Resources Authority Charlestown Navy Yard 100 First Avenue Charlestown, MA 02129
■ Coastal Zone Management	**■ Central Transportation Planning Staff**	**■ Metropolitan Area Planning Council**
N Bruce K. Carlisle, Director Office of Coastal Zone Management 251 Causeway Street, Suite 800 Boston, MA 02114	N Robin Mannion Deputy Executive Director Central Transportation Planning Staff 10 Park Plaza, Room 2150 Boston, MA 02116	N Marc Draisen, Deputy Executive Director Metropolitan Area Planning Council 60 Temple Place, 6th Floor Boston, MA 02111
■ Massachusetts Department of Transportation (MassDOT)		
N Stephanie Pollack Secretary of Transportation, CEO MassDOT 10 Park Plaza, Suite 3170 Boston, MA 02116	N Brian Shortsleeve Chief Administrator, MassDOT 10 Park Plaza, Suite 3910 Boston, MA 02116	N Jonathan Gulliver Administrator, Highway Division MassDOT 10 Park Plaza, Suite 3510 Boston, MA 02116
N Jeffrey DeCarlo Administrator, Aeronautics Division MassDOT Logan Office Center One Harborside Drive, Suite 205N East Boston, MA 02128-2909	N David Mohler Executive Director, Office of Transportation Planning MassDOT 10 Park Plaza, Suite 4150 Boston, MA 02116	N Andrew Brennan Director of Environmental Affairs MBTA 10 Park Plaza, Suite 6720 Boston, MA 02116
N Rick McCullough Director of Environmental Engineering, MassDOT 185 Kneeland Street, 9th floor Boston, MA 02111	N Director of Environmental Services, Highway Division MassDOT 10 Park Plaza, Suite 4260 Boston, MA 02116	
■ Massachusetts Historical Commission	**■ Massachusetts Executive Office of Health and Human Services**	**■ Massachusetts Department of Public Safety**
N William Francis Galvin Secretary of the Commonwealth 220 Morrissey Boulevard Boston, MA 02125	N Secretary Marylou Sudders, Executive Office of Health and Human Services One Ashburton Place, 11th Floor Boston, MA 02108	N Secretary Daniel Bennett Department of Public Safety One Ashburton Place, Room 1301 Boston, MA 02108

■ **Natural Heritage and Endangered Species Program**		
N Lauren Glorioso Administrative Coordinator Natural Heritage and Endangered Species Program 1 Rabbit Hill Road Westboro, MA 01581		
■ **Massachusetts Port Authority Board of Directors**		
N Stephanie Pollack Massport Board of Directors Massachusetts Port Authority One Harborside Drive East Boston, MA 02128-2909	N Laura Sen Massport Board of Directors Massachusetts Port Authority One Harborside Drive East Boston, MA 02128-2909	N L. Duane Jackson, Vice Chair Massport Board of Directors Massachusetts Port Authority One Harborside Drive East Boston, MA 02128-2909
N John Nucci Massport Board of Directors Massachusetts Port Authority One Harborside Drive East Boston, MA 02128-2909	N Sean M. O'Brien Massport Board of Directors Massachusetts Port Authority One Harborside Drive East Boston, MA 02128-2909	N Patricia Jacobs Massport Board of Directors Massachusetts Port Authority One Harborside Drive East Boston, MA 02128-2909
N Lewis G. Evangelidis, Chair Massport Board of Directors Massachusetts Port Authority One Harborside Drive East Boston, MA 02128-2909		
Municipalities		
■ **City of Boston**		
■ ***Office of the Mayor***	■ ***Boston Transportation Department***	■ ***Boston Planning & Development Agency***
P Martin J. Walsh, Mayor City of Boston One City Hall Square Boston, MA 02201	P Gina Fiandaca, Commissioner Boston Transportation Department One City Hall Plaza, Room 721 Boston, MA 02201	P Brian Golden, Director Boston Planning & Development Agency One City Hall Square, Room 959 Boston, MA 02201
■ ***Boston Parks and Recreation Department***	■ ***City Clerk's Office***	■ ***Boston Public Health Commission***
P Chris Cook, Commissioner Parks and Recreation Department 1010 Massachusetts Avenue, 3rd Floor Boston, MA 02118	P Maureen Feeney City Clerk One City Hall Square Boston, MA 02201	P Monica Valdez Lupi, JD, MPH Executive Director Boston Public Health Commission 1010 Massachusetts Avenue Boston, MA 02118
■ ***Office of Environment, Energy, and Open Space***		
P Austin Blackmon Office of Environment, Energy, and Open Space City Hall, Room 709 Boston, MA 02201		

■ ***Boston Environment Department***		
P Carl Spector, Commissioner Environment Department One City Hall Plaza, Room 709 Boston, MA 02201	P Alison Brizius, Director Environment Department One City Hall Plaza, Room 709 Boston, MA 02201	P Maura Zlody Environment Department One City Hall Plaza, Room 709 Boston, MA 02201
■ ***Boston Water and Sewer Commission***		
N John Sullivan, Chief Engineer Boston Water and Sewer Commission 980 Harrison Avenue Boston, MA 02119	N Adam Horst Project Director Boston Water and Sewer Commission 980 Harrison Avenue Boston, MA 02119	N Charlie Jewell Director of Planning Boston Water and Sewer Commission 980 Harrison Avenue Boston, MA 02119
■ ***Boston City Council***		
N Michelle Wu, Councilor-At-Large Boston City Council Boston City Hall Boston, MA 02201	N Lydia Edwards, Councilor, District 1 Boston City Hall Boston, MA 02201	N Frank Baker, Councilor, District 3 Boston City Hall Boston, MA 02201
N Andrea Campbell, President District 4 Boston City Hall Boston, MA 02201	N Timothy McCarthy, Councilor, District 5 Boston City Hall Boston, MA 02201	N Matt O’Malley, Councilor, District 6 Boston City Hall Boston, MA 02201
N Kim Janey, Councilor, District 7 Boston City Hall Boston, MA 02201	N Josh Zakim, Councilor, District 8 Boston City Hall Boston, MA 02201	N Mark Ciommo, Councilor, District 9 Boston City Hall Boston, MA 02201
N Michael Flaherty, Councilor-At- Large Boston City Hall Boston, MA 02201	N Ayanna Pressley Councilor-At-Large Boston City Hall Boston, MA 02201	N Annissa Essaibi, Councilor-At-Large Boston City Hall Boston, MA 02201
N Ed Flynn, Councilor, District 2 Boston City Hall Boston, MA 02201		
■ **Town of Milton**		
N Milton Board of Selectmen Town Hall 525 Canton Avenue Milton, MA 02186	N Michael Dennehy Town Administrator Milton Town Hall 525 Canton Avenue Milton, MA 02186	
■ **City of Chelsea**		
N Thomas G. Ambrosino, City Manager Chelsea City Hall 500 Broadway Chelsea, MA 02150	N Jeannette Cintron White, City Clerk Chelsea City Hall 500 Broadway Chelsea, MA 02150	N Leo Robinson President, Councilor-At-Large Chelsea City Hall 500 Broadway Chelsea, MA 02150
N Stephen Sarikas Chelsea Conservation Commission Chelsea City Hall 500 Broadway Chelsea, MA 02150	N Luis Prado, MSPIH, Director Board of Health & Human Services Chelsea City hall 500 Broadway Chelsea, MA 02150	N John DePriest Director of Planning & Development City of Chelsea 500 Broadway, Room 101 Chelsea, MA 02150

■ **City of Quincy Continued**		
N Thomas Koch, Mayor Quincy City Hall 1305 Hancock Street Quincy, MA 02169	N Kirsten L. Hughes, President, City Council Quincy City Hall 1305 Hancock Street Quincy, MA 02169	N Nicole L. Crispo, City Clerk Quincy City Hall 1305 Hancock Street Quincy, MA 02169
■ **City of Revere**		
N Brian Arrigo, Mayor Revere City Hall 281 Broadway Revere, MA 02151	N Ashley Melnik, City Clerk Revere City Hall 281 Broadway Revere, MA 02151	
■ **Town of Winthrop**		
N Town Manager Winthrop Town Hall One Metcalf Square Winthrop, MA 02152	N David Stasio, Chairman Winthrop Planning Board Winthrop Town Hall One Metcalf Square Winthrop, MA 02152	N Anthony Majahad, Chairman Air Pollution, Noise and Airport Hazards Committee One Metcalf Square Winthrop, MA 02152
N Mary Kelley Chair, Conservation Commission Winthrop Public Facilities Building 100 Kennedy Drive Winthrop, MA 02152	N Russell C. Sanford Council President Winthrop Town Hall One Metcalf Square Winthrop, MA 02152	N Phillip Boncore, Esq. Vice President, Councilor-At-Large Winthrop Town Hall One Metcalf Square Winthrop, MA 02152
N Richard Boyajian, Councilor-At-Large Winthrop Town Hall One Metcalf Square Winthrop, MA 02152	N Paul Varone Councilor, Precinct 1 Winthrop Town Hall One Metcalf Square Winthrop, MA 02152	N James Letterie, Councilor, Precinct 2 Winthrop Town Hall One Metcalf Square Winthrop, MA 02152
N Nicholas DelVento Councilor, Precinct 3 Winthrop Town Hall One Metcalf Square Winthrop, MA 02152	N Heather Engman Councilor, Precinct 4 Winthrop Town Hall One Metcalf Square Winthrop, MA 02152	N Peter Christopher Interim Councilor, Precinct 5 Winthrop Town Hall One Metcalf Square Winthrop, MA 02152
N Linda Calla Councilor, Precinct 6 Winthrop Town Hall One Metcalf Square Winthrop, MA 02152	N Richard Bangs Airport Hazards Committee One Metcalf Square Winthrop, MA 02152	
■ **Town of Bedford**		
N Margot R. Fleischman, Chair Board of Selectmen Town of Bedford 10 Mudge Way Bedford, MA 01730	N Richard T. Reed, Town Manager Town of Bedford 10 Mudge Way Bedford, MA 01730	

Town of Lexington		
N Suzanne E. Barry Chair, Board of Selectmen & Hanscom Area Towns Committee Chair Lexington Town Hall 1625 Massachusetts Avenue Lexington, MA 02173	N Carl F. Valente Town Manager Lexington Town Hall 1625 Massachusetts Avenue Lexington, MA 02173	N Hanscom Field Advisory Committee Representative Town of Lexington 1625 Massachusetts Avenue Lexington, MA 02173
Town of Concord		
N Jane Hotchkiss Chair, Board of Selectman PO Box 535 Concord, MA 01742	N Christopher Whelan Town Manager Town of Concord PO Box 535 Concord, MA 01742	N Hanscom Field Advisory Committee Representative Town of Concord PO Box 535 Concord, MA 01742
Town of Lincoln		
N Timothy S. Higgins Town Administrator Lincoln Town Office 16 Lincoln Road Lincoln, MA 01773	N James Craig Chair, Board of Selectmen Lincoln Town Office 16 Lincoln Road Lincoln, MA 01773	
City of Everett		
N Carlo DeMaria, Mayor Everett City Hall 484 Broadway Everett, MA 02149	N Michael O'Connor Chair, Planning Board Everett City Hall 484 Broadway Everett, MA 02149	N Marzie Galazka Deputy Director, Planning & Development Everett City Hall 484 Broadway, Room 25 Everett, MA 02149
N Stephanie M. Burke, Mayor Medford City Hall 85 George Hassett Drive, Rm 202 Medford, MA 02155	N John DePriest, Chair Community Development Board Medford City Hall 85 George Hassett Drive Medford, MA 02155	N Lauren DiLorenzo Director, Office of Community Development 85 George Hassett Drive, Rm 308 Medford, MA 02155
Community Groups and Interested Parties		
Massport Community Advisory Committee (CAC)		
N David Carlon, Chair P.O. Box 470614 Brookline, MA 02447		
Charlestown Community		
N Tom Cunha, Chairman Charlestown Neighborhood Council 427 Bunker Hill Street Charlestown, MA 02129	N Peggy Bradley, First Vice Chairman Charlestown Neighborhood Council 23 Ferrin Street Charlestown, MA 02129	
Chelsea Community		
N Reverend Dr. Sandra G. Whitley President Chelsea Rotary PO Box 505647 Chelsea, MA 02150-5647	N Rosalba Medina, President Chelsea Collaborative 318 Broadway Chelsea, MA 02150	

Chelsea Community Continued		
N Sergio Jaramillo, President Chelsea Chamber of Commerce 308 Broadway Chelsea, MA 02150	N Rod Hobson 31 Deep Run Cohasset, MA 02025	
Jamaica Plain Community		
N Nancy Brooks and Maura Meagher 92 Bourne St Jamaica Plain, MA 02130	N Marvin Kabakott 98 Bourne St Jamaica Plain, MA 02130	N Martha Merson 19 Roseway St Jamaica Plain, MA 02130
N Susan Morony 33 Bournedale Rd Jamaica Plain, MA 02130		
East Boston Community		
N Commodore Jeffries Yacht Club 565 Sumner Street East Boston, MA 02128	N Rita Sorrento, Chair East Boston Neighborhood Health Center 10 Gove Street East Boston, MA 02128	N John Kelly, Executive Director East Boston Social Centers 68 Central Sq. East Boston, MA 02128
N Matt Barison Harborview Community Association 124 Coleridge Street East Boston, MA 02128	N Mary Berninger, Piers PAC 156 St. Andrew Road East Boston, MA 02128	N Mary Cole Jefferies Point Neighborhood Association 257 Webster Street East Boston, MA 02128
N Gloribell Mota, NUBE 19 Meridian Street, #4 East Boston, MA 02128	N Joseph Ruggiero Orient Heights Neighborhood Association 1225 Bennington Street East Boston, MA 02128	N Debra Cave Eagle Hill Association 106 White Street East Boston, MA 02128
N Mary Ellen Welch 225 Webster Street East Boston, MA 02128	N Bernadette Cantalupo 156 Porter Street East Boston, MA 02128	N Patricia D'Amore 95 Webster Street East Boston, MA 02128
N Gail Miller, President AIR Inc. 232 Orient Avenue East Boston, MA 02128	N Christopher Marchi AIR Inc. 161 Saratoga Street East Boston, MA 02128	N Thomas DePaulo 1st Vice President East Boston Chamber of Commerce 175 McClellan Highway, Suite 1 East Boston, MA 02128
N Karen Maddalena 4 Lamson Street East Boston, MA 02128	N Jack Scalione Gove Street Neighborhood Association 76 Frankfort Street East Boston, MA 02128	N Jesse Purvis 551 Summer Street #2 East Boston, MA 02128

East Boston Community Continued		
N Fran Riley 193 Trenton Street East Boston, MA 02128		
South Boston Community		
N Joanne McDevitt City Point Neighborhood Association 787 East Broadway South Boston, MA 02127	N John Allison Mayor's Office of Neighborhood Services 1 City Hall Plaza Boston, MA 02201	N Lucky Devlin 718 East Second Street South Boston, MA 02127
N Mr. William Spain President Castle Island Association PO Box 342 South Boston, MA 02127	N Seaport Alliance for a Neighborhood Design 300 Summer Street Boston, MA 02210	N Joe Rogers Fort Point Neighborhood Association 21 Wormwood Street South Boston, MA 02127
N Ellie Kasper St. Vincent's Neighborhood Association 125 West Third Street South Boston, MA 02127		
Winthrop Community		
N Dr. Paul McGee Winthrop Chamber of Commerce 52 Crest Avenue Winthrop, MA 02152	N Betsy Shane Executive Director Winthrop Chamber of Commerce 207 Hagman Road Winthrop, MA 02152	N Daniela Foley, President Friends of Belle Isle Marsh P.O. Box 575 East Boston, MA 02128
N Robert Pulsifer 1050 Shirley Street Winthrop, MA 02152	N Ann Vasquez, Vice President Winthrop Chamber of Commerce 12 Revere Street Winthrop, MA 02152	N John Vitagliano 19 Seymour Street Winthrop, MA 02152
Other Communities		
N Philip Johenning 23 Parkwood Drive Milton, MA 02186	N Daniel McCormack R. S., C.H.O. Director of Public Health Weymouth Town Hall 75 Middle Street Weymouth, MA 02189	N Kristen O'Brien 45 Badger Circle Milton, MA 02186
Organizations and Other Interested Parties		
N Philip Johenning 23 Parkwood Drive Milton, MA 02186	N Daniel McCormack R. S., C.H.O. Director of Public Health Weymouth Town Hall 75 Middle Street Weymouth, MA 02189	N Kristen O'Brien 45 Badger Circle Milton, MA 02186

■ **Organizations and Other Interested Parties (Continued)**

N	John E. Drew President, Drew Company, Inc. 2 Seaport Lane, Floor 9 Boston, MA 02210	N	Jim Matthews, President & CEO National Association of Railroad Passengers 505 Capital Court, NE, Suite 300 Washington, DC 20002-7706	N	Adam Mitchell Save That Stuff Inc. 100 Terminal Street Charlestown, MA, 02129
N	Bruce A. Egan, President, Egan Environmental, Inc. 75 Lothrop Street Beverly, MA 01915	N	K. Dun Gifford, President Comm. for Regional Transportation 15 Hilliard Street Cambridge, MA 02138	N	Bradley Campbell, President Conservation Law Foundation 62 Summer Street Boston, MA 02116
N	Stephen Schultz Engel & Schultz, LLP One Federal Street, Suite 2120 Boston, MA 02110	N	Kathy Abbott, President and CEO Boston Harbor Now 15 State Street #1100 Boston, MA 02210	N	Eugene Benson, Executive Director Massachusetts Association of Conservation Commissions 10 Juniper Road Belmont, MA 02178
N	Nathan Phillips, Chair Sierra Club – MA Chapter 10 Milk Street Suite 417 Boston, MA 02108-4621	N	Karl Quakenbush CTPS State Transportation Building 10 Park Plaza, Suite 2150 Boston, MA 02116	N	Mystic View Task Force PO Box 441979 Somerville, MA 02144
N	Patrick Herron, Executive Director Mystic River Watershed Association 20 Academy Street, Suite 306 Arlington, MA 02476	N	Francis X. Callahan, Jr., President Boston Metropolitan District Building Trades Council 35 Highland Avenue Malden, MA 02148	N	Gary Clayton, President Massachusetts Audubon Society 208 South Great Road Lincoln, MA 01773
N	Darrin McAuliffe Manager-Secretary, Rider Oversight Committee 45 High Street Boston, MA 02110	N	Bernadette Cantalupo 156 Porter Street Association 156 Porter Street East Boston, MA 02128	N	Somerville Transportation Equity Partnership 51 Mt. Vernon St. Somerville, MA 02145
N	Bruce Berman Save the Harbor/Save the Bay Boston Fish Pier 212 Northern Avenue, Suite 304 West Boston, MA 02210	N	Mike Bahtiarian, Vice President Noise Control Engineering 799 Middlesex Turnpike Billerica, MA 02821	N	MAPC MetroFuture Steering Committee 60 Temple Place Boston, MA 02111
N	James T. Brett President and Executive Director The New England Council 98 North Washington Street, Suite 201 Boston, MA 02114				

Technical Appendices

- Appendix E, Activity Levels
- Appendix F, Regional Transportation
- Appendix G, Ground Access
- Appendix H, Noise Abatement
- Appendix I, Air Quality/Emissions Reduction
- Appendix J, Water Quality/Environmental Compliance and Management
- Appendix K, 2016 and 2017 Peak Period Pricing Monitoring Report
- Appendix L, Reduced/Single Engine Taxiing at Logan Airport Memoranda

This Page Intentionally Left Blank.

E

Activity Levels

This appendix provides detailed tables in support of Chapter 2, *Activity Levels*:

This Page Intentionally Left Blank.

Table E-1 Logan Airport Historical Air Passenger and Operations Data

Year	Operations	Air Passengers	Year	Operations	Air Passengers
1980	258,167	14,722,363	1999	494,816	27,052,078
1981	251,961	14,827,684	2000	487,996	27,726,833
1982	244,468	15,867,722	2001	463,125	24,474,930
1983	288,956	17,848,797	2002	392,079	22,696,141
1984	318,959	19,417,971	2003	373,304	22,791,169
1985	349,518	20,448,424	2004	405,258	26,142,516
1986	363,995	21,862,718	2005	409,066	27,087,905
1987	414,968	23,369,002	2006	406,119	27,725,443
1988	407,479	23,732,959	2007	399,537	28,102,455
1989	388,797	22,272,860	2008	371,604	26,102,651
1990	424,568	22,878,191	2009	345,306	25,512,086
1991	430,403	21,450,143	2010	352,643	27,428,962
1992	474,378	22,723,138	2011	368,987	28,909,267
1993	493,093	23,579,726	2012	354,869	29,236,087
1994	458,623	24,468,178	2013	361,339	30,218,970
1995	466,327	24,192,095	2014	363,797	31,634,445
1996	456,226	25,134,826	2015	372,930	33,449,580
1997	482,542	25,567,888	2016	391,222	36,288,042
1998	507,449	26,526,708			

This Page Intentionally Left Blank.

Table E-2 Logan Airport Changes in Domestic Passenger Operations by Carrier

Airline	2000	2005	2010	2011	2012	2013	2014	2015	2016	2015-2016 Change	2015-2016 Percent Change
Scheduled Jet Carriers	**233,993**	**190,991**	**203,052**	**207,369**	**203,376**	**211,176**	**214,854**	**225,629**	**235,381**	**9,752**	**4.3%**
AirTran Airlines	3,090	14,580	13,672	12,869							
Alaska Airlines		1,088	1,733	1,757	1,873	2,661	3,090	3,027	3,256	**229**	**7.6%**
America West Airlines	5,116	4,467									
American Airlines[1]	30,821	27,712	21,313	18,943	20,962	22,535	58,222	56,623	55,249	**-1,374**	**-2.4%**
American Trans Air	1,448	2,294									
Continental Airlines	16,894	13,546	10,869								
Delta Air Lines[2]	52,954	36,388	28,980	25,429	23,270	21,139	23,614	30,705	30,476	**-229**	**-0.7%**
Frontier Airlines	1,052		1,094		275						
Independence Air		4,676									
JetBlue		15,069	49,981	58,737	63,210	73,374	76,247	79,364	84,590	**5,226**	**6.6%**
Midway Airlines	4,096										
Midwest Airlines	3,726	3,570	1,961	2,786							
Northwest Airlines	13,147	9,685									
People Express							170				
Southwest Airlines[3]			13,727	17,413	23,667	23,701	21,967	21,542	24,436	**2,894**	**13.4%**
Spirit Airlines			3,023	3,054	3,365	2,721	2,945	4,896	7,245	**2,349**	**48.0%**
Sun Country Airlines	723		313	509	596	926	1,027	1,414	1,374	**-40**	**-2.8%**
Trans World Airlines	6,280										
United Airlines[4]	28,092	18,304	16,314	26,425	25,636	25,214	24,374	24,632	25,031	**399**	**1.6%**
US Airways[5]	66,554	39,612	36,678	36,421	36,633	35,613					
Virgin America			3,394	3,026	3,889	3,292	3,198	3,426	3,724	**298**	**8.7%**
Regional/Commuter Carriers	**160,041**	**137,203**	**94,535**	**89,586**	**79,790**	**79,922**	**76,682**	**70,274**	**68,204**	**-2,070**	**-2.9%**
America West Express	1,267										
American Eagle	62,140	37,394	15,291	6,669	4	4	5	52	6,418	**6,366**	**12242.3%**
Cape Air	31,026	25,018	35,899	35,940	37,184	37,194	35,080	35,994	35,993	**-1**	**0.0%**
Continental Connection			1,809	1,199	131						
Continental Express		12,544	529	902	385						
Delta Connection	15,438	26,557	18,445	23,243	20,925	20,848	20,265	15,466	18,586	**3,120**	**20.2%**
MidAtlantic Express											
Midwest/Republic			258								
Northwest Airlink		5,034									
PenAir					2,268	4,384	4,382	3,747	3,662	**-85**	**-2.3%**
Republic Airlines						58	53	34		**-34**	**-100.0%**
United Express		3,178	2,802	2,763	4,342	5,829	5,628	4,699	3,545	**-1,154**	**-24.6%**
US Airways Express	50,170	27,478	19,502	18,870	14,551	11,605	11,269	10,282		**-10,282**	**-100.0%**
Non-Scheduled Operations (Incl. Charter)	**1,008**	**325**	**501**	**106**	**181**	**200**	**164**	**176**	**158**	**-18**	**-10.2%**
Total Domestic Operations	**395,042**	**328,519**	**298,117**	**297,061**	**283,347**	**291,298**	**291,700**	**296,079**	**303,743**	**7,664**	**2.6%**

Source: Massport

Notes: Excludes general aviation and all-cargo operations.

Table E-3 Logan Airport Changes in International Passenger Operations by Carrier

Airline	2000	2005	2010	2011	2012	2013	2014	2015	2016	2015-2016 Change	2015-2016 Percent Change
Scheduled Jet Carriers	**27,427**	**24,550**	**20,771**	**24,973**	**25,633**	**23,301**	**25,065**	**28,225**	**34,752**	**6,527**	**23.1%**
Aer Lingus	1,160	1,016	1,097	1,130	1,273	1,513	1,933	1,973	2,066	**93**	**4.7%**
Aeromexico		534						345	580	**235**	**68.1%**
Air Berlin									192	**192**	**100.0%**
Air Canada	10,047	5,782	3,895	4,125	4,517	1,747	1,084	1,686	2,729	**1,043**	**61.9%**
Air France	1,046	1,334	995	1,013	974	955	899	910	900	**-10**	**-1.1%**
Air Jamaica		349									
Air One											
Alitalia	729	986	624	604	530	542	550	562	558	**-4**	**-0.7%**
American Airlines[1]	4,657	4,672	2,422	2,149	1,901	447	344	571	533	**-38**	**-6.7%**
Astraeus				100							
British Airways	2,159	2,151	2,082	2,161	2,149	2,573	2,678	2,575	2,702	**127**	**4.9%**
Canadian Airlines	417										
Cathay Pacific								279	454	**175**	**62.7%**
Copa Airlines						347	730	646	638	**-8**	**-1.2%**
Delta Air Lines[2]	733	749	1,675	3,280	2,531	2,851	3,008	3,122	3,459	**337**	**10.8%**
El Al								152	296	**144**	**94.7%**
Emirates							600	914	1,382	**468**	**51.2%**
Eurowings									72	**72**	**100.0%**
Finnair		44									
FlyGlobespan											
Hainan Airlines							280	744	961	**217**	**29.2%**
Iberia Airlines			435	445	441	404	332	336	412	**76**	**22.6%**
Icelandair	726	811	816	928	938	1,120	1,227	1,287	1,338	**51**	**4.0%**
Japan Airlines					474	646	731	728	736	**8**	**1.1%**
JetBlue			2,262	5,173	5,902	6,138	6,348	6,488	7,146	**658**	**10.1%**
Korean Air Lines	314										
LACSA Airlines											
Lufthansa	1,140	1,564	1,657	1,734	1,784	1,723	1,712	1,687	1,728	**41**	**2.4%**
Northwest Airlines	744	727									
Norwegian Air Shuttle								34	656	**622**	**1829.4%**
Olympic Airways	256										
Qatar Airways									552	**552**	**100.0%**
Sabena	724										
SATA International Airlines		315	403	400	412	466	533	542	630	**88**	**16.2%**
Scandinavian Airlines									500	**500**	**100.0%**
SWISS International	926	704	720	725	716	720	722	711	1,020	**309**	**43.5%**

Table E-3 Logan Airport Changes in International Passenger Operations by Carrier

TACA		327									
TACV - Cabo Verde		154	240	236	234	214	186	60		**-60**	**-100.0%**
TAP - Air Portugal	200								378	**378**	**100.0%**
Thomas Cook Airlines									62	**62**	**100.0%**
Trans World Airlines											
Turkish Airlines							452	726	658	**-68**	**-9.4%**
United Airlines	728								21	**21**	**100.0%**
US Airways		1,607	667	49	146	186					
VG Airlines											
Virgin Atlantic Airways	721	724	707	721	711	709	716	702	715	**13**	**1.9%**
Wow Air								445	678	**233**	**52.4%**
Regional/Commuter Carriers	**15,594**	**13,112**	**12,494**	**12,153**	**12,270**	**14,378**	**14,720**	**14,153**	**15,204**	**1,051**	**7.4%**
Air Canada Regional	4,088	5,120	7,065	6,803	7,058	9,563	10,364	10,024	9,051	**-973**	**-9.7%**
American Eagle Airlines	8,975	4,637	2,480	2,206							
Delta Connection	2,531	3,355	81	1	1,489	1,082	56	38	32	**-6**	**-15.8%**
Porter Airlines			2,868	3,143	3,723	3,733	4,300	4,091	3,869	**-222**	**-5.4%**
Westjet Encore									2,252	**2,252**	**100.0%**
Non-Scheduled Operations	**2,141**	**1,068**	**305**	**300**	**268**	**277**	**185**	**248**	**63**	**-185**	**-74.6%**
Total International Operations	**45,162**	**38,643**	**33,570**	**37,426**	**38,171**	**37,956**	**39,970**	**42,626**	**50,019**	**7,393**	**17.3%**

Source: Massport

Notes: Excludes general aviation and all-cargo operations.

1 - American Airlines includes US Airways beginning in 2014 (following 2013 merger)

2 - Delta Air Lines totals include Northwest Airlines beginning in 2009 (following merger)

Table E-4 Logan Airport Scheduled Passenger Departures by Destination

Destination Airport	Code	2000	2005	2010	2011	2012	2013	2014	2015	2016	2015-2016 Change	2015-2016 Percent Change
Domestic		**210,068**	**163,684**	**149,962**	**152,303**	**143,871**	**147,078**	**149,208**	**152,210**	**155,485**	**3,275**	**2.2%**
New York La Guardia	LGA	11,872	13,350	11,705	11,489	9,564	9,255	9,056	9,352	9,365	**13**	**0.1%**
Washington National	DCA	8,474	10,680	9,419	9,793	8,543	8,360	8,645	8,678	8,629	**-48**	**-0.6%**
Chicago O'Hare	ORD	10,063	7,412	7,403	7,635	7,461	7,733	7,822	7,401	7,139	**-261**	**-3.5%**
New York J F Kennedy	JFK	9,899	4,985	7,054	5,969	5,428	5,919	6,139	6,745	6,971	**227**	**3.4%**
Philadelphia	PHL	11,785	7,014	6,548	7,985	6,301	7,305	8,092	7,971	5,786	**-2,185**	**-27.4%**
Baltimore	BWI	1,773	5,029	7,053	6,755	5,910	5,737	5,060	4,897	5,731	**834**	**17.0%**
Atlanta	ATL	7,110	6,003	5,548	5,569	5,574	5,501	5,454	5,192	5,386	**194**	**3.7%**
New York Newark	EWR	5,206	5,626	3,666	4,608	5,228	5,702	5,532	5,366	5,239	**-127**	**-2.4%**
Los Angeles	LAX	3,647	2,655	3,382	3,164	3,544	3,603	4,080	4,456	4,650	**194**	**4.4%**
Nantucket	ACK	5,022	3,452	3,884	3,382	3,469	3,601	3,567	4,311	4,605	**293**	**6.8%**
San Francisco	SFO	3,526	2,591	3,711	3,884	4,198	4,038	4,305	4,272	4,551	**279**	**6.5%**
Detroit	DTW	2,937	2,827	2,353	2,437	2,314	2,340	3,354	3,875	3,932	**57**	**1.5%**
Charlotte	CLT	2,758	3,288	4,180	3,976	3,991	3,911	3,916	3,920	3,878	**-42**	**-1.1%**
Raleigh/Durham	RDU	3,775	4,110	3,259	2,867	3,059	3,313	3,634	3,598	3,718	**121**	**3.4%**
Dallas/Fort Worth	DFW	5,002	3,544	2,938	2,781	3,790	4,147	3,705	3,406	3,418	**12**	**0.4%**
Orlando	MCO	4,914	3,517	3,179	3,580	3,496	3,399	2,883	3,057	3,323	**266**	**8.7%**
Martha's Vineyard	MVY	3,863	2,231	3,218	2,829	2,774	2,740	2,793	2,731	2,929	**198**	**7.2%**
Minneapolis	MSP	3,078	1,791	1,927	2,031	2,062	2,200	2,322	2,737	2,865	**128**	**4.7%**
Denver	DEN	2,628	1,990	2,812	2,640	2,518	2,433	2,446	2,611	2,839	**228**	**8.7%**
Fort Lauderdale/Hollywood	FLL	3,327	3,065	2,370	2,517	2,371	2,379	2,173	2,258	2,634	**376**	**16.6%**
Miami	MIA	2,068	2,072	2,238	2,555	2,610	2,555	2,551	2,520	2,523	**3**	**0.1%**
Washington Dulles	IAD	8,625	6,139	4,625	3,910	3,014	2,974	2,714	2,505	2,485	**-20**	**-0.8%**
Richmond	RIC	1,537	1,404	1,431	1,525	1,481	1,723	2,450	2,603	2,338	**-265**	**-10.2%**
Pittsburgh	PIT	3,086	2,021	2,312	3,179	2,498	2,641	2,678	2,457	2,210	**-247**	**-10.0%**
Buffalo	BUF	950	1,226	2,181	2,183	2,264	2,468	2,433	2,203	2,120	**-83**	**-3.8%**
Cleveland	CLE	2,797	1,260	1,369	1,326	1,455	1,501	1,260	2,070	2,098	**28**	**1.3%**
Fort Myers	RSW	949	1,525	1,587	1,620	1,738	1,806	1,734	1,742	1,938	**195**	**11.2%**
Provincetown	PVC	2,023	1,659	2,410	2,086	2,054	1,982	1,929	1,957	1,912	**-45**	**-2.3%**
Seattle/Tacoma	SEA	458	610	1,001	993	1,051	1,378	1,607	1,625	1,907	**282**	**17.3%**
West Palm Beach	PBI	1,674	1,126	1,450	1,380	1,161	1,235	1,389	1,650	1,652	**3**	**0.2%**
Houston Intercontinental	IAH	1,995	1,752	1,717	1,697	1,704	1,789	1,822	1,831	1,618	**-213**	**-11.6%**
Chicago Midway	MDW	868	1,339	1,756	1,751	1,690	1,617	1,542	1,531	1,604	**73**	**4.8%**
Indianapolis	IND	765	2,076	1,121	977	936	895	844	1,181	1,595	**414**	**35.0%**
Columbus	CMH	2,708	2,114	972	1,048	972	871	844	1,081	1,591	**510**	**47.2%**
Phoenix	PHX	1,386	944	1,348	1,895	1,773	1,413	1,557	1,569	1,552	**-17**	**-1.1%**
Nashville	BNA	642				153	588	628	688	1,467	**779**	**113.2%**
Lebanon	LEB			1,734	1,460	1,464	1,460	1,460	1,460	1,464	**4**	**0.3%**
Tampa	TPA	2,502	1,946	1,246	1,255	1,266	1,195	1,182	1,177	1,429	**252**	**21.4%**
Rockland	RKD	1,152	1,374	1,301	1,279	1,282	1,279	1,279	1,372	1,348	**-24**	**-1.7%**
Augusta	AUG	584	621	1,000	1,187	1,091	1,248	1,248	1,248	1,220	**-28**	**-2.2%**
Las Vegas	LAS	1,098	1,679	756	904	737	813	819	1,162	1,216	**55**	**4.7%**
Cincinnati	CVG	2,235	2,637	1,364	1,308	1,272	1,269	1,239	1,218	1,204	**-14**	**-1.1%**
Bar Harbor	BHB	1,196	1,154	815	1,030	1,213	1,283	1,156	1,095	1,098	**3**	**0.3%**
Albany	ALB	3,433	1,073	647	2,180	1,523	1,183	1,095	1,095	1,098	**3**	**0.3%**
Saranac Lake	SLK		800	1,174	1,157	1,222	1,157	1,095	1,095	1,098	**3**	**0.3%**
Rutland	RUT	1,259	643	1,095	1,148	1,160	1,095	1,095	1,095	1,098	**3**	**0.3%**
San Diego	SAN	366	365	571	535	476	859	1,030	1,052	1,042	**-10**	**-1.0%**
Houston Hobby	HOU						664	1,325	978	1,032	**55**	**5.6%**
Salt Lake City	SLC	1,094	730	669	438	370	584	597	617	1,009	**392**	**63.5%**

Table E-4 Logan Airport Scheduled Passenger Departures by Destination

Destination Airport	Code	2000	2005	2010	2011	2012	2013	2014	2015	2016	2015-2016 Change	2015-2016 Percent Change
Presque Isle	PQI	1,835	1,017	991	991	993	991	991	991	993	**3**	**0.3%**
Milwaukee	MKE	1,189	2,182	2,213	1,941	1,069	880	674	854	990	**136**	**15.9%**
Hyannis	HYA	2,274	1,059	1,165	1,047	1,028	705	731	787	775	**-11**	**-1.4%**
Rochester	ROC	3,644	1,181	908	886	889	878	882	886	767	**-119**	**-13.5%**
Austin	AUS			365	365	366	352	352	444	754	**311**	**70.0%**
St. Louis	STL	2,187	1,461	934	713	815	748	722	722	745	**24**	**3.3%**
Jacksonville	JAX		428	365	544	619	593	984	767	701	**-66**	**-8.6%**
Plattsburgh International	PBG			1,025	899	623	639	787	756	697	**-59**	**-7.8%**
Kansas City	MCI	597	241	313	536	571	515	669	661	631	**-30**	**-4.5%**
Portland	PDX			352	440	528	615	494	519	555	**35**	**6.8%**
Charleston	CHS		61				398	474	365	545	**180**	**49.2%**
New Orleans	MSY		191	348	304	335	339	344	365	527	**162**	**44.5%**
Westchester County	HPN	6,065	2,256						263	502	**239**	**91.1%**
Myrtle Beach	MYR	105	265	365	365	366	378	383	383	379	**-3**	**-0.9%**
Savannah	SAV		78					306	365	370	**5**	**1.5%**
Atlantic City Pomona Field	ACY			536	326	355	123	153	166	366	**200**	**120.1%**
Syracuse	SYR	3,876	1,762	991	964	784	626	617	578	314	**-264**	**-45.7%**
Harrisburg	MDT	1,307	886	551	574	540	469	434	325	300	**-25**	**-7.7%**
Long Beach	LGB		853	459	296	292	274	270	292	297	**5**	**1.7%**
San Jose	SJC	842	245	232	292	227	205	214	223	236	**13**	**5.9%**
Sarasota/Bradenton	SRQ		30	82	242	248	348	181	212	186	**-26**	**-12.1%**
Dallas Love Field	DAL								153	153	**0**	**0.0%**
Oakland	OAK		853	195	105	83	83	83	88	79	**-9**	**-9.8%**
Sacramento	SMF								48	57	**9**	**17.8%**
Madison	MSN									9	**9**	**100.0%**
Akron/Canton	CAK		730	475	488	497	557	457	287		**-287**	**-100.0%**
Islip	ISP	4,222	1,581				293	324				
Norfolk	ORF	838	1,032		511	667	613	71				
Newport News	PHF		671	549	549	60		31				
Memphis	MEM	972	1,034	1,048	1,029	688	313					
Bangor	BGR	6,644	2,946									
Greensboro	GSO	415	1,120									
Trenton	TTN											
Watertown	ART											
Burlington	BTV	5,913	1,632									
Allentown/Bethlehem	ABE	780	626									
Louisville	SDF											
Manchester	MHT											
Massena	MSS											
Dayton	DAY											
Plattsburgh	PLB											
Portland (ME)	PWM	6,267	1,394									
Wilkes-Barre Scranton	AVP	584	420									
Columbia	CAE											
Ithaca	ITH	872										
Elmira/Corning	ELM	441										
Hartford	BDL											
Binghamton	BGM											
Providence	PVD	91										

Table E-4 Logan Airport Scheduled Passenger Departures by Destination

Destination Airport	Code	2000	2005	2010	2011	2012	2013	2014	2015	2016	2015-2016 Change	2015-2016 Percent Change
International		**23,711**	**19,837**	**18,764**	**19,641**	**19,540**	**19,093**	**20,372**	**21,765**	**25,353**	**3,588**	**16.5%**
Toronto Pearson	YYZ	3,691	3,876	3,603	3,737	3,529	3,306	2,715	2,799	3,702	**903**	**32.3%**
Montreal-Trudeau	YUL	3,401	2,578	2,008	2,021	2,009	1,833	1,948	2,047	2,092	**45**	**2.2%**
London Heathrow	LHR	2,187	2,133	2,331	2,833	2,642	2,134	2,069	2,026	2,058	**31**	**1.5%**
Toronto Island Apt	YTZ			1,535	1,687	2,009	2,009	2,310	2,236	2,018	**-218**	**-9.7%**
San Juan	SJU	1,750	1,237	1,294	1,130	1,031	1,038	1,018	1,068	1,141	**73**	**6.8%**
Reykjavik Keflavik Apt	KEF	393	361	404	531	467	561	614	854	968	**114**	**13.4%**
Halifax	YHZ	3,210	1,891	852	744	745	704	704	700	955	**255**	**36.4%**
Paris De Gaulle	CDG	898	853	710	946	619	784	780	916	938	**22**	**2.4%**
Dublin	DUB	223		348	457	480	605	653	653	694	**41**	**6.2%**
Dubai	DXB							306	457	692	**235**	**51.5%**
Ottawa	YOW	2,575	864	744	696	623	652	635	630	649	**19**	**3.0%**
Amsterdam	AMS	366	365	457	553	558	575	536	579	580	**1**	**0.2%**
Santo Domingo	SDQ		174	305	275	358	339	401	365	519	**154**	**42.1%**
Frankfurt	FRA	580	575	548	544	572	545	532	536	515	**-21**	**-4.0%**
Bermuda	BDA	550	518	532	540	511	501	523	536	510	**-26**	**-4.8%**
Aruba	AUA	9	338	407	426	405	408	417	417	471	**54**	**12.9%**
Zurich	ZRH	523	356	365	365	366	365	365	365	366	**1**	**0.3%**
Tokyo Narita	NRT					236	352	365	365	357	**-8**	**-2.1%**
Munich	MUC		210	313	335	357	348	357	357	357	**1**	**0.2%**
Shannon	SNN	366	737	213	118	144	166	348	352	349	**-3**	**-0.9%**
Istanbul	IST							236	365	340	**-25**	**-6.9%**
Cancun	CUN		207	307	270	217	225	273	264	326	**62**	**23.5%**
Beijing	PEK							136	287	323	**35**	**12.3%**
Panama City	PTY							365	334	318	**-16**	**-4.9%**
Copenhagen	CPH									293	**293**	**100.0%**
Mexico City	MEX		234						166	292	**126**	**76.0%**
Doha	DOH									284	**284**	**100.0%**
Santiago	STI				92	201	214	248	206	275	**70**	**34.0%**
Rome Leonardo Da Vinci-Fiumicino	FCO		135	313	314	266	271	258	271	271	**0**	**0.0%**
Hong Kong	HKG								140	227	**87**	**61.9%**
Lisbon	LIS	44		26	26	48	39	39	44	223	**179**	**410.5%**
Punta Cana	PUJ			95	92	139	134	160	174	214	**40**	**22.9%**
Madrid	MAD			218	231	222	209	166	166	205	**39**	**23.8%**
Ponta Delgada	PDL	30	39	165	170	148	179	209	196	196	**0**	**0.1%**
Saint Thomas	STT	78	108	125	117	156	173	176	184	186	**1**	**0.8%**
London Gatwick	LGW	362								161	**161**	**100.0%**
Shanghai Pudong	PVG								83	157	**74**	**88.7%**
Tel Aviv	TLV								75	148	**74**	**98.7%**
Nassau	NAS		100	180	134	142	108	139	136	133	**-3**	**-2.0%**
Providenciales	PLS	4	43	39	26	69	52	82	86	104	**18**	**20.6%**
Dusseldorf	DUS									101	**101**	**100.0%**
Saint Maarten	SXM			39	43	61	61	52	56	91	**35**	**61.9%**
Terceira	TER	44		17	17	17	17	17	31	70	**39**	**127.0%**
Oslo	OSL									57	**57**	**100.0%**
Port Au Prince	PAP								26	53	**26**	**100.0%**
Cologne/Bonn	CGN									52	**52**	**100.0%**
Montego Bay	MBJ		238	126	52	69	56	73	56	52	**-4**	**-7.1%**
Barbados	BGI								9	43	**35**	**398.4%**
Fort-de-France	FDF								9	43	**35**	**390.3%**

Table E-4 Logan Airport Scheduled Passenger Departures by Destination

Destination Airport	Code	2000	2005	2010	2011	2012	2013	2014	2015	2016	2015-2016 Change	2015-2016 Percent Change
Grand Cayman	GCM		31	17		9	26	26	26	43	**17**	**67.4%**
Manchester	MAN	26	241							31	**31**	**100.0%**
Pointe-a-Pitre	PTP								9	30	**22**	**243.5%**
St. Lucia Hewanorra	UVF							9	26	26	**0**	**0.6%**
Liberia	LIR							9	26	26	**0**	**0.6%**
Puerto Plata	POP	4						9	26	26	**0**	**0.6%**
Praia	RAI		9	121	122	109	104	92	30		**-30**	**-100.0%**
Sao Vicente	VXE			4		4						
Charlottetown	YYG											
Helsinki	HEL											
Milan Malpensa	MXP	366	343									
Fredericton	YFC		686									
Quebec	YQB	1,229	30									
Glasgow	GLA											
Connaught	NOC											
Stockholm Arlanda	ARN											
Las Palmas	LPA											
San Salvador	SAL		178									
Vancouver	YVR	366	62									
Ilha Do Sal	SID		56									
Nykoping	NYO		31									
Lerwick Sumburgh Apt	LSI											
Freeport	FPO											
Brussels	BRU	362										
Gander	YQX											
Athens	ATH	74										
Total Scheduled Carrier Operations		**233,779**	**183,520**	**168,726**	**171,945**	**163,411**	**166,171**	**169,579**	**173,974**	**180,838**	**6,864**	**3.9%**

Source: OAG Schedules.

This Page Intentionally Left Blank.

F

Regional Transportation

This appendix provides detailed tables in support of Chapter 4, *Regional Transportation*:

- Table F-1 Aircraft Operations by Classification for New England's Airports, 2000 to 2016
- Table F-2 Percentage Change in Aircraft Operations by Classification for New England's Airports, 2000 to 2016

Scheduled Passenger Operations by Market and Carrier for New England's Regional Airports

- Table F-3 Bradley International Airport, Connecticut
- Table F-4 T.F. Green Airport, Rhode Island
- Table F-5 Manchester-Boston Regional Airport, New Hampshire
- Table F-6 Portland International Jetport, Maine
- Table F-7 Burlington International Airport, Vermont
- Table F-8 Bangor International Airport, Maine
- Table F-9 Tweed-New Haven Airport, Connecticut
- Table F-10 Worcester Regional Airport, Massachusetts
- Table F-11 Hanscom Field, Massachusetts
- Table F-12 Portsmouth International Airport, New Hampshire

This Page Intentionally Left Blank.

Table F-1 Aircraft Operations by Classification for New England's Airports, 2000 to 2016

Airport	Bradley International	T.F. Green	Manchester-Boston Regional	Portland International Jetport	Burlington	Bangor	Tweed-New Haven	Worcester Regional	Portsmouth International	Hanscom Field[2]	Subtotal	Logan Airport[3]	Total
2000													
Commercial	132,062	103,750	61,506	47,609	45,745	21,446	5,260	4,029	6,104	6,572	434,083	452,763	886,846
General Aviation[1]	31,863	52,184	45,740	56,571	59,377	34,831	56,200	46,518	31,601	204,512	619,397	35,233	654,630
Military & Other	5,811	2,764	586	2,072	10,241	26,507	328	495	9,973	1,287	60,064	0	60,064
Total	169,736	158,698	107,832	106,252	115,363	82,784	61,788	51,042	47,678	212,371	1,113,544	487,996	1,601,540
2001													
Commercial	128,638	100,606	61,669	47,770	47,261	18,286	4,581	5,631	4,485	6,414	425,341	434,386	859,727
General Aviation[1]	30,478	45,095	44,358	62,014	61,986	35,230	56,092	45,464	30,148	197,770	608,635	28,739	637,374
Military & Other	5,913	2,635	607	2,259	11,821	26,623	437	917	8,221	1,252	60,685	0	60,685
Total	165,029	148,336	106,634	112,043	121,068	80,139	61,110	52,012	42,854	205,436	1,094,661	463,125	1,557,786
2002													
Commercial	113,194	96,595	62,346	45,899	38,929	24,412	3,827	4,062	5,059	6,603	400,926	366,476	767,402
General Aviation[1]	27,838	45,473	29,549	57,720	59,679	35,711	62,163	52,277	28,333	210,221	608,964	25,596	634,560
Military & Other	6,085	2,587	376	2,162	12,167	27,297	593	418	8,220	1,424	61,329	0	61,329
Total	147,117	144,655	92,271	105,781	110,775	87,420	66,583	56,757	41,612	218,248	1,071,219	392,072	1,463,291
2003													
Commercial	103,917	84,301	68,184	42,658	38,293	25,626	3,705	868	4,552	2,956	375,060	344,644	719,704
General Aviation[1]	27,115	42,878	29,552	44,036	50,461	36,706	54,224	55,972	24,866	190,789	556,599	28,660	585,259
Military & Other	4,214	2,496	324	1,449	11,466	32,938	776	378	7,720	1,142	62,903	0	62,903
Total	135,246	129,675	98,060	88,143	100,220	95,270	58,705	57,218	37,138	194,887	994,562	373,304	1,367,866
2004													
Commercial	108,823	83,496	75,360	46,474	41,719	24,970	4,501	0	3,981	4,308	393,632	374,022	767,654
General Aviation[1]	32,269	34,878	27,438	41,547	54,709	29,884	58,881	61,343	25,962	175,301	542,212	31,236	573,448
Military & Other	4,100	346	749	1,338	12,404	29,676	1,010	530	7,797	1,195	59,145	0	59,145
Total	145,192	118,720	103,547	89,359	108,832	84,530	64,392	61,873	37,740	180,804	994,989	405,258	1,400,247
2005													
Commercial	119,048	88,374	76,342	42,661	43,987	25,976	6,137	2,727	3,197	3,627	412,076	377,830	789,906
General Aviation[1]	33,341	28,138	26,369	36,191	49,888	30,016	60,893	62,743	25,446	165,424	518,449	31,236	549,685
Military & Other	3,701	241	479	1,405	11,468	24,154	1,063	519	7,669	904	51,603	0	51,603
Total	156,090	116,753	103,190	80,257	105,343	80,146	68,093	65,989	36,312	169,955	982,128	409,066	1,391,194

Table F-1 Aircraft Operations by Classification for New England's Airports, 2000 to 2016

Airport	Bradley International	T.F. Green	Manchester-Boston Regional	Portland International Jetport	Burlington	Bangor	Tweed-New Haven	Worcester Regional	Portsmouth International	Hanscom Field[2]	Subtotal	Logan Airport[3]	Total
2006													
Commercial	111,341	81,282	67,326	38,663	41,342	23,466	5,177	3,793	3,981	3,057	379,428	374,675	754,103
General Aviation[1]	34,548	25,510	25,074	35,572	44,471	29,848	51,702	56,770	25,962	167,560	497,017	31,444	528,461
Military & Other	4,348	229	738	1,536	9,299	22,359	1,157	609	7,797	1,433	49,505	0	49,505
Total	150,237	107,021	93,138	75,771	95,112	75,673	58,036	61,172	37,740	172,050	925,950	406,119	1,332,069
2007													
Commercial	107,097	80,525	69,134	41,450	39,928	22,571	4,594	3,162	4,270	3,477	376,208	370,905	747,113
General Aviation[1]	29,308	22,984	23,959	31,724	47,521	25,542	51,200	61,296	27,000	160,992	481,526	28,632	510,158
Military & Other	5,097	242	644	1,384	9,528	20,949	944	879	8,017	1,438	49,122	0	49,122
Total	141,502	103,751	93,737	74,558	96,977	69,062	56,738	65,337	39,287	165,907	906,856	399,537	1,306,393
2008													
Commercial	98,194	73,096	63,505	40,834	37,832	19,282	4,013	2,553	1,347	104	340,760	347,784	688,544
General Aviation[1]	22,908	19,470	16,198	31,869	46,391	27,143	44,642	43,763	31,051	164,195	447,630	23,820	471,450
Military & Other	3,637	187	840	974	9,688	20,449	243	886	7,993	1,590	46,487	0	46,487
Total	124,739	92,753	80,543	73,677	93,911	66,874	48,898	47,202	40,391	165,889	834,877	371,604	1,206,481
2009													
Commercial	82,021	62,233	54,336	35,909	31,153	16,485	3,096	2,527	422	0	288,182	333,064	621,246
General Aviation[1]	19,586	19,438	14,354	25,473	32,872	19,558	37,722	41,700	25,161	148,696	384,560	12,242	396,802
Military & Other	2,726	260	1,163	778	8,628	16,267	486	17	6,851	1,215	38,391	0	38,391
Total	104,333	81,931	69,853	62,160	72,653	52,310	41,304	44,244	32,434	149,911	711,133	345,306	1,056,439
2010													
Commercial	80,418	60,128	53,971	35,035	29,538	16,190	3,201	1,629	1,516	0	281,626	337,961	619,587
General Aviation[1]	18,759	21,096	13,636	24,776	36,106	20,142	31,884	41,843	25,674	161,942	395,858	14,682	410,540
Military & Other	3,028	347	933	446	4,776	15,525	381	572	7,707	1,795	35,510	0	35,510
Total	102,205	81,571	68,540	60,257	70,420	51,857	35,466	44,044	34,897	163,737	712,994	352,643	1,065,637
2011													
Commercial	86,838	57,194	51,379	35,157	29,166	16,177	3,367	2,017	1,717	750	283,762	340,757	624,519
General Aviation[1]	16,483	21,774	12,497	21,453	42,562	19,503	33,919	44,050	27,056	160,840	400,137	28,230	428,367
Military & Other	3,630	369	874	533	5,890	13,220	310	634	8,158	1,409	35,027	0	35,027
Total	106,951	79,337	64,750	57,143	77,618	48,900	37,596	46,701	36,931	162,999	718,926	368,987	1,087,913

Table F-1 Aircraft Operations by Classification for New England's Airports, 2000 to 2016

Airport	Bradley International	T.F. Green	Manchester-Boston Regional	Portland International Jetport	Burlington	Bangor	Tweed-New Haven	Worcester Regional	Portsmouth International	Hanscom Field[2]	Subtotal	Logan Airport[3]	Total
2012													
Commercial	79,704	50,301	45,379	33,118	27,067	14,826	3,936	1,639	502	635	257,107	326,755	583,862
General Aviation[1]	15,589	24,781	12,504	20,864	42,352	18,069	34,775	42,655	30,186	164,841	406,616	28,114	434,730
Military & Other	3,726	434	1,073	584	7,079	11,503	416	740	7,917	738	34,210	0	34,210
Total	99,019	75,516	58,956	54,566	76,498	44,398	39,127	45,034	38,605	166,214	697,933	354,869	1,052,802
2013													
Commercial	78,213	48,340	43,572	31,076	26,814	14,707	4,094	1,586	560	253	249,215	334,657	583,872
General Aviation[1]	15,192	24,729	11,432	20,021	40,413	15,535	28,794	32,888	28,951	153,706	371,661	26,682	398,343
Military & Other	2,558	435	1,224	471	6,972	11,045	423	593	7,573	529	31,823	0	31,823
Total	95,963	73,504	56,228	51,568	74,199	41,287	33,311	35,067	37,084	154,488	652,699	361,339	1,014,038
2014													
Commercial	79,060	44,351	38,674	29,538	26,057	14,428	4,795	2,368	8,278	256	247,805	337,381	585,186
General Aviation[1]	14,752	29,490	12,293	16,535	40,858	15,548	26,273	29,138	24,440	133,437	342,764	26,416	369,180
Military & Other	2,665	1,036	908	560	6,842	11,567	529	956	7,621	602	33,286	0	33,286
Total	96,477	74,877	51,875	46,633	73,757	41,543	31,597	32,462	40,339	134,295	623,855	363,797	987,652
2015													
Commercial	76,425	42,417	38,060	30,415	25,178	13,618	6,316	2,414	8,547	220	243,610	344,764	588,374
General Aviation[1]	14,402	22,700	12,934	17,916	41,576	16,487	27,711	35,711	26,848	127,467	343,752	28,166	371,918
Military & Other	2,680	430	811	567	5,912	10,684	685	889	7,499	592	30,749	0	30,749
Total	93,507	65,547	51,805	48,898	72,666	40,789	34,712	39,014	42,894	128,279	618,111	372,930	991,041
2016													
Commercial	77,174	43,659	40,589	32,171	26,405	14,603	7,195	2,616	9,512	266	254,190	360,442	614,632
General Aviation[1]	14,460	26,032	14,447	18,334	38,614	16,965	28,811	31,858	28,341	120,891	338,753	30,780	369,533
Military & Other	3,178	397	501	488	6,114	11,337	683	780	8,191	632	32,301	0	32,301
Total	94,812	70,088	55,537	50,993	71,133	42,905	36,689	35,254	46,044	121,789	625,244	391,222	1,016,466

Source: Massport, Federal Aviation Administration (FAA) Tower Counts, and individual airport records.

1 Includes itinerant and local general aviation (GA) operations at the regional airports. There are no local (touch-and-go training) operations at Logan Airport.

2 Commercial operations at Hanscom Field include scheduled commercial operations only; other air taxi operations counted as GA.

3 Operations at Logan Airport include international operations.

Table F-2 Percentage Change in Aircraft Operations by Classification for New England's Airports, 2000 to 2016

Airport	Bradley International	T.F. Green	Manchester-Boston Regional	Portland International Jetport	Burlington	Bangor	Tweed-New Haven	Worcester Regional	Portsmouth International	Hanscom Field[2]	Subtotal	Logan Airport[3]	Total
2000 to 2001													
Commercial	(2.59%)	(3.03%)	0.27%	0.34%	3.31%	(14.73%)	(12.91%)	39.76%	(26.52%)	(2.40%)	(2.01%)	(4.06%)	(3.06%)
General Aviation[1]	(4.35%)	(13.58%)	(3.02%)	9.62%	4.39%	1.15%	(0.19%)	(2.27%)	(4.60%)	(3.30%)	(1.74%)	(18.43%)	(2.64%)
Military & Other	1.76%	(4.67%)	3.58%	9.03%	15.43%	0.44%	33.23%	85.25%	(17.57%)	(2.72%)	1.03%	-	1.03%
Total	(2.77%)	(6.53%)	(1.11%)	5.45%	4.95%	(3.20%)	(1.10%)	1.90%	(10.12%)	(3.27%)	(1.70%)	(5.10%)	(2.73%)
2001 Percent of Total	10.59%	9.52%	6.85%	7.19%	7.77%	5.14%	3.92%	3.34%	2.75%	13.19%	70.27%	29.73%	100.00%
2001 to 2002													
Commercial	(12.01%)	(3.99%)	1.10%	(3.92%)	(17.63%)	33.50%	(16.46%)	(27.86%)	12.80%	2.95%	(5.74%)	(15.63%)	(10.74%)
General Aviation[1]	(8.66%)	0.84%	(33.39%)	(6.92%)	(3.72%)	1.37%	10.82%	14.99%	(6.02%)	6.30%	0.05%	(10.94%)	(0.44%)
Military & Other	2.91%	(1.82%)	(38.06%)	(4.29%)	2.93%	2.53%	35.70%	(54.42%)	(0.01%)	13.74%	1.06%	-	1.06%
Total	(10.85%)	(2.48%)	(13.47%)	(5.59%)	(8.50%)	9.09%	8.96%	9.12%	(2.90%)	6.24%	(2.14%)	(15.34%)	(6.07%)
2002 Percent of Total	10.05%	9.89%	6.31%	7.23%	7.57%	5.97%	4.55%	3.88%	2.84%	14.91%	73.21%	26.79%	100.00%
2002 to 2003													
Commercial	(8.20%)	(12.73%)	9.36%	(7.06%)	(1.63%)	4.97%	(3.19%)	(78.63%)	(10.02%)	(55.23%)	(6.45%)	(5.96%)	(6.22%)
General Aviation[1]	(2.60%)	(5.71%)	0.01%	(23.71%)	(15.45%)	2.79%	(12.77%)	7.07%	(12.24%)	(9.24%)	(8.60%)	11.97%	(7.77%)
Military & Other	(30.75%)	(3.52%)	(13.83%)	(32.98%)	(5.76%)	20.67%	30.86%	(9.57%)	(6.08%)	(19.80%)	2.57%	-	2.57%
Total	(8.07%)	(10.36%)	6.27%	(16.67%)	(9.53%)	8.98%	(11.83%)	0.81%	(10.75%)	(10.70%)	(7.16%)	(4.79%)	(6.52%)
2003 Percent of Total	9.89%	9.48%	7.17%	6.44%	7.33%	6.96%	4.29%	4.18%	2.72%	14.25%	72.71%	27.29%	100.00%
2003 to 2004													
Commercial	4.72%	(0.95%)	10.52%	8.95%	8.95%	(2.56%)	21.48%	(100.00%)	(12.54%)	45.74%	4.95%	8.52%	6.66%
General Aviation[1]	19.01%	(18.66%)	(7.15%)	(5.65%)	8.42%	(18.59%)	8.59%	9.60%	4.41%	(8.12%)	(2.58%)	8.99%	(2.02%)
Military & Other	(2.71%)	(86.14%)	131.17%	(7.66%)	8.18%	(9.90%)	30.15%	40.21%	1.00%	4.64%	(5.97%)	-	(5.97%)
Total	7.35%	(8.45%)	5.60%	1.38%	8.59%	(11.27%)	9.69%	8.14%	1.62%	(7.23%)	0.04%	8.56%	2.37%
2004 Percent of Total	10.37%	8.48%	7.39%	6.38%	7.77%	6.04%	4.60%	4.42%	2.70%	12.91%	71.06%	28.94%	100.00%
2004 to 2005													
Commercial	9.40%	5.84%	1.30%	(8.20%)	5.44%	4.03%	36.35%	-	(19.69%)	(15.81%)	4.69%	1.02%	2.90%
General Aviation[1]	3.32%	(19.32%)	(3.90%)	(12.89%)	(8.81%)	0.44%	3.42%	2.28%	(1.99%)	(5.63%)	(4.38%)	0.00%	(4.14%)
Military & Other	(9.73%)	(30.35%)	(36.05%)	5.01%	(7.55%)	(18.61%)	5.25%	(2.08%)	(1.64%)	(24.35%)	(12.75%)	-	(12.75%)
Total	7.51%	(1.66%)	(0.34%)	(10.19%)	(3.21%)	(5.19%)	5.75%	6.65%	(3.78%)	(6.00%)	(1.29%)	0.94%	(0.65%)
2005 Percent of Total	11.22%	8.39%	7.42%	5.77%	7.57%	5.76%	4.89%	4.74%	2.61%	12.22%	70.60%	29.40%	100.00%

Table F-2 Percentage Change in Aircraft Operations by Classification for New England's Airports, 2000 to 2016

Airport	Bradley International	T.F. Green	Manchester-Boston Regional	Portland International Jetport	Burlington	Bangor	Tweed-New Haven	Worcester Regional	Portsmouth International	Hanscom Field[2]	Subtotal	Logan Airport[3]	Total
2005 to 2006													
Commercial	(6.47%)	(8.02%)	(11.81%)	(9.37%)	(6.01%)	(9.66%)	(15.64%)	39.09%	24.52%	(15.72%)	(7.92%)	(0.84%)	(4.53%)
General Aviation[1]	3.62%	(9.34%)	(4.91%)	(1.71%)	(10.86%)	(0.56%)	(15.09%)	(9.52%)	2.03%	1.29%	(4.13%)	0.67%	(3.86%)
Military & Other	17.48%	(4.98%)	54.07%	9.32%	(18.91%)	(7.43%)	8.84%	17.34%	1.67%	58.52%	(4.07%)	-	(4.07%)
Total	(3.75%)	(8.34%)	(9.74%)	(5.59%)	(9.71%)	(5.58%)	(14.77%)	(7.30%)	3.93%	1.23%	(5.72%)	(0.72%)	(4.25%)
2006 Percent of Total	11.28%	8.03%	6.99%	5.69%	7.14%	5.68%	4.36%	4.59%	2.83%	12.92%	69.51%	30.49%	100.00%
2006 to 2007													
Commercial	(3.81%)	(0.93%)	2.69%	7.21%	(3.42%)	(3.81%)	(11.26%)	(16.64%)	7.26%	13.74%	(0.85%)	(1.01%)	(0.93%)
General Aviation[1]	(15.17%)	(9.90%)	(4.45%)	(10.82%)	6.86%	(14.43%)	(0.97%)	7.97%	4.00%	(3.92%)	(3.12%)	(8.94%)	(3.46%)
Military & Other	17.23%	5.68%	(12.74%)	(9.90%)	2.46%	(6.31%)	(18.41%)	44.33%	2.82%	0.35%	(0.77%)	-	(0.77%)
Total	(5.81%)	(3.06%)	0.64%	(1.60%)	1.96%	(8.74%)	(2.24%)	6.81%	4.10%	(3.57%)	(2.06%)	(1.62%)	(1.93%)
2007 Percent of Total	10.83%	7.94%	7.18%	5.71%	7.42%	5.29%	4.34%	5.00%	3.01%	12.70%	69.42%	30.58%	100.00%
2007 to 2008													
Commercial	(8.31%)	(9.23%)	(8.14%)	(1.49%)	(5.25%)	(14.57%)	(12.65%)	(19.26%)	(68.45%)	(97.01%)	(9.42%)	(6.23%)	(7.84%)
General Aviation[1]	(21.84%)	(15.29%)	(32.39%)	0.46%	(2.38%)	6.27%	(12.81%)	(28.60%)	15.00%	1.99%	(7.04%)	(16.81%)	(7.59%)
Military & Other	(28.64%)	(22.73%)	30.43%	(29.62%)	1.68%	(2.39%)	(74.26%)	0.80%	(0.30%)	10.57%	(5.36%)	-	(5.36%)
Total	(11.85%)	(10.60%)	(14.08%)	(1.18%)	(3.16%)	(3.17%)	(13.82%)	(27.76%)	2.81%	(0.01%)	(7.94%)	(6.99%)	(7.65%)
2008 Percent of Total	10.34%	7.69%	6.68%	6.11%	7.78%	5.54%	4.05%	3.91%	3.35%	13.75%	69.20%	30.80%	100.00%
2008 to 2009													
Commercial	(16.47%)	(14.86%)	(14.44%)	(12.06%)	(17.65%)	(14.51%)	(22.85%)	(1.02%)	(68.67%)	(100.00%)	(15.43%)	(4.23%)	(9.77%)
General Aviation[1]	(14.50%)	(0.16%)	(11.38%)	(20.07%)	(29.14%)	(27.94%)	(15.50%)	(4.71%)	(18.97%)	(9.44%)	(14.09%)	(48.61%)	(15.83%)
Military & Other	(25.05%)	39.04%	38.45%	(20.12%)	(10.94%)	(20.45%)	100.00%	(98.08%)	(14.29%)	(23.58%)	(17.42%)	-	(17.42%)
Total	(16.36%)	(11.67%)	(13.27%)	(15.63%)	(22.64%)	(21.78%)	(15.53%)	(6.27%)	(19.70%)	(9.63%)	(14.82%)	(7.08%)	(12.44%)
2009 Percent of Total	9.88%	7.76%	6.61%	5.88%	6.88%	4.95%	3.91%	4.19%	3.07%	14.19%	67.31%	32.69%	100.00%
2009 to 2010													
Commercial	(1.95%)	(3.38%)	(0.67%)	(2.43%)	(5.18%)	(1.79%)	3.39%	(35.54%)	259.24%	-	(2.27%)	1.47%	(0.27%)
General Aviation[1]	(4.22%)	8.53%	(5.00%)	(2.74%)	9.84%	2.99%	(15.48%)	0.34%	2.04%	8.91%	2.94%	19.93%	3.46%
Military & Other	11.08%	33.46%	(19.78%)	(42.67%)	(44.65%)	(4.56%)	(21.60%)	3264.71%	12.49%	47.74%	(7.50%)	-	(7.50%)
Total	(2.04%)	(0.44%)	(1.88%)	(3.06%)	(3.07%)	(0.87%)	(14.13%)	(0.45%)	7.59%	9.22%	0.26%	2.12%	0.87%
2010 Percent of Total	9.59%	7.65%	6.43%	5.65%	6.61%	4.87%	3.33%	4.13%	3.27%	15.37%	66.91%	33.09%	100.00%
2010 to 2011													
Commercial	7.98%	(4.88%)	(4.80%)	0.35%	(1.26%)	(0.08%)	5.19%	23.82%	13.26%	-	0.76%	0.83%	0.80%
General Aviation[1]	(12.13%)	3.21%	(8.35%)	(13.41%)	17.88%	(3.17%)	6.38%	5.27%	5.38%	(0.68%)	1.08%	92.28%	4.34%
Military & Other	19.88%	6.34%	(6.32%)	19.51%	23.32%	(14.85%)	(18.64%)	10.84%	5.85%	(21.50%)	(1.36%)	-	(1.36%)
Total	4.64%	(2.74%)	(5.53%)	(5.17%)	10.22%	(5.70%)	6.01%	6.03%	5.83%	(0.45%)	0.83%	4.63%	2.09%
2011 Percent of Total	9.83%	7.29%	5.95%	5.25%	7.13%	4.49%	3.46%	4.29%	3.39%	14.98%	66.08%	33.92%	100.00%

Table F-2 Percentage Change in Aircraft Operations by Classification for New England's Airports, 2000 to 2016

Airport	Bradley International	T.F. Green	Manchester-Boston Regional	Portland International Jetport	Burlington	Bangor	Tweed-New Haven	Worcester Regional	Portsmouth International	Hanscom Field[2]	Subtotal	Logan Airport[3]	Total
2011 to 2012													
Commercial	(8.22%)	(12.05%)	(11.68%)	(5.80%)	(7.20%)	(8.35%)	16.90%	(18.74%)	(70.76%)	-	(9.39%)	(4.11%)	(6.51%)
General Aviation[1]	(5.42%)	13.81%	0.06%	(2.75%)	(0.49%)	(7.35%)	2.52%	(3.17%)	11.57%	2.49%	1.62%	(0.41%)	1.49%
Military & Other	2.64%	17.62%	22.77%	9.57%	20.19%	(12.99%)	34.19%	16.72%	(2.95%)	(47.62%)	(2.33%)	-	(2.33%)
Total	(7.42%)	(4.82%)	(8.95%)	(4.51%)	(1.44%)	(9.21%)	4.07%	(3.57%)	4.53%	1.97%	(2.92%)	(3.83%)	(3.23%)
2012 Percent of Total	9.41%	7.17%	5.60%	5.18%	7.27%	4.22%	3.72%	4.28%	3.67%	15.79%	66.29%	33.71%	100.00%
2012 to 2013													
Commercial	(1.87%)	(3.90%)	(3.98%)	(6.17%)	(0.93%)	(0.80%)	4.01%	(3.23%)	11.55%	(60.16%)	(3.07%)	2.42%	0.00%
General Aviation[1]	(2.55%)	(0.21%)	(8.57%)	(4.04%)	(4.58%)	(14.02%)	(17.20%)	(22.90%)	(4.09%)	(6.75%)	(8.60%)	(5.09%)	(8.37%)
Military & Other	(31.35%)	0.23%	14.07%	(19.35%)	(1.51%)	(3.98%)	1.68%	(19.86%)	(4.35%)	(28.32%)	(6.98%)	-	(6.98%)
Total	(3.09%)	(2.66%)	(4.63%)	(5.49%)	(3.01%)	(7.01%)	(14.86%)	(22.13%)	(3.94%)	(7.05%)	(6.48%)	1.82%	(3.68%)
2013 Percent of Total	9.46%	7.25%	5.54%	5.09%	7.32%	4.07%	3.28%	3.46%	3.66%	15.23%	64.37%	35.63%	100.00%
2013 to 2014													
Commercial	1.08%	(8.25%)	(11.24%)	(4.95%)	(2.82%)	(1.90%)	17.12%	49.31%	1378.21%	1.19%	(0.57%)	0.81%	0.23%
General Aviation[1]	(2.90%)	19.25%	7.53%	(17.41%)	1.10%	0.08%	(8.76%)	(11.40%)	(15.58%)	(13.19%)	(7.78%)	(1.00%)	(7.32%)
Military & Other	4.18%	138.16%	(25.82%)	18.90%	(1.86%)	4.73%	25.06%	61.21%	0.63%	13.80%	4.60%	-	4.60%
Total	0.54%	1.87%	(7.74%)	(9.57%)	(0.60%)	0.62%	(5.15%)	(7.43%)	8.78%	(13.07%)	(4.42%)	0.68%	(2.60%)
2014 Percent of Total	9.77%	7.58%	5.25%	4.72%	7.47%	4.21%	3.20%	3.29%	4.08%	13.60%	63.17%	36.83%	100.00%
2014 to 2015													
Commercial	(3.33%)	(4.36%)	(1.59%)	2.97%	(3.37%)	(5.61%)	31.72%	1.94%	3.25%	(14.06%)	(1.69%)	2.19%	0.54%
General Aviation[1]	(2.37%)	(23.02%)	5.21%	8.35%	1.76%	6.04%	5.47%	22.56%	9.85%	(4.47%)	0.29%	6.62%	0.74%
Military & Other	0.56%	(58.49%)	(10.68%)	1.25%	(13.59%)	(7.63%)	29.49%	(7.01%)	(1.60%)	(1.66%)	(7.62%)	-	(7.62%)
Total	(3.08%)	(12.46%)	(0.13%)	4.86%	(1.48%)	(1.81%)	9.86%	20.18%	6.33%	(4.48%)	(0.92%)	2.51%	0.34%
2015 Percent of Total	9.44%	6.61%	5.23%	4.93%	7.33%	4.12%	3.50%	3.94%	4.33%	12.94%	62.37%	37.63%	100.00%
2015 to 2016													
Commercial	0.98%	2.93%	6.64%	5.77%	4.87%	7.23%	13.92%	8.37%	11.29%	20.91%	4.34%	4.55%	4.46%
General Aviation[1]	0.40%	14.68%	11.70%	2.33%	(7.12%)	2.90%	3.97%	(10.79%)	5.56%	(5.16%)	(1.45%)	9.28%	(0.64%)
Military & Other	18.58%	(7.67%)	(38.22%)	(13.93%)	3.42%	6.11%	(0.29%)	(12.26%)	9.23%	6.76%	5.05%	-	5.05%
Total	1.40%	6.93%	7.20%	4.28%	(2.11%)	5.19%	5.70%	(9.64%)	7.34%	(5.06%)	1.15%	4.90%	2.57%
2016 Percent of Total	9.33%	6.90%	5.46%	5.02%	7.00%	4.22%	3.61%	3.47%	4.53%	11.98%	61.51%	38.49%	100.00%

Source: Massport, Federal Aviation Administration (FAA) Tower Counts, and individual airport records.

1 Includes itinerant and local general aviation (GA) operations at the regional airports. There are no local (touch-and-go training) operations at Logan Airport.

2 Commercial operations at Hanscom Field include scheduled commercial operations only; other air taxi operations counted as GA.

3 Operations at Logan Airport include international operations.

Table F-3 Scheduled Passenger Operations by Market and Carrier for Bradley International Airport

				Departures											Departing Seats												
Carrier	Code	Market	Code	2000	2005	2010	2011	2012	2013	2014	2015	2016	'15-'16 Change	'15-'16 Pct. Change	2000	2004	2005	2009	2010	2011	2012	2013	2014	2015	2016	'15-'16 Change	'15-'16 Pct. Change
Jet Carriers																											
Aer Lingus		Dublin	DUB									66	66	-											11,657	11,657	-
Alaska	AS	Chicago O'Hare	ORD	30									-	-	4,050											-	-
America West	HP	Columbus	CMH	149									-	-	18,441											-	-
America West	HP	Las Vegas	LAS	210									-	-	27,469											-	-
America West	HP	Phoenix	PHX	275	365								-	-	37,772	51,960	54,570									-	-
American	AA	Charlotte	CLT							1,763	1,775	1,918	143	8.1%									257,645	244,756	278,511	33,755	13.8%
American	AA	Chicago O'Hare	ORD	2,139	1,570							240	240	-	304,855	265,113	203,929								35,717	35,717	-
American	AA	Dallas/Fort Worth	DFW	1,343	1,052	1,052	1,078	1,068	1,069	1,008	695	678	-17	-2.4%	185,922	180,987	136,897	154,343	160,983	172,457	170,811	171,017	157,952	103,576	101,001	-2,575	-2.5%
American	AA	Los Angeles	LAX	214					122	243		205	205	-	31,244							19,520	38,880		30,588	30,588	-
American	AA	Miami	MIA	366	365	413	516	366	396	476	400	365	-35	-8.8%	51,427	71,102	49,990	54,020	63,559	82,560	58,560	63,360	74,981	59,600	54,342	-5,258	-8.8%
American	AA	Philadelphia	PHL							265	31	271	240	774.2%									29,004	3,069	28,245	25,176	820.3%
American	AA	New York J F Kennedy	JFK										-	-												-	-
American	AA	San Juan	SJU	366	365	365	365	91					-	-	69,348	92,171	84,425	56,900	55,856	58,400	14,560					-	-
American	AA	St. Louis	STL										-	-												-	-
American	AA	Washington National	DCA							103	18	17	-1	-5.6%									12,536	2,196	1,680	-516	-23.5%
Boston-Maine Airways	E9	Fort Lauderdale/Hollywood	FLL		13								-	-			1,993									-	-
Continental	CO	Cleveland	CLE	582	131								-	-	68,974	15,985	16,262	9,203								-	-
Continental	CO	Houston Intercontinental	IAH	366	313								-	-	45,790	25,341	34,072									-	-
Continental	CO	New York Newark	EWR	331									-	-	38,916											-	-
Delta	DL	Atlanta	ATL	2,192	3,098	2,099	2,094	2,105	2,109	2,391	2,374	2,360	-14	-0.6%	392,835	450,671	479,098	300,052	300,185	310,149	317,331	319,290	355,968	354,751	354,943	192	0.1%
Delta	DL	Boston	BOS	4									-	-	634											-	-
Delta	DL	Cancun	CUN			35	35	17	13	17	35	39	4	11.4%				4,543	5,470	5,397	2,735	1,973	2,571	5,207	5,956	749	14.4%
Delta	DL	Cincinnati	CVG	1,464	1,373						4		-4	-100.0%	244,837	257,177	196,741	37,709						471		-471	-100.0%
Delta	DL	Detroit	DTW			1,003	658	506	753	1,053	1,375	1,366	-9	-0.7%				113,746	129,228	91,657	73,117	110,361	145,867	187,833	184,729	-3,104	-1.7%
Delta	DL	Fort Lauderdale/Hollywood	FLL	732	673	237	210						-	-	87,108	139,613	133,927	39,902	33,674	29,280						-	-
Delta	DL	Fort Myers	RSW			99	90						-	-				17,369	13,104	12,780						-	-
Delta	DL	Las Vegas	LAS			9							-	-					1,394							-	-
Delta	DL	Los Angeles	LAX		100	83							-	-			19,928		13,257							-	-
Delta	DL	Minneapolis	MSP			758	576	511	549	605	858	662	-196	-22.8%				84,739	99,431	79,418	75,291	82,545	87,377	114,722	96,039	-18,683	-16.3%
Delta	DL	New York J F Kennedy	JFK	183									-	-	39,894											-	-
Delta	DL	Orlando	MCO	1,838	1,095	261	608		57			4	4	-	218,705	203,634	217,905	93,534	99,129	88,041		8,514			471	471	-
Delta	DL	Salt Lake City	SLC		27								-	-			3,986									-	-
Delta	DL	Tampa	TPA		678	813	120						-	-		131,795	134,894	58,210	33,625	15,420						-	-
Delta	DL	West Palm Beach	PBI	732	516	205	120						-	-	87,108	106,806	102,684	48,132	37,536	16,500						-	-
Frontier Airlines	F9	Denver	DEN										-	-												-	-
jetBlue	B6	Washington National	DCA							402	730	714	-16	-2.2%									40,229	85,300	77,600	-7,700	-9.0%
jetBlue	B6	Fort Lauderdale/Hollywood	FLL			101	599	627	612	590	590	568	-22	-3.7%					15,086	90,231	94,029	91,800	87,836	88,479	85,264	-3,215	-3.6%
jetBlue	B6	Fort Myers	RSW						61	181	212	242	30	14.2%								9,150	27,150	31,800	36,300	4,500	14.2%
jetBlue	B6	Orlando	MCO			101	730	723	730	747	730	746	16	2.2%					15,086	109,860	108,300	109,500	112,071	109,500	111,100	1,600	1.5%
jetBlue	B6	San Juan	SJU					366	365	405	465	561	96	20.6%							54,900	54,793	60,729	69,686	84,150	14,464	20.8%
jetBlue	B6	Tampa	TPA						61	365	365	365	-	0.0%								9,150	44,693	48,750	54,750	6,000	12.3%
jetBlue	B6	West Palm Beach	PBI					366	365	365	365	387	22	6.0%							45,700	54,750	44,907	45,550	51,929	6,379	14.0%
Laker Airways (Bahamas)	7Z	Freeport	FPO	39									-	-	5,850	3,900										-	-
Midway Airlines	JI	Raleigh/Durham	RDU	683									-	-	69,213											-	-
Midwest/Republic	YX	Milwaukee	MKE	619									-	-	44,455											-	-
Northwest	NW	Amsterdam	AMS										-	-												-	-
Northwest	NW	Detroit	DTW	1,699	1,451								-	-	215,750	204,604	192,679									-	-
Northwest	NW	Fort Myers	RSW										-	-												-	-
Northwest	NW	Minneapolis	MSP	1,177	1,042								-	-	135,570	149,646	140,194									-	-
Northwest	NW	Orlando	MCO										-	-												-	-
Northwest	NW	Tampa	TPA										-	-												-	-
Northwest	NW	West Palm Beach	PBI										-	-												-	-
Southwest	WN	Atlanta	ATL						174	1,086	172		-172	-100.0%								20,391	131,627	24,482		-24,482	-100.0%
Southwest	WN	Baltimore	BWI	2,841	3,094	2,700	2,708	2,658	2,610	2,448	2,435	2,514	79	3.2%	389,158	419,083	423,878	371,357	367,534	367,414	362,995	372,650	353,791	353,038	372,278	19,240	5.4%
Southwest	WN	Chicago Midway	MDW	723	953	923	979	964	967	961	974	966	-8	-0.9%	99,090	97,309	130,541	128,780	126,412	133,267	133,533	146,270	142,513	147,672	148,701	1,029	0.7%
Southwest	WN	Denver	DEN			306	365	366	365	374	374	374	0	0.1%					41,922	50,005	50,982	54,860	58,570	61,917	60,234	-1,683	-2.7%
Southwest	WN	Fort Lauderdale/Hollywood	FLL			70	365	366	348	369	387	387	0	0.1%					9,551	50,005	50,272	49,521	53,381	57,309	56,240	-1,069	-1.9%
Southwest	WN	Fort Myers	RSW					147	203	216	212	212	-	0.0%							20,413	28,917	30,949	30,586	30,586	0	0.0%
Southwest	WN	Las Vegas	LAS	52	365	361	365	270	245	245	306	306	-	0.0%	7,163	51,336	50,005	50,005	49,398	50,005	40,466	34,876	35,035	44,037	46,551	2,514	5.7%
Southwest	WN	Nashville	BNA	672	365	361	304						-	-	92,064	50,142	50,005	50,005	49,398	41,648						-	-
Southwest	WN	Orlando	MCO	375	1,108	1,016	1,003	997	944	975	1,003	999	-4	-0.4%	51,336	114,082	151,816	143,459	139,212	137,411	137,843	136,115	140,866	151,806	156,562	4,756	3.1%
Southwest	WN	Philadelphia	PHL		1,590								-	-		40,591	217,850									-	-

Table F-3 Scheduled Passenger Operations by Market and Carrier for Bradley International Airport

				Departures											Departing Seats												
Carrier	Code	Market	Code	2000	2005	2010	2011	2012	2013	2014	2015	2016	'15-'16 Change	'15-'16 Pct. Change	2000	2004	2005	2009	2010	2011	2012	2013	2014	2015	2016	'15-'16 Change	'15-'16 Pct. Change
Southwest	WN	Tampa	TPA		695	570	656	623	629	656	651	642	-9	-1.4%		52,530	95,156	58,362	78,129	89,852	85,873	90,219	93,662	93,905	93,646	-259	-0.3%
Southwest	WN	West Palm Beach	PBI				61				4	4	-	0.0%						8,357				633	633	-	0.0%
Sunworld International	SM	Philadelphia	PHL										-	-												-	-
Trans World Airlines	TW	Portland (ME)	PWM	305									-	-	43,310											-	-
Trans World Airlines	TW	St. Louis	STL	1,460									-	-	206,109											-	-
United	UA	Chicago O'Hare	ORD	2,034	1,812	1,296	1,077	697	593	800	554	605	51	9.2%	299,522	317,682	259,437	200,920	198,709	159,738	104,725	86,911	112,864	72,529	84,972	12,443	17.2%
United	UA	Denver	DEN	366								275	275	-	46,901										36,838	36,838	-
United	UA	New York Newark	EWR						18				-	-								2,126				-	-
United	UA	San Francisco	SFO	366									-	-	45,384											-	-
United	UA	Washington Dulles	IAD	1,455	726	1,192	812	514	180	222	82	472	390	475.6%	173,869	63,854	81,631	131,883	155,750	108,500	66,780	25,418	32,132	11,182	73,998	62,816	561.8%
US Airways	US	Baltimore	BWI	488									-	-	41,760											-	-
US Airways	US	Charlotte	CLT	1,464	2,188	1,588	1,664	1,665	1,734				-	-	214,719	229,826	350,776	146,512	228,119	238,508	241,320	255,885				-	-
US Airways	US	Fort Lauderdale/Hollywood	FLL	366	123								-	-	39,232	1,272	15,161									-	-
US Airways	US	Orlando	MCO	1,098	30								-	-	117,696	5,986	3,842									-	-
US Airways	US	Philadelphia	PHL	2,148	2,102	361	317	340	365				-	-	310,118	267,741	301,242	58,153	49,914	44,595	46,989	49,083				-	-
US Airways	US	Phoenix	PHX										-	-												-	-
US Airways	US	Pittsburgh	PIT	1,800	27								-	-	278,575	157,633	3,189									-	-
US Airways	US	Washington Dulles	IAD	732									-	-	86,376											-	-
US Airways	US	Washington National	DCA	1,329	1,064	361	365	335	208				-	-	171,891	141,901	141,068	84,917	51,434	52,210	46,511	25,610				-	-
US Airways	US	West Palm Beach	PBI	366									-	-	39,232											-	-
USA 3000 Airlines	U5	Cancun	CUN		26								-	-			4,336									-	-
USA 3000 Airlines	U5	Punta Cana	PUJ		13								-	-			2,128									-	-
Subtotal				38,171	30,507	18,695	18,841	16,686	16,845	19,331	18,175	19,530	1,354	7.5%	5,179,671	4,361,471	4,486,236	2,496,754	2,622,086	2,693,666	2,404,036	2,484,577	2,765,786	2,604,342	2,846,211	241,870	9.3%
Regional/Commuter Carriers																											
Air Canada Express	AC	Montreal Dorval	YUL	1,385	1,038	1,021	986	976	952	996	1,008	1,038	30	3.0%	19,392	21,557	19,475	19,157	19,399	18,739	18,549	17,144	17,925	18,141	18,692	551	3.0%
Air Canada Express	AC	Toronto	YYZ	1,589	1,342	1,287	1,308	1,294	1,295	1,313	1,395	1,399	4	0.3%	61,991	35,666	38,242	38,410	36,960	38,342	33,044	28,103	25,102	25,118	35,328	10,210	40.6%
America West Express	HP	Columbus	CMH	450									-	-	22,493											-	-
American Connection	AA	St. Louis	STL		947								-	-		32,571	44,356	9,240								-	-
American Eagle	AA	Charlotte	CLT							366	290	156	-134	-46.1%									28,940	22,265	11,774	-10,491	-47.1%
American Eagle	AA	Chicago O'Hare	ORD			1,501	1,630	1,613	1,630	1,622	1,604	1,421	-183	-11.4%		416		50,374	79,594	95,985	80,413	90,663	115,856	115,366	93,468	-21,898	-19.0%
American Eagle	AA	New York J F Kennedy	JFK	1,460									-	-	48,166											-	-
American Eagle	AA	Philadelphia	PHL							2,234	2,502	2,133	-369	-14.8%									136,683	146,222	123,285	-22,937	-15.7%
American Eagle	AA	Pittsburgh	PIT							939	782		-782	-100.0%									67,549	39,086		-39,086	-100.0%
American Eagle	AA	Raleigh/Durham	RDU		1,364	257							-	-		46,535	54,521	45,154	10,774							-	-
American Eagle	AA	St. Louis	STL										-	-				4,600								-	-
American Eagle	AA	Washington National	DCA							2,119	2,125	2,251	126	5.9%									141,783	130,975	142,309	11,334	8.7%
Continental Connection	CO	Albany	ALB		51								-	-		16,337	961									-	-
Continental Connection	CO	Binghamton	BGM										-	-												-	-
Continental Connection	CO	Boston	BOS										-	-												-	-
Continental Connection	CO	Buffalo	BUF	89									-	-	1,683											-	-
Continental Connection	CO	Burlington	BTV	4									-	-	84											-	-
Continental Connection	CO	New York J F Kennedy	JFK										-	-												-	-
Continental Connection	CO	New York Newark	EWR			608							-	-				13,859	22,485							-	-
Continental Connection	CO	Philadelphia	PHL										-	-												-	-
Continental Connection	CO	Rochester	ROC	93									-	-	1,767											-	-
Continental Connection	CO	Syracuse	SYR	97									-	-	1,851											-	-
Continental Express	CO	Cleveland	CLE	803	1,102	1,208							-	-	39,357	56,179	54,951	58,179	60,400							-	-
Continental Express	CO	New York Newark	EWR	1,747	1,351	465							-	-	82,365	68,285	67,455	42,029	23,264							-	-
Delta Connection	DL	Atlanta	ATL				48	9	4	4	4		-4	-100.0%						3,396	647	279	288	326		-326	-100.0%
Delta Connection	DL	Cincinnati	CVG			1,218	1,251	902	895	839	475	300	-175	-36.8%				60,954	61,642	66,559	45,181	44,757	43,557	25,537	22,800	-2,737	-10.7%
Delta Connection	DL	Cleveland	CLE							170	243	266	23	9.5%									11,898	15,450	19,798	4,348	28.1%
Delta Connection	DL	Columbus	CMH		994								-	-		4,650	49,196									-	-
Delta Connection	DL	Detroit	DTW			1,004	1,323	1,429	1,195	659	313	264	-49	-15.7%				53,556	54,265	82,915	100,525	80,351	45,421	20,860	18,905	-1,955	-9.4%
Delta Connection	DL	Fort Lauderdale/Hollywood	FLL										-	-												-	-
Delta Connection	DL	Fort Myers	RSW		612								-	-			42,840									-	-
Delta Connection	DL	Indianapolis	IND										-	-				3,857								-	-
Delta Connection	DL	Minneapolis	MSP			481	814	858	812	738	342	539	197	57.6%				34,895	36,567	61,731	64,643	61,035	55,233	25,556	40,845	15,289	59.8%
Delta Connection	DL	Myrtle Beach	MYR	61									-	-	3,057											-	-
Delta Connection	DL	New York J F Kennedy	JFK			365	304	183					-	-				39,736	18,250	15,200	9,216					-	-
Delta Connection	DL	Orlando	MCO							43	35	8	-27	-77.1%									3,156	2,354	641	-1,713	-72.8%
Delta Connection	DL	Raleigh/Durham	RDU			100	569	454	270	257	261	253	-8	-3.1%					6,136	28,436	22,686	13,500	12,850	17,611	18,054	443	2.5%
Delta Connection	DL	Tampa	TPA										-	-												-	-
Delta Connection	DL	Washington National	DCA			166	929	360					-	-					11,324	51,524	18,074					-	-
Delta Connection	DL	West Palm Beach	PBI										-	-												-	-
Frontier Express	F9	Milwaukee	MKE			140	417						-	-					6,313	18,746						-	-
Independence Air	DH	Washington Dulles	IAD		1,966								-	-		57,714	98,307									-	-
Midway Airlines	JI	Raleigh/Durham	RDU	1,348									-	-	67,393											-	-
Midwest Connect	YX	Milwaukee	MKE	4	965								-	-	142	30,117	30,871									-	-

Table F-3 Scheduled Passenger Operations by Market and Carrier for Bradley International Airport

				Departures											Departing Seats												
Carrier	**Code**	**Market**	**Code**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**'15-'16 Change**	**'15-'16 Pct. Change**	**2000**	**2004**	**2005**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**'15-'16 Change**	**'15-'16 Pct. Change**
Northwest Airlink	NW	Detroit	DTW										-	-												-	-
Northwest Airlink	NW	Indianapolis	IND		638								-	-		5,664	31,907									-	-
Northwest Airlink	NW	Memphis	MEM										-	-												-	-
Northwest Airlink	NW	Minneapolis	MSP		31								-	-			1,550									-	-
OneJet		Pittsburgh	PIT									289	289	-											2,597	2,597	-
Shuttle America	S5	Albany	ALB	66									-	-	3,286											-	-
Shuttle America	S5	Bedford	BED	233									-	-	11,671											-	-
Shuttle America	S5	Buffalo	BUF	337									-	-	16,857											-	-
Shuttle America	S5	Islip	ISP	27									-	-	1,329											-	-
Shuttle America	S5	Wilmington	ILG	159									-	-	7,936											-	-
Swissair	SR	New York J F Kennedy	JFK	31									-	-	1,023											-	-
Trans World Airlines	TW	New York J F Kennedy	JFK	1,098									-	-	31,842											-	-
United Express	UA	Chicago O'Hare	ORD		691	548	685	1,038	1,045	877	904	696	-208	-23.0%		24,456	48,370	26,387	36,797	43,701	63,807	59,896	47,419	60,980	45,255	-15,725	-25.8%
United Express	UA	Cleveland	CLE				1,200	1,125	1,127	235			-	-						59,979	55,744	56,436	11,750			-	-
United Express	UA	Houston	IAH							96	365	361	-4	-1.1%									7,521	26,998	25,240	-1,758	-6.5%
United Express	UA	New York Newark	EWR				1,159	1,347	1,269	853	1,335	1,357	22	1.6%						46,231	56,787	61,339	38,317	65,086	69,442	4,356	6.7%
United Express	UA	Washington Dulles	IAD		1,519	494	889	928	1,280	1,224	1,243	870	-373	-30.0%		84,513	84,484	46,746	30,270	54,707	59,507	72,861	68,684	77,783	56,035	-21,748	-28.0%
US Airways Express	US	Baltimore	BWI	1,185									-	-	43,850											-	-
US Airways Express	US	Buffalo	BUF	1,032	839								-	-	38,200	32,121	28,607									-	-
US Airways Express	US	Charlotte	CLT		4	537	452	462	364				-	-		650	221	86,653	45,043	37,510	39,235	28,392				-	-
US Airways Express	US	New York La Guardia	LGA			139	1,057	364					-	-					5,159	39,098	13,468					-	-
US Airways Express	US	New York Newark	EWR										-	-												-	-
US Airways Express	US	Philadelphia	PHL		439	2,404	2,430	2,356	2,260				-	-		9,500	27,685	148,400	183,838	163,675	151,526	133,663				-	-
US Airways Express	US	Pittsburgh	PIT		1,646	939	939	941	939				-	-		9,247	84,598	46,929	46,929	46,929	47,057	77,901				-	-
US Airways Express	US	Rochester	ROC	937	574	478							-	-	34,658	21,280	19,555	19,501	16,242							-	-
US Airways Express	US	Syracuse	SYR	732	478								-	-	27,084	11,093	9,077									-	-
US Airways Express	US	Washington National	DCA		551	1,334	1,411	1,574	1,825				-	-		19,813	34,454	60,107	89,629	89,940	109,321	115,989				-	-
Subtotal				14,968	19,143	16,694	19,799	18,212	17,164	15,584	15,226	13,601	-1,625	-10.7%	567,477	588,364	871,682	908,722	901,282	1,063,342	989,430	942,310	879,932	835,714	744,468	-91,246	-10.9%
													-	-												-	-
Total				53,139	49,651	35,389	38,640	34,898	34,009	34,915	33,402	33,131	-271	-0.8%	5,747,148	4,949,835	5,357,918	3,405,476	3,523,368	3,757,008	3,393,466	3,426,886	3,645,718	3,440,056	3,590,679	150,624	4.4%

Source: OAG Schedules.

Notes:

All Northwest Airlines operations included in Delta Air Lines from 2009 onwars (following 2008 merger)

All Continental Airlines operations included in United Airlines from 2011 onwards (following 2010 merger)

All AirTran Airways operations included in Southwest Airlines from 2012 onwards (following 2011 merger)

All US Airways operations included in American Airlines from 2014 onwards (following 2013 merger)

Table F-4 Scheduled Passenger Operations by Market and Carrier for T.F. Green Airport

Departures

Carrier	Market	Code	2000	2001	2003	2004	2005	2010	2011	2012	2013	2014	2015	2016	'15-'16 Change	'15-'16 Pct. Change
Jet Carriers																
American	Charlotte	CLT										1,275	1,176	1,274	98	8.3%
American	Chicago O'Hare	ORD	1,464	1,460	1,421	1,609	1,113								-	-
American	Dallas/Fort Worth	DFW			61	366	365								-	-
American	Philadelphia	PHL										347	366	520	154	42.1%
American	Washington National	DCA										77	52		-52	-100.0%
Continental	Cleveland	CLE	569	167	13	131	13								-	-
Continental	Houston Intercontinental	IAH	366	243											-	-
Continental	New York Newark	EWR	738	1,170	450	331	282								-	-
Condor	Frankfurt	FRA											22	18	-4	-18.2%
Delta	Atlanta	ATL	1,464	1,460	1,825	1,830	1,976	510	1,043	990	978	993	997	1,060	63	6.3%
Delta	Cincinnati	CVG	732	730	730	732	695								-	-
Delta	Detroit	DTW						414	58		218	476	707	719	12	1.7%
Delta	Fort Lauderdale/Hollywood	FLL		306											-	-
Delta	Minneapolis	MSP						74							-	-
Delta	Orlando	MCO	732	730	424										-	-
jetBlue	Fort Lauderdale/Hollywood	FLL								31	365	365	365	365	-	0.0%
jetBlue	Orlando	MCO								62	713	713	713	713	0	0.1%
Laker Airways (Bahamas)	Freeport	FPO				9									-	-
Northwest	Detroit	DTW	1,682	1,631	1,513	1,512	1,550								-	-
Northwest	Minneapolis	MSP			726	641	539								-	-
Sata Internacional	Ponta Delgada	PDL				17								9	9	-
Southwest	Baltimore	BWI	3,913	3,877	4,043	4,222	4,180	3,260	3,043	3,128	3,004	2,820	2,793	2,793	0	0.0%
Southwest	Chicago Midway	MDW	1,072	1,022	1,056	1,089	1,349	1,135	1,095	1,094	992	975	988	996	8	0.9%
Southwest	Denver	DEN								366	304	9			-	-
Southwest	Fort Lauderdale/Hollywood	FLL	9	30		26		594	590	500	479	474	477	485	8	1.7%
Southwest	Fort Myers	RSW								86	40	44	48	52	4	8.0%
Southwest	Houston	HOU	152												-	-
Southwest	Islip	ISP	608	1,369											-	-
Southwest	Kansas City	MCI	366	365	365	366	365								-	-
Southwest	Las Vegas	LAS				9	31	365	365	362					-	-
Southwest	Nashville	BNA	706	700	708	706	721	296	123						-	-
Southwest	Orlando	MCO	955	1,095	1,460	1,586	1,821	1,799	1,659	1,585	1,423	1,419	1,464	1,469	5	0.3%
Southwest	Philadelphia	PHL				1,199	1,773	1,402	1,298						-	-
Southwest	Phoenix	PHX	366	703	730	732	726	361	365						-	-
Southwest	Tampa	TPA	745	730	1,095	1,085	1,086	813	808	763	753	748	735	713	-22	-3.0%
Southwest	West Palm Beach	PBI									31	35	31	31	-	0.0%
Southwest	Washington National	DCA												122	122	-
Spirit Airlines	Detroit	DTW				61	120								-	-
Spirit Airlines	Fort Lauderdale/Hollywood	FLL				131	568								-	-
Spirit Airlines	Fort Myers	RSW				70	365								-	-
TACV	Praia	RAI											39	74	35	89.7%
United	Chicago O'Hare	ORD	1,477	1,491	1,666	1,555	1,460	644	626	388	334	320	144	236	92	63.9%
US Airways	Baltimore	BWI	2,462	2,101											-	-
US Airways	Charlotte	CLT	977	1,309	1,513	1,582	1,858	1,643	1,599	1,726	1,608				-	-
US Airways	Fort Lauderdale/Hollywood	FLL				31	17								-	-
US Airways	Orlando	MCO	52	48		48	43								-	-
US Airways	Philadelphia	PHL	1,830	1,794	1,738	2,416	2,182	1,299	1,012	399	313				-	-
US Airways	Pittsburgh	PIT	1,339	1,460	1,165	1,290	31								-	-
US Airways	Washington National	DCA	1,333	1,147	1,390	1,107	1,270	365	313	182	124				-	-
Subtotal			26,108	27,136	24,093	26,488	26,499	14,974	13,998	11,661	11,677	11,090	11,116	11,649	533	4.8%

Departing Seats

Carrier	Market	Code	2000	2004	2005	2010	2011	2012	2013	2014	2015	2016	'15-'16 Change	'15-'16 Pct. Change
Jet Carriers														
American	Charlotte	CLT								196,644	170,310	189,856	19,546	11.5%
American	Chicago O'Hare	ORD	203,104	207,543	143,522								-	-
American	Dallas/Fort Worth	DFW		47,214	47,085								-	-
American	Philadelphia	PHL								34,381	36,514	50,988	14,474	39.6%
American	Washington National	DCA								9,566	6,483		-6,483	-100.0%
Continental	Cleveland	CLE	69,771	15,622	1,630								-	-
Continental	Houston Intercontinental	IAH	45,946										-	-
Continental	New York Newark	EWR	96,448	38,535	34,808								-	-
Condor	Frankfurt	FRA									5,940	4,783	-1,157	-19.5%
Delta	Atlanta	ATL	207,888	289,611	290,915	72,461	150,526	147,729	145,241	148,012	148,078	156,507	8,429	5.7%
Delta	Cincinnati	CVG	103,944	103,944	89,235								-	-
Delta	Detroit	DTW				50,065	7,139		30,414	62,046	87,078	91,281	4,203	4.8%
Delta	Fort Lauderdale/Hollywood	FLL											-	-
Delta	Minneapolis	MSP				9,211							-	-
Delta	Orlando	MCO	87,108										-	-
jetBlue	Fort Lauderdale/Hollywood	FLL						4,650	54,750	54,750	54,750	54,750	-	0.0%
jetBlue	Orlando	MCO						9,300	103,786	106,886	106,886	106,886	0	0.0%
Laker Airways (Bahamas)	Freeport	FPO		1,329									-	-
Northwest	Detroit	DTW	200,509	203,837	202,255								-	-
Northwest	Minneapolis	MSP		85,995	68,977								-	-
Sata Internacional	Ponta Delgada	PDL		3,486								1,966	1,966	-
Southwest	Baltimore	BWI	535,911	578,063	572,699	442,637	415,554	433,081	429,658	411,154	407,651	414,057	6,406	1.6%
Southwest	Chicago Midway	MDW	146,844	149,232	184,813	153,121	149,877	150,303	154,633	156,543	158,640	153,783	-4,857	-3.1%
Southwest	Denver	DEN						51,110	44,281	1,246			-	-
Southwest	Fort Lauderdale/Hollywood	FLL	1,194	3,562		81,378	80,791	68,347	70,413	68,401	70,778	74,477	3,699	5.2%
Southwest	Fort Myers	RSW						11,743	5,520	6,292	7,305	7,918	613	8.4%
Southwest	Houston	HOU	20,824										-	-
Southwest	Islip	ISP	83,237										-	-
Southwest	Kansas City	MCI	50,142	50,142	50,005								-	-
Southwest	Las Vegas	LAS		1,194	4,247	50,005	50,005	49,932					-	-
Southwest	Nashville	BNA	96,702	96,722	98,816	39,578	16,067						-	-
Southwest	Orlando	MCO	130,855	217,302	249,418	245,156	225,244	216,998	210,082	204,947	215,253	219,994	4,741	2.2%
Southwest	Philadelphia	PHL		164,224	238,366	192,054	177,001						-	-
Southwest	Phoenix	PHX	50,142	100,284	99,403	49,398	50,005						-	-
Southwest	Tampa	TPA	102,065	148,625	148,821	111,231	109,572	104,140	107,959	107,481	108,451	107,723	-728	-0.7%
Southwest	West Palm Beach	PBI							4,433	5,046	4,433	4,433	-	0.0%
Southwest	Washington National	DCA										19,119	19,119	-
Spirit Airlines	Detroit	DTW		9,150	18,000								-	-
Spirit Airlines	Fort Lauderdale/Hollywood	FLL		19,586	84,117								-	-
Spirit Airlines	Fort Myers	RSW		10,436	54,750								-	-
TACV	Praia	RAI									7,739	14,578	6,839	88.4%
United	Chicago O'Hare	ORD	239,076	234,843	200,677	82,802	78,487	48,697	46,258	42,658	17,570	31,940	14,370	81.8%
US Airways	Baltimore	BWI	263,921										-	-
US Airways	Charlotte	CLT	128,984	223,314	274,039	233,886	226,854	238,503	225,454				-	-
US Airways	Fort Lauderdale/Hollywood	FLL		3,941	2,186								-	-
US Airways	Orlando	MCO	5,605	6,126	5,831								-	-
US Airways	Philadelphia	PHL	253,015	345,461	312,890	130,008	101,987	39,529	30,973				-	-
US Airways	Pittsburgh	PIT	185,109	174,598	4,446								-	-
US Airways	Washington National	DCA	167,278	149,503	170,009	49,501	44,006	24,350	14,997				-	-
Subtotal			3,475,622	3,683,422	3,651,961	1,992,492	1,883,114	1,598,412	1,678,851	1,616,053	1,613,859	1,705,039	91,180	5.6%

Table F-4 Scheduled Passenger Operations by Market and Carrier for T.F. Green Airport

Departures

Carrier	Market	Code	2000	2001	2003	2004	2005	2010	2011	2012	2013	2014	2015	2016	'15-'16 Change	'15-'16 Pct. Change
Regional/Commuter Carriers																
Air Canada Express	Toronto	YYZ	989	991	906	798	734	625	591	593	84				-	-
American Eagle	Charlotte	CLT										175	341	301	-40	-11.7%
American Eagle	Chicago O'Hare	ORD												550	550	-
American Eagle	Detroit	DTW								12					-	-
American Eagle	New York J F Kennedy	JFK	1,291	1,404	330										-	-
American Eagle	New York La Guardia	LGA	2,756	1,788											-	-
American Eagle	Raleigh/Durham	RDU				643	343								-	-
American Eagle	Philadelphia	PHL										2,213	2,163	1,982	-181	-8.4%
American Eagle	Washington National	DCA										1,609	1,755	2,112	357	20.3%
Cape Air	Block Island	BID										538	418		-418	-100.0%
Cape Air	Hyannis	HYA													-	-
Cape Air	Martha's Vineyard	MVY	1,762	1,871	1,502	1,960	1,015	747	672	659	501	285	192		-192	-100.0%
Cape Air	Nantucket	ACK	2,453	2,653	1,975	2,765	1,199	681	668	576	501	271	244		-244	-100.0%
Continental Connection	Albany	ALB		944	863	702	51								-	-
Continental Connection	Boston	BOS		51											-	-
Continental Connection	New York Newark	EWR						427							-	-
Continental Connection	Plattsburgh	PLB		22											-	-
Continental Connection	Washington Dulles	IAD													-	-
Continental Express	Cleveland	CLE	699	1,190	1,200	1,119	1,238	1,217							-	-
Continental Express	New York Newark	EWR	1,482	465	1,019	1,395	1,455	1,028							-	-
Delta Connection	Atlanta	ATL					31	724	9	43	70	51	43		-43	-100.0%
Delta Connection	Cincinnati	CVG		275	334	335	373	43							-	-
Delta Connection	Detroit	DTW						1,324	1,995	2,054	1,748	871	289	324	35	12.1%
Delta Connection	Minneapolis	MSP						347	392	266	240	170			-	-
Delta Connection	New York J F Kennedy	JFK													-	-
Delta Connection	New York La Guardia	LGA	610	155											-	-
Delta Connection	Raleigh/Durham	RDU							131						-	-
Delta Connection	Washington National	DCA							685	225					-	-
Independence Air	Washington Dulles	IAD				875	1,509								-	-
Midway Airlines	Raleigh/Durham	RDU		510											-	-
Northwest Airlink	Detroit	DTW													-	-
Northwest Airlink	Minneapolis	MSP		302	40	79	31								-	-
United Express	Chicago O'Hare	ORD				214	262	455	375	309	306	325	605	464	-141	-23.3%
United Express	Cleveland	CLE							1,079	886	875	102			-	-
United Express	New York Newark	EWR							1,439	1,346	1,213	994	1,356	1,355	-1	-0.1%
United Express	Washington Dulles	IAD	1,468	1,507	1,460	1,876	1,716	1,569	1,421	1,157	1,035	1,031	837	886	49	5.9%
US Airways Express	Albany	ALB	679												-	-
US Airways Express	Boston	BOS	48												-	-
US Airways Express	Charlotte	CLT				13	18	126	147	65	166				-	-
US Airways Express	Hyannis	HYA			17										-	-
US Airways Express	Nantucket	ACK			9										-	-
US Airways Express	New York La Guardia	LGA	2,298	2,233	1,876	1,808	1,669	1,222	957	286					-	-
US Airways Express	New York Newark	EWR	1,569	1,507											-	-
US Airways Express	Philadelphia	PHL	366	365	9	22	716	1,526	1,713	2,206	2,347				-	-
US Airways Express	Pittsburgh	PIT				183	1,360								-	-
US Airways Express	Plattsburgh	PLB	26												-	-
US Airways Express	Washington National	DCA				143	482	1,373	1,304	1,479	1,492				-	-
Subtotal			18,527	18,233	11,538	14,930	14,200	13,436	13,577	12,161	10,577	8,635	8,243	7,974	-269	-3.3%
															-	-
Total			44,635	45,369	35,631	41,419	40,699	28,409	27,575	23,822	22,255	19,725	19,359	19,623	264	1.4%

Departing Seats

Carrier	Market	Code	2000	2004	2005	2010	2011	2012	2013	2014	2015	2016	'15-'16 Change	'15-'16 Pct. Change
Regional/Commuter Carriers														
Air Canada Express	Toronto	YYZ	37,482	14,364	13,783	11,880	11,232	11,262	1,517				-	-
American Eagle	Charlotte	CLT								13,971	26,810	25,452	-1,358	-5.1%
American Eagle	Chicago O'Hare	ORD										34,650	34,650	-
American Eagle	Detroit	DTW						808					-	-
American Eagle	New York J F Kennedy	JFK	42,589										-	-
American Eagle	New York La Guardia	LGA	90,957										-	-
American Eagle	Raleigh/Durham	RDU		25,643	13,081								-	-
American Eagle	Philadelphia	PHL								150,139	142,721	127,895	-14,826	-10.4%
American Eagle	Washington National	DCA								111,183	111,865	138,655	26,790	23.9%
Cape Air	Block Island	BID								4,846	3,765		-3,765	-100.0%
Cape Air	Hyannis	HYA											-	-
Cape Air	Martha's Vineyard	MVY	15,861	17,640	9,132	6,722	6,048	5,930	4,513	2,561	1,725		-1,725	-100.0%
Cape Air	Nantucket	ACK	22,073	24,885	10,787	6,128	6,012	5,181	4,510	2,438	2,196		-2,196	-100.0%
Continental Connection	Albany	ALB		13,335	961								-	-
Continental Connection	Boston	BOS											-	-
Continental Connection	New York Newark	EWR				31,630							-	-
Continental Connection	Plattsburgh	PLB											-	-
Continental Connection	Washington Dulles	IAD											-	-
Continental Express	Cleveland	CLE	34,936	55,900	61,900	60,836							-	-
Continental Express	New York Newark	EWR	86,552	67,702	71,185	51,407							-	-
Delta Connection	Atlanta	ATL			1,550	52,959	662	3,279	4,522	3,380	3,001		-3,001	-100.0%
Delta Connection	Cincinnati	CVG		16,750	19,109	2,150							-	-
Delta Connection	Detroit	DTW				78,701	111,901	113,630	90,191	45,809	18,671	22,103	3,432	18.4%
Delta Connection	Minneapolis	MSP				26,192	29,553	20,189	17,380	12,878			-	-
Delta Connection	New York J F Kennedy	JFK											-	-
Delta Connection	New York La Guardia	LGA	19,520										-	-
Delta Connection	Raleigh/Durham	RDU					6,557						-	-
Delta Connection	Washington National	DCA					34,243	11,271					-	-
Independence Air	Washington Dulles	IAD		43,764	75,429								-	-
Midway Airlines	Raleigh/Durham	RDU											-	-
Northwest Airlink	Detroit	DTW											-	-
Northwest Airlink	Minneapolis	MSP		3,943	1,550								-	-
United Express	Chicago O'Hare	ORD		10,700	18,330	29,820	24,079	19,900	19,896	19,443	34,473	24,750	-9,723	-28.2%
United Express	Cleveland	CLE					53,943	42,991	43,757	5,100			-	-
United Express	New York Newark	EWR					69,724	61,168	65,636	57,558	73,682	64,804	-8,878	-12.0%
United Express	Washington Dulles	IAD	52,832	93,779	85,821	99,719	89,593	73,470	65,632	67,077	52,139	55,328	3,189	6.1%
US Airways Express	Albany	ALB	12,898										-	-
US Airways Express	Boston	BOS	909										-	-
US Airways Express	Charlotte	CLT		657	879	10,047	12,035	5,423	12,857				-	-
US Airways Express	Hyannis	HYA											-	-
US Airways Express	Nantucket	ACK											-	-
US Airways Express	New York La Guardia	LGA	84,116	50,163	55,077	45,225	33,141	10,582					-	-
US Airways Express	New York Newark	EWR	31,176										-	-
US Airways Express	Philadelphia	PHL	13,542	1,324	45,199	107,790	122,386	152,816	154,401				-	-
US Airways Express	Pittsburgh	PIT		9,157	72,808								-	-
US Airways Express	Plattsburgh	PLB	497										-	-
US Airways Express	Washington National	DCA		7,171	30,996	92,151	95,527	110,451	107,775				-	-
Subtotal			546,963	456,879	587,576	713,356	706,634	648,351	592,587	496,383	471,048	493,637	22,589	4.8%
													-	
Total			4,022,585	4,140,301	4,239,537	2,705,848	2,589,748	2,246,763	2,271,438	2,112,436	2,084,907	2,198,676	113,769	5.5%

Source: OAG Schedules.

Notes:

- All Northwest Airlines operations included in Delta Air Lines from 2009 onwards (following 2008 merger)
- All Continental Airlines operations included in United Airlines from 2011 onwards (following 2010 merger)
- All AirTran Airways operations included in Southwest Airlines from 2012 onwards (following 2011 merger)
- All US Airways operations included in American Airlines from 2014 onwards (following 2013 merger)

Table F-5 Scheduled Passenger Operations by Market and Carrier for Manchester-Boston Regional Airport

			Departures													Departing Seats												
Carrier	Market	Code	2000	2004	2005	2009	2010	2011	2012	2013	2014	2015	2016	'15-'16 Change	'15-'16 Pct. Change	2000	2004	2005	2009	2010	2011	2012	2013	2014	2015	2016	'15-'16 Change	'15-'16 Pct. Change
Jet Carriers																												
Boston-Maine Airways	Myrtle Beach	MYR		83										-	-		12,429										-	-
Boston-Maine Airways	Portsmouth	PSM		183										-	-		27,471										-	-
Boston-Maine Airways	Sanford	SFB		87										-	-		13,114										-	-
Continental	Cleveland	CLE	130			9								-	-	16,151			1,038								-	-
Continental	New York Newark	EWR	462	314	286									-	-	62,358	36,123	30,953									-	-
Delta	Atlanta	ATL	244	732	668		275	565	514	463	459	365	365	-	0.0%	34,648	103,944	94,856		39,050	81,600	76,629	69,307	68,468	53,545	54,212	667	1.2%
Delta	Cincinnati	CVG		710	664									-	-		100,840	86,583									-	-
Delta	Detroit	DTW				778	796					122	87	-35	-28.8%				93,450	89,289					14,414	9,881	-4,533	-31.4%
Delta	New York - LGA	LGA										4		-4	-100.0%										596		-596	-100.0%
Northwest	Detroit	DTW	1,609	1,460	1,399									-	-	194,058	202,623	180,879									-	-
Northwest	Minneapolis	MSP		362	365									-	-		44,835	46,933									-	-
Southwest	Baltimore	BWI	2,828	3,874	3,850	3,312	2,891	2,761	2,775	2,726	2,494	2,476	2,576	100	4.1%	387,397	530,588	527,405	450,616	393,093	376,945	385,044	387,879	364,979	363,524	383,914	20,390	5.6%
Southwest	Chicago Midway	MDW	706	693	1,355	1,253	1,144	1,244	1,168	1,010	984	948	996	48	5.0%	96,702	94,744	185,481	169,754	155,466	169,440	161,822	158,820	157,501	148,825	153,459	4,634	3.1%
Southwest	Denver	DEN						92	366	304				-	-						12,604	50,379	43,211				-	-
Southwest	Fort Lauderdale/Hollywood	FLL		9		120	9	9	152	90		4		-4	-100.0%		1,194		16,440	1,194	1,194	21,190	12,793		633		-633	-100.0%
Southwest	Kansas City	MCI	366	305										-	-	50,142	41,785										-	-
Southwest	Las Vegas	LAS		375	365	365	365	365	122	61	9	9		-9	-100.0%		51,336	50,005	50,005	50,005	50,005	16,766	8,723	1,246	1,246		-1,246	-100.0%
Southwest	Nashville	BNA	397	715	730									-	-	54,389	97,896	99,879									-	-
Southwest	Orlando	MCO	410	1,129	1,468	1,201	1,125	977	906	831	752	743	765	22	3.0%	56,111	154,673	201,175	164,332	154,145	133,829	125,620	123,873	109,202	113,888	118,422	4,534	4.0%
Southwest	Philadelphia	PHL		788	1,786	1,894	1,411	1,325						-	-		107,995	244,356	259,275	192,456	180,871						-	-
Southwest	Phoenix	PHX				365	322	273						-	-				50,005	44,114	37,401						-	-
Southwest	Tampa	TPA		845	1,099	673	782	629	579	466	470	479	487	8	1.7%		115,693	150,165	92,240	107,173	86,212	79,639	68,120	67,509	70,529	71,922	1,393	2.0%
United	Chicago O'Hare	ORD	1,403	1,464	1,339	608								-	-	221,523	209,179	179,151	85,929								-	-
United	Portland (ME)	PWM	57											-	-	7,241											-	-
US Airways	Baltimore	BWI	1,782											-	-	191,078											-	-
US Airways	Charlotte	CLT		1,276	1,308	378	365	51						-	-		167,699	178,836	53,676	52,560	7,406						-	-
US Airways	Orlando	MCO	52											-	-	5,605											-	-
US Airways	Philadelphia	PHL	1,821	1,806	2,021	395	365	313	187	351				-	-	222,331	244,129	274,215	56,219	33,132	30,973	18,499	34,791				-	-
US Airways	Pittsburgh	PIT	1,085	553										-	-	139,837	77,259										-	-
US Airways	Washington National	DCA	675	113	575									-	-	82,085	14,323	77,461									-	-
Subtotal			14,026	17,876	19,279	11,352	9,850	8,604	6,769	6,302	5,168	5,150	5,276	126	2.4%	1,821,657	2,449,873	2,608,335	1,542,979	1,311,677	1,168,481	935,588	907,518	768,905	767,200	791,810	24,610	3.2%
Regional/Commuter Carriers																												
Air Canada Express	Montreal Dorval	YUL												-	-												-	-
Air Canada Express	Toronto	YYZ	339	1,024	930	908	707	403						-	-	5,616	18,758	17,439	17,252	13,441	7,652						-	-
American Eagle	Charlotte	CLT									496	730	734	4	0.5%									37,761	54,688	60,890	6,202	11.3%
American Eagle	New York La Guardia	LGA	1,833											-	-	60,480											-	-
American Eagle	Philadelphia	PHL									2,295	2,237	2,090	-147	-6.6%									149,598	152,206	136,795	-15,411	-10.1%
American Eagle	Washington National	DCA									1,198	1,152	1,304	152	13.2%									77,065	74,008	85,620	11,612	15.7%
Boston-Maine Airways	Bangor	BGR		4										-	-		80										-	-
Boston-Maine Airways	Martha's Vineyard	MVY												-	-												-	-
Boston-Maine Airways	Nantucket	ACK												-	-												-	-
Boston-Maine Airways	New London/Groton	GON		22										-	-		399										-	-
Boston-Maine Airways	Portsmouth	PSM		4										-	-		80										-	-
Boston-Maine Airways	Saint John	YSJ												-	-												-	-
Continental Connection	Albany	ALB	80	1,007	313									-	-	1,515	19,130	5,944									-	-
Continental Connection	New York J F Kennedy	JFK												-	-												-	-
Continental Connection	New York Newark	EWR				337	141							-	-				24,906	9,483							-	-
Continental Connection	Plattsburgh	PLB												-	-												-	-
Continental Connection	Rochester	ROC	44											-	-	841											-	-
Continental Connection	Syracuse	SYR	22											-	-	421											-	-
Continental Connection	Westchester County	HPN												-	-												-	-
Continental Express	Cleveland	CLE	593	1,198	1,186	1,178	1,178							-	-	29,614	59,729	58,991	58,893	58,921							-	-
Continental Express	New York Newark	EWR	1,028	1,150	1,165	1,072	1,267							-	-	64,944	57,169	58,140	53,579	63,336							-	-
Delta Connection	Atlanta	ATL	488	366	485	365	90			51	59			-	-	24,400	18,300	26,620	25,550	6,300			3,843	4,484			-	-
Delta Connection	Bangor	BGR	244											-	-	12,200											-	-
Delta Connection	Cincinnati	CVG	1,673	750	735									-	-	83,657	39,299	38,426									-	-
Delta Connection	Detroit	DTW				359	499	1,858	1,609	1,510	1,296	912	935	23	2.5%				25,524	32,795	95,802	80,786	75,507	69,261	51,960	60,782	8,822	17.0%
Delta Connection	New York J F Kennedy	JFK												-	-												-	-
Delta Connection	New York La Guardia	LGA	727	1,067	486				586	1,165	1,140	970	804	-166	-17.1%	36,357	53,350	24,300				31,216	66,132	63,202	55,968	49,250	-6,718	-12.0%
Delta Connection	Minneapolis	MSP				92								-	-				6,992								-	-
Independence Air	Washington Dulles	IAD		1,439	1,568									-	-		71,971	78,379									-	-
Northwest Airlink	Detroit	DTW		13										-	-		664										-	-
Northwest Airlink	Minneapolis	MSP		324	233									-	-		16,179	11,664									-	-
United Express	Chicago O'Hare	ORD		213	31	388	1,040	983	867	695	857	779	718	-61	-7.8%		10,650	2,170	25,402	67,675	62,096	45,929	39,114	49,854	42,976	39,887	-3,089	-7.2%
United Express	Cleveland	CLE						935	759	740	111			-	-						46,736	36,046	36,986	5,564			-	-
United Express	New York Newark	EWR						1,391	1,298	1,120	965	1,304	1,284	-20	-1.5%						67,250	60,049	54,604	44,824	60,052	59,682	-370	-0.6%
United Express	Washington Dulles	IAD		1,678	1,760	1,161	1,104	658	427	90				-	-		83,900	90,419	62,534	55,951	33,514	20,788	5,444				-	-
US Airways Express	Boston	BOS												-	-												-	-
US Airways Express	Charlotte	CLT			307	227	153	318	366	417				-	-			21,863	19,547	13,146	27,181	31,476	32,885				-	-

Table F-5 Scheduled Passenger Operations by Market and Carrier for Manchester-Boston Regional Airport

Departures

Carrier	Market	Code	2000	2004	2005	2009	2010	2011	2012	2013	2014	2015	2016	'15-'16 Change	'15-'16 Pct. Change
US Airways Express	New York La Guardia	LGA	2,583	2,632	2,499	1,464	1,381	1,269	594					-	-
US Airways Express	Philadelphia	PHL		370	562	1,929	2,116	2,068	2,092	2,004				-	-
US Airways Express	Pittsburgh	PIT		567	1,022									-	-
US Airways Express	Washington National	DCA		976	508	1,008	1,039	1,043	1,002	1,252				-	-
Subtotal			9,655	14,804	13,788	10,486	10,716	10,925	9,600	9,045	8,417	8,084	7,869	-215	-2.7%
														-	-
Total			23,681	32,680	33,067	21,839	20,566	19,529	16,369	15,347	13,585	13,234	13,145	-89	-0.7%

Departing Seats

Carrier	Market	Code	2000	2004	2005	2009	2010	2011	2012	2013	2014	2015	2016	'15-'16 Change	'15-'16 Pct. Change
US Airways Express	New York La Guardia	LGA	96,936	90,511	86,492	49,761	49,420	43,737	21,962					-	-
US Airways Express	Philadelphia	PHL		19,654	30,239	118,750	140,277	135,156	134,567	126,552				-	-
US Airways Express	Pittsburgh	PIT		28,935	51,107									-	-
US Airways Express	Washington National	DCA		48,684	25,379	76,259	81,095	81,683	78,512	84,499				-	-
Subtotal			416,980	637,439	627,572	564,949	591,840	600,808	541,331	525,567	501,613	491,858	492,906	1,048	0.2%
														-	-
Total			2,238,636	3,087,313	3,235,907	2,107,928	1,903,517	1,769,288	1,476,919	1,433,085	1,270,518	1,259,058	1,284,716	25,658	2.0%

Source: OAG Schedules.

Notes:

All Northwest Airlines operations included in Delta Air Lines from 2009 onwards (following 2008 merger)
All Continental Airlines operations included in United Airlines from 2011 onwards (following 2010 merger)
All AirTran Airways operations included in Southwest Airlines from 2012 onwards (following 2011 merger)
All US Airways operations included in American Airlines from 2014 onwards (following 2013 merger)

Table F-6 Scheduled Passenger Operations by Market and Carrier for Portland International Jetport

			Departures											Departing Seats										
Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	2015	2016	'15-'16 Change	'15-'16 Pct. Change	2000	2005	2010	2011	2012	2013	2014	2015	2016	'15-'16 Change	'15-'16 Pct. Change
Jet Carriers																								
American	Charlotte	CLT							374	365	487	122	33.4%							46,341	45,504	62,336	16,832	37.0%
American	Philadelphia	PHL							92			-	-							9,108			-	-
American	Washington National	DCA								30	4	-26	-86.7%								3,720	567	-3,153	-84.8%
AirTran	Atlanta	ATL			92	167						-	-			10,764	19,522						-	-
AirTran	Baltimore	BWI			944	927						-	-			112,951	109,024						-	-
AirTran	Orlando	MCO			52	52						-	-			6,503	6,355						-	-
Continental	Cleveland	CLE										-	-										-	-
Continental	New York Newark	EWR										-	-										-	-
Delta	Atlanta	ATL	732	486	424	793	751	737	693	714	710	-4	-0.6%	103,944	61,229	60,167	114,597	110,397	109,750	103,571	107,000	106,660	-340	-0.3%
Delta	Cincinnati	CVG	1,089	486								-	-	154,658	69,012								-	-
Delta	Detroit	DTW									74	74	-									8,124	8,124	-
Delta	New York La Guardia	LGA					184	239	79	30		-30	-100.0%					24,256	35,374	11,750	3,300		-3,300	-100.0%
Independence Air	Washington Dulles	IAD		307								-	-		40,524								-	-
jetBlue	New York J F Kennedy	JFK			1,201	1,323	1,239	1,307	1,332	1,295	1,198	-97	-7.5%			128,936	135,379	124,571	130,671	133,200	130,314	119,800	-10,514	-8.1%
jetBlue	Orlando	MCO			212	181						-	-			21,214	21,344						-	-
Northwest	Detroit	DTW	523	427								-	-	52,105	42,700								-	-
Southwest	Baltimore	BWI					1,016	1,005	1,084	1,106	1,175	69	6.2%					119,112	136,588	152,939	158,358	168,423	10,065	6.4%
Southwest	Orlando	MCO					13		4	4	4	-	0.0%					1,521		633	633	633	-	0.0%
Southwest	Chicago Midway	MDW							9	9	9	-	0.0%							1,246	1,246	1,246	-	0.0%
Trans World Airlines	Hartford	BDL	305									-	-	43,310									-	-
United	Chicago O'Hare	ORD	728								66	66	-	88,996								8,066	8,066	-
United	Manchester	MHT	366									-	-	53,802									-	-
United	New York Newark	EWR									9	9	-									1,196	1,196	-
United	Washington Dulles	IAD									18	18	-									2,657	2,657	-
US Airways	Charlotte	CLT			395	352	366	365				-	-			48,688	47,130	49,044	45,260				-	-
US Airways	Philadelphia	PHL	1,312	154		217	18					-	-	163,051	19,404		21,525	1,895					-	-
US Airways	Pittsburgh	PIT	1,081									-	-	137,472									-	-
US Airways	Washington National	DCA		52								-	-		6,668								-	-
Subtotal			6,135	1,912	3,320	4,013	3,587	3,653	3,667	3,553	3,754	201	5.7%	797,338	239,537	389,224	474,876	430,796	457,644	458,788	450,075	479,708	29,633	6.6%
Regional/Commuter Carriers																								
Air Canada Express	Montreal Dorval	YUL	344									-	-	4,734									-	-
Air Canada Express	Toronto	YYZ			481	783	671	97				-	-			9,142	14,872	12,749	1,741				-	-
America West	New York Newark	EWR	52									-	-	2,457									-	-
American Eagle	Boston	BOS	3,804									-	-	125,518									-	-
American Eagle	Charlotte	CLT							26	143	243	100	69.9%							2,065	11,666	20,898	9,232	79.1%
American Eagle	Chicago O'Hare	ORD										-	-										-	-
American Eagle	New York La Guardia	LGA	2,033									-	-	67,084									-	-
American Eagle	Philadelphia	PHL							1,986	2,148	2,066	-82	-3.8%							125,325	141,789	120,072	-21,717	-15.3%
American Eagle	Washington National	DCA							1,426	1,613	1,707	94	5.8%							99,757	107,469	113,463	5,994	5.6%
Continental Conenction	Albany	ALB		291								-	-		5,537								-	-
Continental Conenction	Boston	BOS	204	241								-	-	3,871	4,576								-	-
Continental Conenction	New York Newark	EWR			1,426							-	-			105,503							-	-
Continental Conenction	Presque Isle	PQI										-	-										-	-
Continental Express	Cleveland	CLE	425	223	188							-	-	20,378	11,021	9,400							-	-
Continental Express	New York Newark	EWR	1,429	1,394	4							-	-	70,393	69,605	200							-	-
Delta Connection	Atlanta	ATL		700	350							-	-		48,440	25,532							-	-
Delta Connection	Boston	BOS		1,153								-	-		57,650								-	-
Delta Connection	Cincinnati	CVG		600								-	-		31,166								-	-
Delta Connection	Detroit	DTW			1,217	1,314	1,264	1,249	1,061	896	840	-56	-6.3%			62,320	65,686	64,758	62,436	60,448	59,315	60,354	1,039	1.8%
Delta Connection	New York J F Kennedy	JFK			270							-	-			13,500							-	-
Delta Connection	New York La Guardia	LGA	475	1,095	786	1,034	1,050	1,202	1,231	1,284	1,332	48	3.7%	15,191	54,750	41,440	57,437	67,453	80,898	80,103	76,325	80,582	4,257	5.6%
Delta Connection	Minneapolis	MSP										-	-										-	-
Independence Air	Washington Dulles	IAD		1,384								-	-		69,186								-	-
Lufthansa German Airlines	Washington Dulles	IAD	31									-	-	1,550									-	-
Northwest Airlink	Detroit	DTW	484	915								-	-	33,366	53,132								-	-
Northwest Airlink	Minneapolis	MSP		404								-	-		20,186								-	-
Starlink Aviation	Yarmouth	YQI			521	521	217					-	-			9,386	9,386	3,909					-	-
Swissair	Boston	BOS	31									-	-	1,023									-	-
Ulendo Airlink	Bar Harbor	BHB									18	18	-									886	886	-
Ulendo Airlink	Islip	ISP									18	18	-									886	886	-
Ulendo Airlink	Melbourne	MLB									91	91	-									5,573	5,573	-

Table F-6 Scheduled Passenger Operations by Market and Carrier for Portland International Jetport

Ulendo Airlink	Sarasota/Bradenton	SRQ									17	17	-
United Express	Chicago O'Hare	ORD		1,095	1,249	1,176	1,125	1,045	1,038	1,029	964	-65	-6.3%
United Express	Cleveland	CLE				188	249	298				-	-
United Express	New York Newark	EWR				1,426	1,596	1,630	1,470	1,779	2,035	256	14.4%
United Express	Washington Dulles	IAD	996	1,456	1,078	1,066	885	750	689	560	572	12	2.1%
US Airways Express	Bangor	BGR	231									-	-
US Airways Express	Boston	BOS	2,229									-	-
US Airways Express	Charlotte	CLT		365	88	18	31	35				-	-
US Airways Express	New York La Guardia	LGA	1,218	1,665	1,647	1,526	598					-	-
US Airways Express	Philadelphia	PHL		1,913	1,947	1,987	2,153	2,131				-	-
US Airways Express	Pittsburgh	PIT		219								-	-
US Airways Express	Plattsburgh	PLB	48									-	-
US Airways Express	Presque Isle	PQI										-	-
US Airways Express	Washington National	DCA	1,089	1,149	1,043	1,043	1,260	1,408				-	-
US Airways Express	Westchester County	HPN	65									-	-
Subtotal			15,187	16,261	12,296	12,081	11,098	9,843	8,927	9,452	9,903	451	4.8%
												-	-
Total			21,322	18,174	15,615	16,094	14,684	13,496	12,594	13,005	13,657	652	5.0%

Ulendo Airlink	Sarasota/Bradenton	SRQ									906	906	-
United Express	Chicago O'Hare	ORD		67,590	82,273	72,457	59,896	65,872	63,099	64,054	53,558	-10,496	-16.4%
United Express	Cleveland	CLE				9,400	11,906	14,886				-	-
United Express	New York Newark	EWR				103,511	81,454	102,156	92,953	108,900	113,044	4,144	3.8%
United Express	Washington Dulles	IAD	49,779	83,730	64,767	62,493	43,839	39,624	37,949	35,213	35,764	551	1.6%
US Airways Express	Bangor	BGR	8,558									-	-
US Airways Express	Boston	BOS	42,359									-	-
US Airways Express	Charlotte	CLT		23,710	5,323	1,364	2,542	2,777				-	-
US Airways Express	New York La Guardia	LGA	43,901	77,909	78,477	68,755	26,013					-	-
US Airways Express	Philadelphia	PHL		100,307	133,521	129,133	139,908	137,137				-	-
US Airways Express	Pittsburgh	PIT		10,971								-	-
US Airways Express	Plattsburgh	PLB	909									-	-
US Airways Express	Presque Isle	PQI										-	-
US Airways Express	Washington National	DCA	33,976	75,568	83,302	87,190	102,160	100,248				-	-
US Airways Express	Westchester County	HPN	1,235									-	-
Subtotal			526,282	865,033	724,086	681,682	616,586	607,775	561,699	604,731	605,986	1,255	0.2%
												-	-
Total			1,323,619	1,104,570	1,113,310	1,156,558	1,047,382	1,065,419	1,020,487	1,054,806	1,085,694	30,888	2.9%

Source: OAG Schedules.

Notes:

All Northwest Airlines operations included in Delta Air Lines from 2009 onwards (following 2008 merger)
All Continental Airlines operations included in United Airlines from 2011 onwards (following 2010 merger)
All AirTran Airways operations included in Southwest Airlines from 2012 onwards (following 2011 merger)
All US Airways operations included in American Airlines from 2014 onwards (following 2013 merger)

Table F-7 Scheduled Passenger Operations by Market and Carrier for Burlington International Airport

			Departures											Departing Seats										
Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	2015	2016	'15-'16 Change	'15-'16 Pct. Change	2000	2005	2010	2011	2012	2013	2014	2015	2016	'15-'16 Change	'15-'16 Pct. Change
Jet Carriers																								
AirTran	Baltimore	BWI										-	-										-	-
Allegiant Air	Orlando/Sanford	SFB							94	104	95	-9	-8.7%							15,873	17,880	16,452	-1,428	-8.0%
American	Philadelphia	PHL							116			-	-							11,470			-	-
Continental	New York Newark	EWR										-	-										-	-
Delta	Atlanta	ATL						153	92	92	110	18	19.6%						21,394	13,708	13,708	15,202	1,494	10.9%
jetBlue	New York J F Kennedy	JFK	244	1,126	1,434	1,405	1,363	1,365	1,244	1,156	1,182	26	2.2%	39,528	173,920	180,286	163,839	163,821	143,907	124,357	115,600	118,157	2,557	2.2%
jetBlue	Orlando	MCO			330	339	326					-	-			33,014	33,871	32,643					-	-
Northwest	Detroit	DTW		174								-	-		17,429								-	-
United	Chicago O'Hare	ORD	815	365						113	345	232	205.3%	105,509	42,379						13,777	45,877	32,100	233.0%
United	Portland (ME)	PWM										-	-										-	-
US Airways	Philadelphia	PHL	1,098	365				26				-	-	150,338	46,170				2,546				-	-
US Airways	Pittsburgh	PIT	732									-	-	103,568									-	-
US Airways	Washington National	DCA		4								-	-		558								-	-
Subtotal			2,889	2,035	1,764	1,744	1,690	1,543	1,546	1,465	1,732	267	18.2%	398,943	280,456	213,300	197,710	196,464	167,847	165,408	160,965	195,688	34,723	21.6%
Regional/Commuter Carriers																								
America West	New York Newark	EWR	166									-	-	7,889									-	-
American Eagle	Boston	BOS	3,094									-	-	102,111									-	-
American Eagle	Charlotte	CLT								122	378	256	209.8%								9,516	29,858	20,342	213.8%
American Eagle	Chicago O'Hare	ORD										-	-										-	-
American Eagle	New York La Guardia	LGA									18	18	-									886	886	-
American Eagle	Philadelphia	PHL							1,823	1,921	1,933	12	0.6%							110,129	126,772	103,725	-23,047	-18.2%
American Eagle	Washington National	DCA							1,276	1,339	1,394	55	4.1%							89,462	86,015	96,228	10,213	11.9%
Continental Connecti	Albany	ALB										-	-										-	-
Continental Connecti	Boston	BOS	244	634								-	-	4,628	12,054								-	-
Continental Connecti	Buffalo	BUF	4									-	-	84									-	-
Continental Connecti	Hartford	BDL										-	-										-	-
Continental Connecti	New York Newark	EWR			405							-	-			30,002							-	-
Continental Connecti	Plattsburgh	PLB	213	367								-	-	4,039	6,970								-	-
Continental Connecti	Plattsburgh International	PBG										-	-										-	-
Continental Connecti	Poughkeepsie	POU	66									-	-	1,262									-	-
Continental Connecti	Washington Dulles	IAD										-	-										-	-
Continental Connecti	Westchester County	HPN										-	-										-	-
Continental Express	Cleveland	CLE	322	509	366							-	-	16,064	25,351	18,286							-	-
Continental Express	New York Newark	EWR	1,458	1,455	1,020							-	-	70,203	72,707	51,000							-	-
Continental Express	Westchester County	HPN										-	-										-	-
Delta Connection	Atlanta	ATL		62				61	273	273	255	-18	-6.6%		3,100				4,636	20,701	20,748	19,369	-1,379	-6.6%
Delta Connection	Boston	BOS		1,002								-	-		50,100								-	-
Delta Connection	Cincinnati	CVG		1,060								-	-		52,979								-	-
Delta Connection	Detroit	DTW			1,227	1,309	1,282	1,223	1,201	1,004	1,005	1	0.1%			61,417	65,443	64,114	61,224	60,043	57,053	55,842	-1,211	-2.1%
Delta Connection	New York J F Kennedy	JFK			1,336	1,338	221					-	-			67,071	81,259	14,884					-	-
Delta Connection	New York La Guardia	LGA	355				781	1,279	1,248	1,257	1,151	-106	-8.4%	11,351				50,144	83,899	82,592	76,339	69,396	-6,943	-9.1%
Independence Air	Washington Dulles	IAD		1,903								-	-		95,136								-	-
Lufthansa German Ai	Washington Dulles	IAD	31									-	-	1,550									-	-
Northwest Airlink	Detroit	DTW		1,159								-	-		61,983								-	-
Northwest Airlink	Minneapolis	MSP		61								-	-		3,050								-	-
Porter Airlines	Toronto Island Apt	YTZ				9	31	56	47	39	22	-17	-43.6%				620	2,150	3,910	3,308	2,886	1,607	-1,279	-44.3%
Swissair	Boston	BOS	31									-	-	1,023									-	-
United Express	Chicago O'Hare	ORD		1,003	1,353	1,565	1,391	1,396	1,402	1,144	794	-350	-30.6%		59,930	84,431	88,435	81,204	84,669	85,350	63,845	42,348	-21,497	-33.7%
United Express	Cleveland	CLE				348	331	409	73			-	-				17,421	15,376	20,464	3,636			-	-
United Express	New York Newark	EWR				1,425	1,425	1,456	1,281	1,569	1,705	136	8.7%				94,675	80,261	85,373	82,670	96,340	94,246	-2,094	-2.2%
United Express	Washington Dulles	IAD	1,477	1,456	1,130	1,112	1,000	910	892	738	795	57	7.7%	73,843	72,786	61,988	69,793	58,665	48,930	50,633	41,127	48,150	7,023	17.1%

Table F-7 Scheduled Passenger Operations by Market and Carrier for Burlington International Airport

			Departures											Departing Seats										
Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	2015	2016	'15-'16 Change	'15-'16 Pct. Change	2000	2005	2010	2011	2012	2013	2014	2015	2016	'15-'16 Change	'15-'16 Pct. Change
US Airways Express	Boston	BOS	2,404									-	-	48,139									-	-
US Airways Express	Charlotte	CLT										-	-										-	-
US Airways Express	New York La Guardia	LGA	2,074	2,175	1,680	1,487	650					-	-	76,749	80,491	62,144	55,008	24,050					-	-
US Airways Express	Philadelphia	PHL		1,980	1,903	1,956	1,873	1,803				-	-		97,288	128,140	131,727	121,653	111,615				-	-
US Airways Express	Pittsburgh	PIT										-	-										-	-
US Airways Express	Plattsburgh	PLB	2,427									-	-	46,116									-	-
US Airways Express	Poughkeepsie	POU	718									-	-	13,639									-	-
US Airways Express	Saranac Lake	SLK	44									-	-	841									-	-
US Airways Express	Washington National	DCA	988	990	1,043	1,043	1,072	1,347				-	-	31,574	61,458	77,625	82,974	85,623	100,348				-	-
US Airways Express	Wilkes-Barre Scranton	AVP	22									-	-	415									-	-
Subtotal			16,138	15,816	11,461	11,593	10,058	9,941	9,516	9,405	9,450	45	0.5%	511,521	755,382	642,104	687,357	598,123	605,069	588,524	580,640	561,655	-18,985	-3.3%
												-	-										-	-
Total			19,028	17,851	13,225	13,336	11,748	11,484	11,062	10,870	11,182	312	2.9%	910,464	1,035,838	855,404	885,067	794,588	772,916	753,932	741,605	757,343	15,738	2.1%

Source: OAG Schedules.

Notes:

Allegiant stopped reporting to the OAG in 2009, so Allegiant 2009-2015 statistics from the T100 database.
All Northwest Airlines operations included in Delta Air Lines from 2009 onwards (following 2008 merger)
All Continental Airlines operations included in United Airlines from 2011 onwards (following 2010 merger)
All AirTran Airways operations included in Southwest Airlines from 2012 onwards (following 2011 merger)
All US Airways operations included in American Airlines from 2014 onwards (following 2013 merger)

Table F-8 Scheduled Passenger Operations by Market and Carrier for Bangor International Airport

			Departures											Departing Seats										
Carrier	**Market**	**Code**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**'15-'16 Change**	**'15-'16 Pct. Change**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**'15-'16 Change**	**'15-'16 Pct. Change**
Jet Carriers																								
Allegiant Air	Orlando/Sanford	SFB			181	150	156	165	153	180	182	2	1.1%			27,150	22,500	23,912	27,335	26,536	31,156	31,730	574	1.8%
Allegiant Air	Punta Gorda	PGD							33	0		-	-							5,478	0		-	-
Allegiant Air	St. Petersburg/Clearwater	PIE			107	93	112	115	119	134	143	9	6.7%			16,050	13,950	16,944	19,090	20,501	23,531	25,201	1,670	7.1%
Delta	Detroit	DTW								175	180	5	2.9%								19,334	19,769	435	2.2%
Pan American Airways	Allentown/Bethlehem	ABE										-	-										-	-
Pan American Airways	Baltimore	BWI										-	-										-	-
Pan American Airways	Pittsburgh	PIT	285									-	-	42,729									-	-
Pan American Airways	Portsmouth	PSM	389									-	-	58,414									-	-
Pan American Airways	Sanford	SFB										-	-										-	-
Subtotal			674	0	288	243	268	280	305	489	505	16	3.3%	101,143	0	43,200	36,450	40,856	46,425	52,515	74,021	76,700	2,679	3.6%
Regional/Commuter Carriers																								
American Eagle	Boston	BOS	4,670	1,530								-	-	154,115	56,594								-	-
American Eagle	New York La Guardia	LGA	382	518							35	35	-	12,606	19,166							1,757	1,757	-
American Eagle	Philadelphia	PHL							1,496	1,452	1,447	-5	-0.3%							94,849	91,163	85,549	-5,614	-6.2%
American Eagle	Washington National	DCA							791	771	900	129	16.7%							41,033	40,260	47,737	7,477	18.6%
Boston-Maine Airways	Halifax	YHZ										-	-										-	-
Boston-Maine Airways	Manchester	MHT										-	-										-	-
Boston-Maine Airways	Portsmouth	PSM										-	-										-	-
Boston-Maine Airways	Saint John	YSJ										-	-										-	-
Continental Connection	Albany	ALB		189								-	-		3,583								-	-
Continental Express	New York Newark	EWR		481								-	-		22,698								-	-
Delta Connection	Atlanta	ATL										-	-										-	-
Delta Connection	Boston	BOS		1,416								-	-		70,800								-	-
Delta Connection	Cincinnati	CVG	1,342	1,394								-	-	67,100	82,439								-	-
Delta Connection	Detroit	DTW			975	871	703	706	711	279	204	-75	-26.9%			50,540	54,640	46,260	46,371	47,269	19,614	14,863	-4,751	-24.2%
Delta Connection	New York J F Kennedy	JFK			180							-	-			9,000							-	-
Delta Connection	New York La Guardia	LGA			537	844	1,043	1,153	975	976	1,007	31	3.2%			26,958	49,368	62,868	71,955	59,239	57,025	58,761	1,736	3.0%
Delta Connection	Minneapolis	MSP										-	-										-	-
Northwest Airlink	Boston	BOS	27									-	-	797									-	-
Northwest Airlink	Detroit	DTW		1,012								-	-		55,222								-	-
Northwest Airlink	Minneapolis	MSP		61								-	-		3,050								-	-
Pan American Airways	Portsmouth	PSM										-	-										-	-
Pan American Airways	Saint John	YSJ										-	-										-	-
United Express	Chicago O'Hare	ORD							245	215	206	-9	-4.2%							16,170	14,190	13,624	-566	-4.0%
United Express	New York Newark										123	123	-									6,150	6,150	-
US Airways Express	Boston	BOS	1,942									-	-	36,906									-	-
US Airways Express	New York La Guardia	LGA	35	158	1,017	1,230	299					-	-	1,295	7,914	44,051	53,371	14,950					-	-
US Airways Express	Philadelphia	PHL	428	1,179	1,156	1,405	1,543	1,564				-	-	15,836	58,943	68,510	89,548	99,457	101,167				-	-
US Airways Express	Pittsburgh	PIT										-	-										-	-
US Airways Express	Portland (ME)	PWM	231									-	-	8,558									-	-
US Airways Express	Presque Isle	PQI	299									-	-	6,224									-	-
US Airways Express	Washington National	DCA			31	52	589	883				-	-			1,529	2,607	29,464	47,981				-	-
Subtotal			9,357	7,937	3,896	4,402	4,178	4,307	4,218	3,693	3,922	229	6.2%	303,436	380,408	200,587	249,535	253,000	267,474	258,560	222,252	228,441	6,189	2.8%
												-	-										-	-
Total			10,031	7,937	4,184	4,645	4,446	4,587	4,523	4,182	4,427	245	5.9%	404,579	380,408	243,787	285,985	293,856	313,899	311,075	296,273	305,141	8,868	3.0%

Source: OAG Schedules.
Notes:

Allegiant stopped reporting to the OAG in 2009, so Allegiant 2009-2015 statistics from the T100 database.
All Northwest Airlines operations included in Delta Air Lines from 2009 onwars (following 2008 merger)
All Continental Airlines operations included in United Airlines from 2011 onwards (following 2010 merger)
All AirTran Airways operations included in Southwest Airlines from 2012 onwards (following 2011 merger)
All US Airways operations included in American Airlines from 2014 onwards (following 2013 merger)

Table F-9 Scheduled Passenger Operations by Market and Carrier for Tweed-New Haven Airport

Departures

Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	2015	2016	'15-'16 Change	'15-'16 Pct. Change
Regional/Commuter Carriers													
American Eagle	Philadelphia	PHL							1,356	1,222	1,121	-101	-8.3%
Delta Connection	Cincinnati	CVG		1,025								-	-
Boston-Maine Airways	Baltimore	BWI										-	-
Boston-Maine Airways	Bedford	BED										-	-
Boston-Maine Airways	Elmira/Corning	ELM										-	-
Boston-Maine Airways	Portsmouth	PSM										-	-
US Airways Express	Philadelphia	PHL	1,773	1,904	1,608	1,535	1,381	1,399				-	-
US Airways Express	Washington National	DCA	937									-	-
												-	-
Total			2,710	2,929	1,608	1,535	1,381	1,399	1,356	1,222	1,121	-101	-8.3%

Departing Seats

Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	2015	2016	'15-'16 Change	'15-'16 Pct. Change
Regional/Commuter Carriers													
American Eagle	Philadelphia	PHL							50,161	49,657	63,913	14,256	28.7%
Delta Connection	Cincinnati	CVG		51,236								-	-
Boston-Maine Airways	Baltimore	BWI										-	-
Boston-Maine Airways	Bedford	BED										-	-
Boston-Maine Airways	Elmira/Corning	ELM										-	-
Boston-Maine Airways	Portsmouth	PSM										-	-
US Airways Express	Philadelphia	PHL	65,612	76,208	59,491	56,806	52,972	51,768				-	-
US Airways Express	Washington National	DCA	34,658									-	-
												-	-
Total			100,270	127,444	59,491	56,806	52,972	51,768	50,161	49,657	63,913	14,256	28.7%

Source: OAG Schedules.
Notes:
All Northwest Airlines operations included in Delta Air Lines from 2009 onwars (following 2008 merger)
All Continental Airlines operations included in United Airlines from 2011 onwards (following 2010 merger)
All AirTran Airways operations included in Southwest Airlines from 2012 onwards (following 2011 merger)
All US Airways operations included in American Airlines from 2014 onwards (following 2013 merger)

Table F-10 Scheduled Passenger Operations by Market and Carrier for Worcester Regional Airport

			Departures											Departing Seats										
Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	2015	2016	'15-'16 Change	'15-'16 Pct. Change	2000	2005	2010	2011	2012	2013	2014	2015	2016	'15-'16 Change	'15-'16 Pct. Change
Jet Carriers																								
Allegiant Air	Sanford	SFB										-	-										-	-
Boston-Maine Airways	Allentown/Bethlehem	ABE										-	-										-	-
Boston-Maine Airways	Portsmouth	PSM										-	-										-	-
Boston-Maine Airways	Sanford	SFB										-	-										-	-
Direct Air	Myrtle Beach	MYR			73	96						-	-			9,782	14,120						-	-
Direct Air	Orlando/Sanford	SFB			144	148						-	-			21,937	24,339						-	-
Direct Air	Punta Gorda	PGD			94	105						-	-			14,541	17,287						-	-
Direct Air	West Palm Beach	PBI			13	51						-	-			1,872	7,444						-	-
jetBlue	Fort Lauderdale/Hollywood	FLL						61	365	365	365	-	0.0%						6,100	36,500	36,500	36,500	-	0.0%
jetBlue	Orlando	MCO						61	365	365	365	-	0.0%						6,100	36,500	36,500	36,500	-	0.0%
Subtotal			0	0	324	400	0	122	730	730	730	-	0.0%	0	0	48,132	63,190	0	12,200	73,000	73,000	73,000	-	0.0%
Regional/Commuter Carriers																								
American Eagle	Chicago O'Hare	ORD										-	-										-	-
American Eagle	New York J F Kennedy	JFK	552									-	-	18,216									-	-
Delta Connection	Atlanta	ATL	670									-	-	33,500									-	-
US Airways Express	Philadelphia	PHL	1,464									-	-	54,168									-	-
Subtotal			2,686	0	0	0	0	0	0	0		-	-	105,884	0	0	0	0	0	0			-	-
												-	-										-	-
Total			2,686	0	324	400	0	122	730	730	730	-	0.0%	105,884	0	48,132	63,190	0	12,200	73,000	73,000	73,000	-	0.0%

Source: OAG Schedules.

Notes:

All Northwest Airlines operations included in Delta Air Lines from 2009 onwars (following 2008 merger)

All Continental Airlines operations included in United Airlines from 2011 onwards (following 2010 merger)

All AirTran Airways operations included in Southwest Airlines from 2012 onwards (following 2011 merger)

All US Airways operations included in American Airlines from 2014 onwards (following 2013 merger)

Table F-11 Scheduled Passenger Operations by Market and Carrier for Hanscom Field

			Departures												Departing Seats									
Carrier	Market	Code	2000	2004	2005	2010	2011	2012	2013	2014	2015	2016	'15-'16 Change	'15-'16 Pct. Change	2000	2005	2010	2011	2012	2013	2014	2015	'15-'16 Change	'15-'16 Pct. Change
Regional/Commuter Carriers																								
Boston-Maine Airways	Elmira/Corning	ELM											-	-									-	-
Boston-Maine Airways	Hyannis	HYA											-	-									-	-
Boston-Maine Airways	Manchester	MHT											-	-									-	-
Boston-Maine Airways	Martha's Vineyard	MVY											-	-									-	-
Boston-Maine Airways	Nantucket	ACK											-	-									-	-
Boston-Maine Airways	New Haven	HVN											-	-									-	-
Boston-Maine Airways	New London/Groton	GON		61	9								-	-		159							-	-
Boston-Maine Airways	Portsmouth	PSM		336	193								-	-		3,482							-	-
Boston-Maine Airways	Trenton	TTN		987	867								-	-		15,606							-	-
Pan American Airways	Atlantic City Pomona Field	ACY											-	-									-	-
Pan American Airways	Martha's Vineyard	MVY											-	-									-	-
Pan American Airways	New York Newark	EWR											-	-									-	-
Pan American Airways	Portsmouth	PSM											-	-									-	-
Pan American Airways	Westchester County	HPN											-	-									-	-
Shuttle America	Buffalo	BUF	1,119										-	-	55,950								-	-
Shuttle America	Hartford	BDL	173										-	-	8,636								-	-
Shuttle America	New York La Guardia	LGA	523										-	-	26,143								-	-
Shuttle America	Trenton	TTN	2,062	43									-	-	103,093								-	-
Streamline	Trenton	TTN					155						-	-				4,650					-	-
US Airways	Martha's Vineyard	MVY											-	-									-	-
US Airways	Nantucket	ACK											-	-									-	-
US Airways	New York La Guardia	LGA											-	-									-	-
US Airways	Philadelphia	PHL											-	-									-	-
US Airways	Trenton	TTN		734									-	-									-	-
US Airways	Westchester County	HPN											-	-									-	-
													-	-									-	-
Total			3,876	2,161	1,069	0	155	0	0	0	0	0	-	-	193,821	19,247	0	4,650	0	0	0	0	-	-

Source: OAG Schedules.

Notes:

All Northwest Airlines operations included in Delta Air Lines from 2009 onwards (following 2008 merger)
All Continental Airlines operations included in United Airlines from 2011 onwards (following 2010 merger)
All AirTran Airways operations included in Southwest Airlines from 2012 onwards (following 2011 merger)
All US Airways operations included in American Airlines from 2014 onwards (following 2013 merger)

Table F-12 Scheduled Passenger Operations by Market and Carrier for Portsmouth International Airport

Carrier	Market	Code	Departures 2000	Departures 2005	Departures 2010	Departures 2011	Departures 2012	Departures 2013	Departures 2014	Departures 2015	Departures 2016	Departures '15-'16 Change	Departures '15-'16 Pct. Change	Departing Seats 2000	Departing Seats 2005	Departing Seats 2010	Departing Seats 2011	Departing Seats 2012	Departing Seats 2013	Departing Seats 2014	Departing Seats 2015	Departing Seats 2016	Departing Seats '15-'16 Change	Departing Seats '15-'16 Pct. Change
Jet Carriers																								
Allegiant Airways	Orlando/Sanford	SFB		35				16	83	95	100	5	5.3%		5,229				2,656	14,242	16,111	17,062	951	5.9%
Allegiant Airways	Punta Gorda	PGD							22	35	48	13	37.1%							3,652	5,909	8,496	2,587	43.8%
Allegiant Airways	Fort Lauderdale/Hollywood	FLL								27	43	16	59.3%								4,779	7,611	2,832	59.3%
Allegiant Airways	St. Petersburg/Clearwater	PIE									13	13	-									2,158	2,158	-
Boston-Maine Airways	Fort Lauderdale/Hollywood	FLL		13								-	-		1,993								-	-
Boston-Maine Airways	Hartford	BDL		13								-	-		1,993								-	-
Boston-Maine Airways	Newburgh	SWF		48								-	-		7,179								-	-
Boston-Maine Airways	Sanford	SFB		57								-	-		8,593								-	-
Pan American Airways	Allentown/Bethlehem	ABE	93									-	-	13,950									-	-
Pan American Airways	Bangor	BGR	389									-	-	58,414									-	-
Pan American Airways	Gary	GYY	51									-	-	7,714									-	-
Pan American Airways	Manchester	MHT										-	-										-	-
Pan American Airways	New York Newark	EWR										-	-										-	-
Pan American Airways	Pittsburgh	PIT	261									-	-	39,171									-	-
Pan American Airways	Sanford	SFB	296									-	-	44,400									-	-
Pan American Airways	Santo Domingo	SDQ										-	-										-	-
Pan American Airways	St. Petersburg/Clearwater	PIE										-	-										-	-
Pan American Airways	Worcester	ORH										-	-										-	-
Skybus	Columbus	CMH										-	-										-	-
Skybus	Greensboro	GSO										-	-										-	-
Skybus	Punta Gorda	PGD										-	-										-	-
Skybus	Saint Augustine	UST										-	-										-	-
Subtotal			1,091	167	0	0	0	16	105	157	204	47	29.9%	163,650	24,986	0	0	0	2,656	17,894	26,799	35,327	8,528	31.8%
Regional/Commuter Carriers																								
Boston-Maine Airways	Baltimore	BWI										-	-										-	-
Boston-Maine Airways	Bangor	BGR										-	-										-	-
Boston-Maine Airways	Bedford	BED		171								-	-		3,083								-	-
Boston-Maine Airways	Hyannis	HYA										-	-										-	-
Boston-Maine Airways	Manchester	MHT										-	-										-	-
Boston-Maine Airways	Martha's Vineyard	MVY										-	-										-	-
Boston-Maine Airways	Nantucket	ACK										-	-										-	-
Boston-Maine Airways	New Haven	HVN										-	-										-	-
Boston-Maine Airways	New London/Groton	GON										-	-										-	-
Boston-Maine Airways	Saint John	YSJ										-	-										-	-
Boston-Maine Airways	Trenton	TTN		22								-	-		399								-	-
Boston-Maine Airways	Westchester County	HPN										-	-										-	-
Pan American Airways	Atlantic City Pomona Field	ACY										-	-										-	-
Pan American Airways	Baltimore	BWI										-	-										-	-
Pan American Airways	Bangor	BGR										-	-										-	-
Pan American Airways	Bedford	BED										-	-										-	-
Pan American Airways	Martha's Vineyard	MVY										-	-										-	-
Pan American Airways	Saint John	YSJ										-	-										-	-
Subtotal			0	193	0	0	0	0	0	0	0	-	-	0	3,482	0	0	0	0	0	0		-	-
												-	-										-	-
Total			1,091	360	0	0	0	16	105	157	204	47	29.9%	163,650	28,467	0	0	0	2,656	17,894	26,799	35,327	8,528	31.8%

Source: OAG Schedules.

Notes:

Allegiant stopped reporting to the OAG in 2009, so Allegiant 2009-2015 statistics from the T100 database.

All Northwest Airlines operations included in Delta Air Lines from 2009 onwars (following 2008 merger)

All Continental Airlines operations included in United Airlines from 2011 onwards (following 2010 merger)

All AirTran Airways operations included in Southwest Airlines from 2012 onwards (following 2011 merger)

All US Airways operations included in American Airlines from 2014 onwards (following 2013 merger)

G

Ground Access

This appendix provides information in support of Chapter 5, *Ground Access to and from Logan Airport*:

- Table G-1A Logan Express Bus Service Ridership (Annual)
- Table G-1B Logan Express Back Bay Service Ridership (Annual)
- Table G-2 Water Transportation Services Ridership (Annual)
- Table G-3 Massachusetts Bay Transportation Authority (MBTA) Airport Station Passengers
- Table G-4 Annual Taxi Dispatches (Tickets Sold)
- Table G-5 Logan Airport Employee Parking Supply
- Table G-6 Logan Airport Commercial Parking Supply
- Table G-7 2016 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment, and Vehicle Miles Traveled (VMT) Summary
- VISSIM Traffic Roadway Network
- April 2016 Logan Airport Parking Space Inventory, submitted to Massachusetts Department of Environmental Protection (also known as the *Parking Freeze Report*)
- September 2016 Logan Airport Parking Space Inventory, submitted to Massachusetts Department of Environmental Protection (also known as the *Parking Freeze Report*)
- Massport Sustainable Transportation Options Newsletter, February 2018

This Page Intentionally Left Blank.

Table G-1A Logan Express Bus Service Ridership

	Ridership			Percent Change		
Service Year	**Air Passengers**	**Employees**	**Total**	**Air Passengers**	**Employees**	**Total**
Framingham						
1992	207,847	7,573	215,420	4.3%	21.3%	4.8%
1993	229,064	12,307	241,371	10.2%	62.5%	12.0%
1994	250,342	17,352	267,694	9.3%	41.0%	10.9%
1995	274,754	21,129	295,883	9.8%	21.8%	10.5%
1996	325,665	22,932	348,597	18.5%	8.5%	17.8%
1997	316,306	29,871	346,175	(2.9%)	30.3%	(0.7%)
1998	337,007	33,971	370,978	6.5%	13.7%	7.2%
1999	345,715	31,946	380,661	3.5%	(6.0%)	2.6%
2000	371,560	34,508	406,068	6.6%	8.0%	6.7%
2001	354,521	38,740	393,261	(4.6%)	12.3%	(3.2%)
2002	342,746	42,441	385,187	(3.3%)	8.7%	(2.1%)
2003	310,024	55,979	366,003	(9.5%)	31.9%	(5.0%)
2004	323,931	54,763	378,694	4.5%	(2.2%)	3.5%
2005	318,125	57,569	375,694	(1.8%)	5.1%	(0.8%)
2006	349,022	60,764	409,789	9.7%	5.5%	9.1%
2007	311,299	57,252	368,551	(2.1%)[5]	(0.6%)[5]	(1.9%)[5]
2008	276,112	57,797	333,909	(11.3%)	1.0%	(9.4%)
2009	264,233	59,840	324,073	(4.3%)	3.5%	(2.9%)
2010	272,190	62,226	334,416	3.0%	4.0%	3.2%
2011[1]	272,301	68,228	340,529	0.0%	9.6%	1.8%
2012	279,603	82,951	362,554	2.7%	21.6%	6.5%
2013	295,654	84,008	379,662	5.7%	1.3%	4.7%
2014	303,646	87,488	391,134	2.7%	4.1%	3.0%
2015	345,680	82,943	428,623	13.8%	(5.2%)	9.6%
2016	**406,253**	**92,642**	**498,895**	**17.5%**	**11.7%**	**16.4%**

Table G-1A Logan Express Bus Service Ridership (Continued)

	Ridership			Percent Change		
Service Year	**Air Passengers**	**Employees**	**Total**	**Air Passengers**	**Employees**	**Total**
Braintree						
1992	186,217	9,694	195,911	10.6%	16.6%	10.8%
1993	205,209	22,768	227,977	10.2%	134.9%	16.4%
1994	247,636	37,489	285,125	20.7%	64.7%	25.1%
1995	264,579	70,723	335,302	6.8%	88.7%	17.6%
1996	335,232	103,519	438,751	26.7%	46.4%	30.1%
1997	300,006	135,340	435,346	(10.5%)	30.7%	(0.8%)
1998	300,005	156,105	456,110	0.0%	15.3%	4.8%
1999	328,818	125,286	454,105	9.6%	(19.7%)	(0.5%)
2000	355,932	149,687	505,619	8.2%	19.5%	11.3%
2001	345,249	156,240	501,489	(3.0%)	4.4%	(0.8%)
2002	323,115	190,360	513,475	(6.4%)	21.8%	2.4%
2003	301,013	216,765	517,778	(6.8%)	13.9%	0.8%
2004	318,100	208,566	526,666	5.7%	(3.8%)	1.7%
2005	307,659	189,531	497,190	(3.2%)	(9.1%)	(5.5%)
2006	333,413	202,983	536,396	8.4%	7.1%	7.9%
2007	300,715	196,955	497,670	(2.3%)5	3.9%[5]	0.1%[5]
2008	252,289	221,591	473,880	(16.1%)	12.5%	(4.8%)
2009	231,151	234,908	466,059	(8.4%)	6.0%	(1.7%)
2010	231,422	251,443	482,865	0.1%	7.0%	3.6%
2011[1]	233,521	285,515	519,036	0.9%	13.6%	7.5%
2012	247,346	314,542	561,888	5.9%	10.2%	8.3%
2013	268,154	320,329	588,483	8.4%	1.8%	4.7%
2014	296,975	313,334	610,309	10.7%	(2.2%)	3.7%
2015	313,576	311,695	625,271	5.6%	(0.5%)	2.5%
2016	**329,043**	**326,115**	**655,158**	**4.9%**	**4.6%**	**4.8%**

Table G-1A	Logan Express Bus Service Ridership (Continued)					
	Ridership			Percent Change		
Service Year	**Air Passengers**	**Employees**	**Total**	**Air Passengers**	**Employees**	**Total**
Woburn[2]						
1992[3]	3,052	91	3,143	NA	NA	-
1993	59,635	5,027	64,662	NA	NA	-
1994	119,567	9,082	128,649	100.5%	80.7%	99.0%
1995	150,147	13,376	163,523	25.6%	47.3%	27.1%
1996	190,566	17,322	207,888	26.9%	29.5%	27.1%
1997	199,715	20,018	219,733	4.8%	15.6%	5.7%
1998	208,286	22,876	231,162	4.3%	14.3%	5.2%
1999	191,454	23,495	214,949	(8.1%)	2.7%	(7.0%)
2000	195,744	27,522	223,266	2.2%	17.1%	3.9%
2001	177,375	38,318	215,530	(9.4%)	39.2%	(3.4%)
2002	161,145	73,277	234,422	(9.2%)	91.0%	8.7%
2003	164,980	103,963	268,943	(2.4%)	41.9%	14.7%
2004	172,110	111,326	283,436	4.3%	7.1%	5.4%
2005	163,227	110,961	274,188	(5.1%)	(0.3%)	(3.2%)
2006	167,341	121,672	289,013	2.5%	9.7%	5.4%
2007	149,149	123,066	272,215	(8.6%)[5]	10.9%[5]	(0.7%)[5]
2008	129,385	122,777	252,162	(13.3%)	(0.2%)	(7.4%)
2009	113,607	121,633	235,240	(12.2%)	(0.9%)	(6.7%)
2010	115,257	127,120	242,377	1.5%	4.5%	3.0%
2011[1]	118,232	151,029	269,261	2.6%	18.8%	11.1%
2012	126,549	188,747	315,296	7.0%	25.0%	17.1%
2013	140,407	192,289	332,696	11.0%	1.9%	5.5%
2014	156,045	194,341	350,386	11.1%	1.1%	5.3%
2015	163,469	191,242	354,711	4.8%	(1.6%)	1.2%
2016	**170,704**	**197,568**	**368,272**	**4.4%**	**3.3%**	**3.8%**

Table G-1A Logan Express Bus Service Ridership (Continued)

	Ridership			Percent Change		
Service Year	**Air Passengers**	**Employees**	**Total**	**Air Passengers**	**Employees**	**Total**
Peabody						
2001[4]	8,151	3,097	11,248	NA	NA	NA
2002	28,626	20,629	49,255	NA	NA	NA
2003	32,318	23,425	55,743	21.4%	13.6%	13.2%
2004	43,389	33,642	77,031	34.3%	43.6%	38.2%
2005	51,023	39,599	87,622	17.6%	17.7%	13.7%
2006	42,142	32,632	74,774	(17.4%)	(17.6%)	(14.7%)
2007	36,367	26,949	63,316	(28.7%)[5]	(31.9%)[5]	(27.7%)[5]
2008	30,887	30,596	61,483	(15.1%)	13.5%	(2.9%)
2009	27,856	32,220	60,076	(9.8%)	5.3%	(2.3%)
2010	25,543	26,231	51,744	(8.3%)	(18.6%)	(13.8%)
2011[1]	25,555	31,741	57,296	0.0%	21.0%	10.7%
2012	27,542	37,909	65,451	7.8%	19.4%	14.2%
2013	28,790	38,067	66,857	4.5%	0.4%	2.1%
2014	31,485	36,848	68,333	9.4%	(3.2%)	2.2%
2015	37,478	36,125	73,603	19.0%	(2.0%)	7.7%
2016	**40,872**	**36,143**	**77,015**	**9.1%**	**0.0%**	**4.6%**

Table G-1A Logan Express Bus Service Ridership (Continued)

	Ridership			Percent Change		
Service Year	**Air Passengers**	**Employees**	**Total**	**Air Passengers**	**Employees**	**Total**
Total System Ridership						
1992	397,116	17,358	414,474	8.0%	19.2%	8.5%
1993	493,908	39,832	533,740	24.4%	129.5%	28.8%
1994	617,545	63,923	681,468	25.0%	60.5%	27.7%
1995	689,480	105,228	794,708	11.6%	64.6%	16.6%
1996	851,463	143,773	995,236	23.4%	36.6%	25.2%
1997	816,015	185,229	1,001,254	(4.2%)	28.8%	0.6%
1998	845,598	212,952	1,058,550	3.6%	15.0%	5.7%
1999	868,987	180,727	1,049,714	2.7%	(15.2%)	(0.8%)
2000	923,236	211,717	1,134,953	6.2%	17.1%	8.1%
2001	885,296	236,395	1,121,691	(4.1%)	11.7%	(1.2%)
2002	855,632	326,707	1,182,339	(3.4%)	38.2%	5.4%
2003	808,335	400,132	1,208,467	(5.5%)	22.5%	2.2%
2004	857,530	408,297	1,265,827	6.1%	2.0%	2.2%
2005	837,034	397,660	1,234,694	(2.4%)	(2.6%)	(2.4%)
2006	891,918	418,051	1,309,969	6.6%	5.1%	6.1%
2007	797,530	404,222	1,201,752	(4.7%)[5]	1.7%[5]	(2.7%)[5]
2008	688,673	432,761	1,121,434	(13.6%)	7.1%	(6.7%)
2009	636,847	448,601	1,085,448	(7.5%)	3.7%	(3.2%)
2010	644,412	467,020	1,111,432	1.2%	4.1%	2.4%
2011[1]	649,609	536,513	1,186,122	0.8%	14.9%	6.7%
2012	681,040	624,149	1,305,189	4.8%	16.3%	10.0%
2013	733,005	634,693	1,367,698	8.0%	2.0%	5.0%
2014	788,151	632,011	1,420,162	7.5%	(0.4%)	3.8%
2015	860,203	622,005	1,482,208	9.1%	-1.6%	4.4%
2016	**946,872**	**652,468**	**1,599,340**	**10.1%**	**4.9%**	**7.9%**

Source: Massport.
Notes: January 23, 2008: I-90/Ted Williams Tunnel opens to all traffic. The last toll pricing change for Ted Williams Tunnel and Sumner/Callahan Tunnels was October 2016.
NA Not applicable.
1 Changes to employee parking and bus fares were implemented in October 2011.
2 Woburn Express moved from Mishawum Station to the Anderson Regional Transportation Center (ARTC) in Woburn in May 2001.
3 Reflects a partial year of operation. Woburn Logan Express service was implemented in November 1992.
4 Reflects a partial year of operation. The Peabody Logan Express service commenced in September 2001.
5 Percent comparison between 2007 and 2005. The I-90 Ted Williams Tunnel closures in 2006 resulted in atypical ridership.

Table G-1B Logan Express Back Bay Service Ridership[1]

	Ridership	Percent Change
Service Year		
2014	152,892	NA
2015	290,796	NA
2016	**216,329**	**(25.6%)**

Source: Massport.

Notes:

1 Back Bay Logan Express service commenced in April 2014. Only total ridership available.

Table G-2 Water Transportation Services Ridership to and from Logan Airport

	Rowes Wharf/Fan Pier Water Shuttle	Private Water Taxi (on-demand)	Harbor Express (Long Wharf/Quincy/Hull)[1]	Boston-Logan Water Shuttle (Long Wharf)	Total
1990	181,530	NS	NS	NS	181,530
1991	142,500	NS	NS	NS	142,500
1992	133,297	NS	NS	NS	133,297
1993	159,525	NS	NS	NS	159,525
1994	209,057	NS	NS	NS	209,057
1995	203,829	NS	NS	NS	203,829
1996	159,992	3,364	11,781	NS	175,137
1997	132,542	6,299	71,309	NS	210,150
1998	124,836	9,243	101,174	NS	235,253
1999	122,211	17,252	98,539	NS	238,002
2000	128,097	26,335	83,243	NS	237,675
2001	107,400	29,642	82,704	NS	219,746
2002	75,304	36,736	66,471	NS	178,511
2003	26,480[2]	35,724[3]	61,849	5,722[4]	129,775
2004	NS	54,540	58,788	3,202[5]	116,530
2005	NS	44,975	51,960	NS	96,935
2006	NS	63,639	70,998	NS	134,637
2007	NS	50,737	59,460	NS	110,197
2008	NS	48,630	48,003	NS	96,633
2009	NS	50,734	37,861	NS	88,595
2010	NS	54,382	34,794	NS	89,176
2011	NS	58,879	33,403	NS	92,282
2012	NS	60,840	30,337	NS	91,177
2013	NS	70,378	21,925	NS	92,303
2014	NS	67,479	19,340	NS	86,819
2015	NS	70,798	7,748	NS	78,546
2016	**NS**	**74,788**	**7,757**	**NS**	**82,545**

Source: Massport.
Notes: Figures from 2003 – 2007 have been revised from previous documents.
NS Operation not in service.
1 Service to Quincy was discontinued in 2013 and now operates between Long Wharf/Hingham/Hull.
2 Rowes Wharf Water Shuttle operated from January to June only in 2003.
3 Operated from May to October only in 2003.
4 Long Wharf Boston-Logan Water Shuttle operated from August to December in 2003.
5 Joint operation with City Water Taxi began on August 16, 2003.

Table G-3 Massachusetts Bay Transportation Authority (MBTA) Airport Station Passengers

Year	Entrances	Exits	Total Turnstile Count[1]	Percent Change
1990	NA	NA	2,854,317	-
1991	NA	NA	2,515,293	(11.9%)
1992	NA	NA	2,626,572	4.2%
1993	NA	NA	2,604,980	(0.8%)
1994	NA	NA	3,108,734	19.3%
1995	NA	NA	3,040,868	(2.2%)
1996	NA	NA	2,974,850	(2.2%)
1997[2]	NA	NA	2,774,268	(6.7%)
1998	NA	NA	2,850,367	2.7%
1999	NA	NA	2,974,045	4.3%
2000	NA	NA	3,019,086	1.5%
2001	NA	NA	2,896,638	(4.1%)
2002	NA	NA	2,670,594	(7.8%)
2003[3]	1,300,272	1,275,627	2,575,899	(3.6%)
2004	1,373,861	1,366,511	2,740,372	6.4%
2005	NA	NA	NA	NA
2006	NA	NA	NA	NA
2007[4]	1,412,055	--	2,524,079	--
2008[5]	2,212,111	--	3,647,394	56.7%
2009[5]	2,329,370	--	3,750,549	5.3%
2010[5]	2,270,241	--	3,629,193	(2.5%)
2011	2,277,311	NA	NA	0.3%
2012	2,442,085	NA	NA	7.2%
2013	2,597,306	NA	NA	6.3%
2014	2,378,965	NA	NA	(8.4%)[6]
2015	2,122,597	NA	NA	(10.8%)[6]
2016	**2,240,744**	**NA**	**NA**	**5.6%**

Source: MBTA.
Note: Total Turnstile count figures include both Logan Airport bound (turnstile exits) and non-Logan Airport bound (turnstile entrances) passengers.
NA Data not available
1 As stated in the *Logan Airport 1999 ESPR*, Massport believes that ridership estimates through 2005 from the old Airport Station were understated because many travelers that were destined for the Airport with baggage had been observed to avoid the turnstiles and exit the old Airport Station via the wide gate (designed for handicapped access) that did not have the capability to count passengers.
2 Airport Station was closed on six weekends during September and October 1997 due to construction.
3 Airport Station was closed on eight weekend days during 2003.
4 Automated fare collection and new fare gates implemented beginning January 2007. Station access to Bremen Street Park opened June 2007. Exits are undercounted.
5 Exits are undercounted, as some exits occur through exit doors rather than turnstiles.
6 Due to the closure of Government Center Station in 2014, it is possible that passengers who would normally take the Blue Line to the Green Line switched to alternate modes for their trips.

Table G-4	Annual Taxi Dispatches (Tickets Sold)	
Year	**Total (yearly tickets sold)**	**Percent Change**
1990	1,330,418	-
1991	1,208,611	(9.2%)
1992	1,266,033	4.8%
1993	1,336,603	5.6%
1994	1,409,505	5.5%
1995	1,499,869	6.4%
1996	1,721,093	14.7%
1997	1,827,244	6.2%
1998	1,888,281	3.3%
1999	1,955,895	3.6%
2000	2,140,724	9.4%
2001	1,789,736	(16.4%)
2002	1,679,508	(6.2%)
2003	1,562,076	(7.0%)
2004	1,713,696	9.7%
2005	1,769,876	3.3%
2006	1,857,609	5.0%
2007	1,925,817	3.7%
2008	1,749,730	(9.1%)
2009	1,630,333	(6.8%)
2010	1,829,961	12.1%
2011	1,937,743	6.0%
2012	2,022,239	4.4%
2013	2,131,371	5.0%
2014	2,237,793	5.0%
2015	2,302,059	2.9%
2016	**2,420,391**	**5.1%**

Source: Massport.

Table G-5 Logan Airport Employee Parking Supply

	Number of Spaces					
Location	**March 2014**	**September 2014**	**March 2015**	**September 2015**	**March 2016**	**September 2016**
Terminal Area	857	868	868	865	**865**	**865**
North Service Area	883	883	881	876	**876**	**876**
Southwest Service Area	4	4	14	16	**16**	**16**
South Service Area	681	681	674	665	**665**	**665**
Airside (Fire/Rescue)	0	0	0	0	**0**	**0**
Total spaces in service	2,425	2,436	2,437	2,422	**2,422**	**2,422**
Total spaces out of service	248	237	236	251	**26**	**26**
Total employee spaces	2,673	2,673	2,673	2,673	**2,448**	**2,448**

Source: Logan Airport Parking Space Inventory submitted to Massachusetts Department of Environmental Protection (MassDEP), March and September 2014, 2015, and 2016.

Note: As of June 2013, the Logan Airport Parking Freeze sets a limit of 18,415 commercial spaces and 2,673 employee spaces at the Airport.

Table G-6 Logan Airport Commercial Parking Supply

	Number of Spaces					
Location	**March 2014**	**September 2014**	**March 2015**	**September 2015**	**March 2016**	**September 2016**
Terminal Area						
Central Garage and West Garage	10,267	10,267	10,267	10,340	**11,954**	**11,954**
Terminal B Garage	2,254	2,254	2,254	2,201	**2,212**	**2,212**
Terminal E Lot 1	275	275	243	237	**237**	**237**
Terminal E Lot 2	248	248	248	249	**249**	**249**
Terminal E Lot 3 (Gulf Lot)	219	219	219	217	**217**	**217**
Signature (General Aviation)	35	35	35	35	**35**	**35**
Logan Airport Hilton	235	235	35	35	**235**	**235**
North Service Area					**2,864**	**2,864**
Economy Garage	2,809	2,809	2,809	2,864	**2,864**	**2,864**
Overflow Green Lot (Wood Island)	0	0	235	242	**0**	**0**
South Service Area						
Harborside Hyatt Conference Center and Hotel	270	270	270	270	**270**	**270**
Overflow Blue Lot (Harborside Dr.)	0	0	315	339	**367**	**367**
Southwest Service Area						
Overflow Red Lot (Tomahawk Dr.)	0	0	282	282	**0**	**0**
Total spaces in service	16,612	16,612	17,212	17,311	**18,640**	**18,640**
Total spaces out of service	1,803	1,803	1,203	1,104	**-**	**-**
Total commercial spaces	18,415	18,415	18,415	18,415	**18,640**	**18,640**

Source: Logan Airport Parking Space Inventory submitted to MassDEP, March and September 2014, 2015, and 2016.

Note: Logan Airport Parking Freeze sets a limit of 21,088 spaces on Airport. As of June 2013, the allocation is 18,640 commercial and 2,448 employee spaces.

Table G-7 2016 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary

Link Name	Link Distance (ft)	Link Speed (mph)	VOLUME				VMT			
			AM Peak	PM Peak	High 8-Hour	AWDT	AM Peak	PM Peak	High 8-Hour	AWDT
1	344	23	1105	1362	9722	21698	72.00	88.75	633.51	1413.89
2	496	27	569	701	5004	11167	53.45	65.85	470.04	1048.95
3	1347	20	510	628	4483	10005	130.11	160.22	1143.73	2552.53
4	1166	28	1054	1298	9265	20678	232.74	286.62	2045.88	4566.08
5	378	25	1563	1926	13747	30683	111.97	137.97	984.81	2198.07
6	441	30	462	569	4061	9065	38.60	47.54	339.29	757.36
7	896	24	1097	1352	9650	21538	186.24	229.53	1638.31	3656.58
8	644	26	1087	1339	9557	21331	132.68	163.44	1166.54	2603.68
9	1214	21	528	650	4640	10355	121.37	149.42	1066.61	2380.34
10	1303	19	634	781	5575	12442	156.50	192.78	1376.13	3071.19
11	421	20	592	730	5211	11629	47.21	58.21	415.55	927.34
12	236	25	42	52	371	828	1.87	2.32	16.56	36.96
13	1311	26	64	79	564	1259	15.89	19.61	140.00	312.52
14	750	23	1674	2063	14725	32865	237.79	293.05	2091.67	4668.43
15	441	25	1457	1795	12812	28596	121.66	149.88	1069.77	2387.70
16	1724	23	22	27	193	430	7.18	8.82	63.02	140.40
17	644	15	636	783	5589	12474	77.52	95.43	681.20	1520.36
18	354	23	558	687	4904	10944	37.42	46.07	328.87	733.92
19	687	17	84	104	742	1657	10.92	13.52	96.48	215.44
20	94	14	638	786	5610	12522	11.38	14.02	100.04	223.29
21	877	6	28	35	250	558	4.65	5.82	41.54	92.72
22	79	28	28	35	250	558	0.42	0.52	3.72	8.31
23	81	29	22	27	193	430	0.34	0.41	2.94	6.56
24	79	5	24	30	214	478	0.36	0.45	3.22	7.19
25	87	9	32	40	286	637	0.53	0.66	4.70	10.46
26	209	5	32	40	286	637	1.27	1.59	11.34	25.27
27	187	5	24	30	214	478	0.85	1.06	7.58	16.93
28	124	5	57	70	500	1115	1.34	1.65	11.77	26.25
29	226	30	241	297	2120	4731	10.32	12.71	90.75	202.52
30	1070	5	494	609	4347	9702	100.07	123.36	880.54	1965.27
31	385	32	172	212	1513	3377	12.53	15.44	110.23	246.03
32	516	18	68	84	600	1338	6.65	8.21	58.64	130.78
34	181	17	382	471	3362	7503	13.07	16.12	115.03	256.72
35	248	18	450	555	3961	8842	21.12	26.05	185.93	415.04
36	89	16	390	481	3433	7663	6.57	8.10	57.79	129.00
37	102	18	61	75	535	1195	1.18	1.46	10.38	23.19
38	110	28	106	131	935	2087	2.21	2.73	19.46	43.45
39	219	32	25	31	221	494	1.04	1.28	9.16	20.47
40	232	9	33	41	293	653	1.45	1.80	12.87	28.69
41	177	22	6	8	57	127	0.20	0.27	1.91	4.26
42	205	30	9	11	79	175	0.35	0.43	3.06	6.78
43	597	18	27	33	236	526	3.06	3.73	26.71	59.52
44	587	28	67	82	585	1306	7.45	9.12	65.03	145.18
45	96	32	59	73	521	1163	1.07	1.33	9.48	21.16
46	112	14	5	6	43	96	0.11	0.13	0.92	2.04
47	859	28	12	15	107	239	1.95	2.44	17.40	38.86
48	94	15	422	520	3712	8284	7.49	9.23	65.86	146.97
49	420	25	433	534	3812	8507	34.48	42.52	303.55	677.42
50	353	33	25	31	221	494	1.67	2.07	14.76	32.99
51	717	25	458	564	4026	8985	62.18	76.57	546.56	1219.78
52	403	33	258	318	2270	5066	19.70	24.28	173.31	386.79
53	321	33	5	6	43	96	0.30	0.36	2.61	5.83

Table G-7 2016 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

Link Name	Link Distance (ft)	Link Speed (mph)	VOLUME				VMT			
			AM Peak	PM Peak	High 8-Hour	AWDT	AM Peak	PM Peak	High 8-Hour	AWDT
54	612	25	263	324	2313	5162	30.48	37.54	268.03	598.17
55	194	25	603	743	5303	11837	22.12	27.26	194.54	434.23
56	101	5	0	0	0	0	0.00	0.00	0.00	0.00
57	97	32	123	152	1085	2421	2.27	2.80	20.00	44.63
58	103	5	0	0	0	0	0.00	0.00	0.00	0.00
59	105	5	0	0	0	0	0.00	0.00	0.00	0.00
60	331	25	726	895	6388	14258	45.44	56.02	399.86	892.48
61	224	5	151	186	1328	2963	6.39	7.87	56.21	125.42
62	218	23	287	353	2520	5624	11.88	14.61	104.27	232.71
63	242	5	0	0	0	0	0.00	0.00	0.00	0.00
64	232	5	34	42	300	669	1.50	1.85	13.21	29.45
65	593	25	863	1063	7587	16934	96.97	119.45	852.53	1902.84
66	465	25	17	21	150	335	1.50	1.85	13.20	29.48
67	483	21	10	12	86	191	0.92	1.10	7.87	17.49
68	487	5	0	0	0	0	0.00	0.00	0.00	0.00
69	361	14	28	34	243	542	1.91	2.32	16.61	37.05
90	582	5	400	493	3519	7854	44.10	54.35	387.96	865.89
103	85	33	13	16	114	255	0.21	0.26	1.83	4.09
104	85	5	0	0	0	0	0.00	0.00	0.00	0.00
105	95	5	0	0	0	0	0.00	0.00	0.00	0.00
106	95	5	0	0	0	0	0.00	0.00	0.00	0.00
107	260	20	123	152	1085	2421	6.06	7.49	53.48	119.33
108	389	19	81	100	714	1593	5.97	7.37	52.59	117.33
109	114	12	27	33	236	526	0.58	0.71	5.10	11.36
110	169	17	27	33	236	526	0.86	1.05	7.54	16.81
111	261	5	0	0	0	0	0.00	0.00	0.00	0.00
112	237	26	16	20	143	319	0.72	0.90	6.43	14.34
113	565	17	29	36	257	574	3.11	3.86	27.52	61.47
114	609	32	20	25	178	398	2.31	2.88	20.52	45.89
115	451	29	265	326	2327	5193	22.64	27.85	198.76	443.57
116	399	21	28	35	250	558	2.12	2.64	18.89	42.16
117	283	21	43	53	378	844	2.31	2.84	20.27	45.26
118	295	29	276	340	2427	5416	15.41	18.99	135.53	302.44
119	240	12	196	242	1727	3855	8.91	11.00	78.52	175.26
120	365	28	52	64	457	1020	3.60	4.43	31.61	70.54
121	356	17	87	107	764	1705	5.87	7.22	51.54	115.01
122	486	19	78	96	685	1529	7.18	8.83	63.03	140.70
123	486	18	88	108	771	1721	8.09	9.93	70.90	158.27
124	280	20	50	62	443	988	2.65	3.29	23.48	52.36
125	280	19	70	86	614	1370	3.71	4.56	32.54	72.60
126	631	20	124	153	1092	2437	14.82	18.29	130.52	291.29
127	652	19	80	99	707	1577	9.88	12.23	87.32	194.77
128	257	32	18	22	157	350	0.88	1.07	7.64	17.03
129	257	18	27	33	236	526	1.31	1.61	11.48	25.59
130	422	5	0	0	0	0	0.00	0.00	0.00	0.00
131	493	30	4	5	36	80	0.37	0.47	3.36	7.46
132	361	23	140	173	1235	2756	9.57	11.83	84.42	188.38
133	236	24	72	89	635	1418	3.22	3.98	28.37	63.35
134	1521	27	192	236	1685	3760	55.29	67.96	485.26	1082.82
135	1542	24	67	83	592	1322	19.57	24.24	172.93	386.17
136	384	5	14	17	121	271	1.02	1.24	8.80	19.72
137	354	16	10	12	86	191	0.67	0.80	5.77	12.81

Table G-7 2016 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

Link Name	Link Distance (ft)	Link Speed (mph)	VOLUME				VMT			
			AM Peak	PM Peak	High 8-Hour	AWDT	AM Peak	PM Peak	High 8-Hour	AWDT
138	225	22	37	46	328	733	1.57	1.96	13.95	31.17
139	96	13	37	46	328	733	0.67	0.84	5.98	13.36
140	295	24	68	84	600	1338	3.80	4.69	33.51	74.74
142	257	17	154	190	1356	3027	7.48	9.23	65.91	147.12
144	518	8	129	159	1135	2533	12.64	15.58	111.25	248.28
145	195	17	58	71	507	1131	2.15	2.63	18.76	41.85
146	463	17	54	67	478	1067	4.73	5.87	41.90	93.52
147	230	17	167	206	1470	3282	7.28	8.98	64.11	143.13
148	794	17	38	47	335	749	5.71	7.06	50.35	112.58
149	661	20	88	109	778	1736	11.02	13.65	97.39	217.32
150	281	20	90	111	792	1768	4.79	5.91	42.15	94.10
151	360	20	56	69	493	1099	3.82	4.70	33.59	74.87
152	88	32	3	4	29	64	0.05	0.07	0.49	1.07
153	66	30	34	42	300	669	0.42	0.52	3.75	8.35
154	173	33	37	46	328	733	1.21	1.51	10.76	24.04
155	258	30	147	181	1292	2883	7.20	8.86	63.24	141.13
156	645	23	58	71	507	1131	7.08	8.67	61.89	138.07
157	218	22	89	110	785	1752	3.67	4.54	32.39	72.30
158	185	24	265	326	2327	5193	9.30	11.44	81.63	182.17
159	354	19	353	435	3105	6930	23.68	29.18	208.30	464.91
160	470	28	57	70	500	1115	5.07	6.23	44.46	99.16
161	94	13	115	142	1014	2262	2.06	2.54	18.12	40.42
162	50	13	1	1	7	16	0.01	0.01	0.07	0.15
163	66	13	114	140	999	2230	1.43	1.76	12.57	28.05
164	367	33	50	62	443	988	3.48	4.31	30.81	68.72
165	124	29	119	147	1049	2342	2.79	3.44	24.57	54.85
166	84	29	103	127	906	2023	1.65	2.03	14.48	32.34
167	956	29	103	127	906	2023	18.65	22.99	164.04	366.28
168	380	15	52	64	457	1020	3.74	4.60	32.87	73.35
169	293	13	155	191	1363	3043	8.61	10.61	75.71	169.03
170	205	33	16	20	143	319	0.62	0.78	5.54	12.37
171	158	5	0	0	0	0	0.00	0.00	0.00	0.00
172	180	5	0	0	0	0	0.00	0.00	0.00	0.00
173	48	5	0	0	0	0	0.00	0.00	0.00	0.00
174	502	14	226	279	1991	4445	21.47	26.51	189.18	422.35
175	640	17	198	244	1742	3887	24.00	29.58	211.16	471.17
176	319	23	1364	1681	11999	26780	82.29	101.42	723.93	1615.71
177	286	30	1364	1681	11999	26780	73.91	91.08	650.15	1451.04
178	353	23	1139	1403	10014	22351	76.25	93.92	670.35	1496.21
179	348	31	720	887	6331	14131	47.41	58.41	416.87	930.47
180	366	29	945	1164	8308	18543	65.50	80.68	575.87	1285.31
181	453	14	74	91	650	1450	6.35	7.81	55.75	124.37
182	119	14	74	91	650	1450	1.66	2.04	14.59	32.55
183	50	14	62	76	542	1211	0.59	0.72	5.13	11.46
184	54	14	47	58	414	924	0.48	0.59	4.20	9.37
185	62	14	50	61	435	972	0.59	0.71	5.09	11.38
186	39	14	117	144	1028	2294	0.87	1.07	7.63	17.03
187	208	5	0	0	0	0	0.00	0.00	0.00	0.00
188	212	5	0	0	0	0	0.00	0.00	0.00	0.00
189	218	5	0	0	0	0	0.00	0.00	0.00	0.00
190	193	32	12	15	107	239	0.44	0.55	3.91	8.73

Table G-7 2016 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

Link Name	Link Distance (ft)	Link Speed (mph)	VOLUME				VMT			
			AM Peak	PM Peak	High 8-Hour	AWDT	AM Peak	PM Peak	High 8-Hour	AWDT
191	169	5	0	0	0	0	0.00	0.00	0.00	0.00
192	540	5	67	83	592	1322	6.86	8.50	60.59	135.31
193	138	17	199	245	1749	3903	5.19	6.39	45.65	101.87
194	932	16	196	242	1727	3855	34.59	42.70	304.74	680.24
195	79	16	15	18	128	287	0.23	0.27	1.92	4.31
196	49	16	277	341	2434	5432	2.55	3.14	22.43	50.05
197	83	18	277	341	2434	5432	4.38	5.39	38.49	85.90
198	692	18	324	399	2848	6356	42.47	52.30	373.28	833.06
199	70	28	299	368	2627	5863	3.98	4.90	34.97	78.04
200	158	5	0	0	0	0	0.00	0.00	0.00	0.00
201	160	9	44	54	385	860	1.33	1.63	11.64	26.01
202	335	22	45	55	393	876	2.85	3.49	24.92	55.56
203	30	5	0	0	0	0	0.00	0.00	0.00	0.00
204	2022	9	111	137	978	2183	42.50	52.46	374.48	835.88
205	71	25	378	466	3326	7424	5.11	6.29	44.92	100.27
206	142	25	264	325	2320	5178	7.11	8.76	62.52	139.53
207	859	33	247	304	2170	4843	40.17	49.44	352.92	787.65
208	284	33	215	265	1892	4222	11.56	14.25	101.76	227.09
209	80	29	787	970	6924	15453	11.98	14.76	105.39	235.21
210	71	29	946	1165	8316	18559	12.79	15.75	112.45	250.95
211	390	29	1002	1235	8815	19675	73.98	91.18	650.83	1452.66
212	117	29	583	718	5125	11438	12.94	15.94	113.80	253.97
213	1344	24	1458	1796	12819	28612	371.25	457.32	3264.13	7285.54
214	449	31	967	1191	8501	18974	82.19	101.23	722.53	1612.66
215	1110	30	50	61	435	972	10.51	12.82	91.41	204.26
216	905	31	410	505	3605	8045	70.31	86.60	618.21	1379.61
217	1050	30	211	260	1856	4142	41.96	51.70	369.06	823.62
218	581	28	713	879	6274	14003	78.42	96.68	690.04	1540.12
219	1063	32	347	427	3048	6802	69.89	86.00	613.88	1369.94
220	415	32	347	427	3048	6802	27.27	33.55	239.51	534.49
221	698	5	0	0	0	0	0.00	0.00	0.00	0.00
222	1920	22	17	21	150	335	6.18	7.64	54.56	121.85
223	1564	29	1060	1306	9322	20806	313.95	386.81	2761.00	6162.34
224	377	28	629	775	5532	12346	44.96	55.39	395.39	882.40
225	551	28	125	154	1099	2453	13.04	16.07	114.68	255.96
226	788	32	161	198	1413	3154	24.03	29.55	210.88	470.71
227	1303	32	458	564	4026	8985	112.99	139.14	993.22	2216.62
228	580	29	1029	1268	9051	20200	113.09	139.36	994.77	2220.13
229	1653	30	342	421	3005	6707	107.06	131.79	940.69	2099.58
230	2058	28	687	847	6046	13493	267.78	330.14	2356.61	5259.31
231	1300	10	681	839	5989	13366	167.62	206.51	1474.14	3289.91
232	736	13	803	989	7059	15756	111.89	137.81	983.64	2195.52
233	488	23	687	846	6039	13477	63.50	78.20	558.18	1245.67
234	449	11	472	581	4147	9256	40.13	49.40	352.59	786.97
235	310	26	379	467	3333	7440	22.25	27.41	195.66	436.75
236	310	5	92	113	807	1800	5.41	6.64	47.46	105.85
237	105	5	206	254	1813	4046	4.11	5.06	36.13	80.63
238	697	31	81	100	714	1593	10.69	13.19	94.20	210.16
239	186	25	56	69	493	1099	1.97	2.43	17.33	38.63
240	145	29	177	218	1556	3473	4.87	6.00	42.83	95.60
241	578	29	233	287	2049	4572	25.53	31.44	224.49	500.90

Table G-7 2016 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

Link Name	Link Distance (ft)	Link Speed (mph)	VOLUME				VMT			
			AM Peak	PM Peak	High 8-Hour	AWDT	AM Peak	PM Peak	High 8-Hour	AWDT
242	125	32	81	100	714	1593	1.91	2.36	16.88	37.66
243	564	32	81	100	714	1593	8.65	10.68	76.25	170.13
244	88	32	81	100	714	1593	1.34	1.66	11.83	26.40
245	48	5	0	0	0	0	0.00	0.00	0.00	0.00
246	175	12	227	280	1999	4461	7.52	9.28	66.24	147.83
247	65	22	3	4	29	64	0.04	0.05	0.36	0.79
248	39	12	311	383	2734	6101	2.28	2.81	20.08	44.80
249	128	12	230	283	2020	4508	5.57	6.85	48.88	109.09
250	484	12	239	295	2106	4700	21.93	27.07	193.24	431.25
251	388	5	0	0	0	0	0.00	0.00	0.00	0.00
252	308	14	321	395	2819	6293	18.75	23.08	164.69	367.65
253	54	12	10	12	86	191	0.10	0.12	0.88	1.95
254	51	5	0	0	0	0	0.00	0.00	0.00	0.00
255	290	31	3	4	29	64	0.17	0.22	1.60	3.52
256	377	31	38	47	335	749	2.71	3.36	23.93	53.51
257	215	31	24	29	207	462	0.98	1.18	8.44	18.83
258	321	29	6	7	50	112	0.36	0.43	3.04	6.81
259	203	29	2	3	21	48	0.08	0.12	0.81	1.84
260	362	29	2	3	21	48	0.14	0.21	1.44	3.29
261	219	31	20	25	178	398	0.83	1.04	7.39	16.53
262	218	11	6	7	50	112	0.25	0.29	2.06	4.62
263	177	33	24	29	207	462	0.80	0.97	6.93	15.46
264	157	5	0	0	0	0	0.00	0.00	0.00	0.00
265	2458	26	104	128	914	2039	48.41	59.58	425.47	949.17
266	752	26	149	184	1313	2931	21.22	26.20	186.99	417.42
267	1323	26	218	268	1913	4269	54.61	67.13	479.20	1069.37
268	1252	29	288	355	2534	5655	68.27	84.15	600.67	1340.49
269	302	30	17	21	150	335	0.97	1.20	8.59	19.19
270	1005	11	550	678	4839	10801	104.68	129.05	921.02	2055.78
271	954	14	638	786	5610	12522	115.24	141.98	1013.35	2261.88
272	656	8	593	731	5218	11645	73.68	90.83	648.37	1446.97
273	485	5	620	764	5453	12171	56.96	70.19	500.99	1118.19
274	1244	26	160	197	1406	3138	37.70	46.41	331.26	739.33
275	419	5	0	0	0	0	0.00	0.00	0.00	0.00
276	649	26	147	181	1292	2883	18.06	22.24	158.75	354.25
277	2473	24	101	125	892	1991	47.31	58.56	417.86	932.69
278	573	31	218	269	1920	4285	23.67	29.20	208.43	465.17
279	458	18	256	316	2256	5034	22.19	27.40	195.58	436.42
280	295	24	157	194	1385	3091	8.78	10.85	77.43	172.81
281	440	14	153	188	1342	2995	12.74	15.65	111.72	249.34
282	76	14	97	120	857	1912	1.40	1.74	12.41	27.68
283	697	14	275	339	2420	5401	36.28	44.72	319.24	712.48
284	690	21	446	549	3919	8746	58.25	71.70	511.81	1142.21
285	91	21	389	479	3419	7631	6.70	8.25	58.90	131.46
286	464	21	766	944	6738	15039	67.33	82.97	592.23	1321.84
287	229	27	736	907	6474	14449	31.95	39.37	281.00	627.14
288	500	9	733	903	6445	14386	69.35	85.43	609.74	1361.02
289	738	12	2022	2491	17780	39684	282.64	348.20	2485.31	5547.09
290	190	14	1734	2137	15253	34044	62.32	76.80	548.15	1223.45
291	494	31	420	518	3697	8252	39.32	48.49	346.08	772.47
292	689	10	1313	1618	11549	25776	171.23	211.01	1506.13	3361.50

Table G-7 2016 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

Link Name	Link Distance (ft)	Link Speed (mph)	VOLUME				VMT			
			AM Peak	PM Peak	High 8-Hour	AWDT	AM Peak	PM Peak	High 8-Hour	AWDT
293	325	16	1291	1591	11356	25346	79.48	97.95	699.14	1560.45
294	396	5	365	450	3212	7169	27.40	33.78	241.10	538.13
295	1017	27	917	1130	8066	18002	176.65	217.68	1553.84	3467.92
296	162	16	287	354	2527	5640	8.81	10.87	77.60	173.20
297	140	16	287	354	2527	5640	7.60	9.38	66.94	149.41
298	951	7	278	343	2448	5464	50.09	61.80	441.07	984.47
299	805	17	305	376	2684	5990	46.51	57.33	409.25	913.35
300	518	11	99	122	871	1944	9.72	11.98	85.49	190.82
301	749	7	127	156	1113	2485	18.02	22.13	157.92	352.59
302	652	5	340	419	2991	6675	41.98	51.74	369.33	824.24
303	547	5	196	242	1727	3855	20.29	25.05	178.79	399.10
304	406	10	34	42	300	669	2.61	3.23	23.06	51.43
305	442	5	31	38	271	605	2.60	3.18	22.70	50.67
306	207	5	65	80	571	1274	2.55	3.14	22.40	49.97
307	70	5	261	322	2298	5130	3.46	4.27	30.47	68.02
308	319	8	58	71	507	1131	3.50	4.29	30.64	68.35
309	281	6	84	104	742	1657	4.47	5.53	39.47	88.15
310	555	30	554	682	4868	10865	58.19	71.63	511.28	1141.13
311	208	26	554	682	4868	10865	21.82	26.87	191.77	428.02
312	125	26	1295	1596	11392	25426	30.66	37.78	269.70	601.94
313	332	10	610	751	5360	11964	38.39	47.27	337.35	753.00
314	440	10	924	1139	8130	18145	77.03	94.96	677.81	1512.77
315	215	17	886	1092	7794	17396	36.08	44.47	317.43	708.49
316	543	11	125	154	1099	2453	12.86	15.84	113.06	252.36
317	180	8	381	470	3355	7487	12.99	16.02	114.38	255.25
318	221	9	381	470	3355	7487	15.93	19.65	140.25	312.98
319	2544	11	472	581	4147	9256	227.40	279.92	1997.97	4459.42
320	552	12	43	53	378	844	4.49	5.54	39.50	88.19
321	628	11	310	382	2727	6086	36.89	45.46	324.51	724.24
322	181	9	377	465	3319	7408	12.93	15.94	113.80	253.99
323	58	9	310	382	2727	6086	3.42	4.22	30.10	67.18
324	387	9	4	5	36	80	0.29	0.37	2.64	5.87
325	406	9	314	387	2762	6165	24.13	29.73	212.21	473.68
326	89	5	88	109	778	1736	1.48	1.83	13.07	29.16
327	463	12	331	408	2912	6500	29.03	35.78	255.36	570.00
328	79	19	418	515	3676	8204	6.26	7.71	55.05	122.85
329	103	19	418	515	3676	8204	8.12	10.01	71.43	159.42
330	323	12	22	27	193	430	1.34	1.65	11.80	26.29
331	179	10	469	578	4126	9208	15.89	19.59	139.83	312.05
332	993	7	347	427	3048	6802	65.25	80.29	573.12	1278.98
333	384	5	0	0	0	0	0.00	0.00	0.00	0.00
334	366	23	297	366	2612	5831	20.57	25.35	180.89	403.82
335	583	31	427	526	3754	8380	47.15	58.08	414.49	925.26
336	428	27	935	1152	8223	18352	75.84	93.44	666.97	1488.54
337	94	23	360	444	3169	7073	6.42	7.92	56.55	126.23
338	366	5	200	247	1763	3935	13.86	17.11	122.14	272.62
339	311	5	161	198	1413	3154	9.47	11.65	83.11	185.51
340	273	18	20	25	178	398	1.03	1.29	9.20	20.56
341	66	16	20	25	178	398	0.25	0.31	2.22	4.96
342	48	5	0	0	0	0	0.00	0.00	0.00	0.00
343	52	22	45	55	393	876	0.44	0.54	3.87	8.63

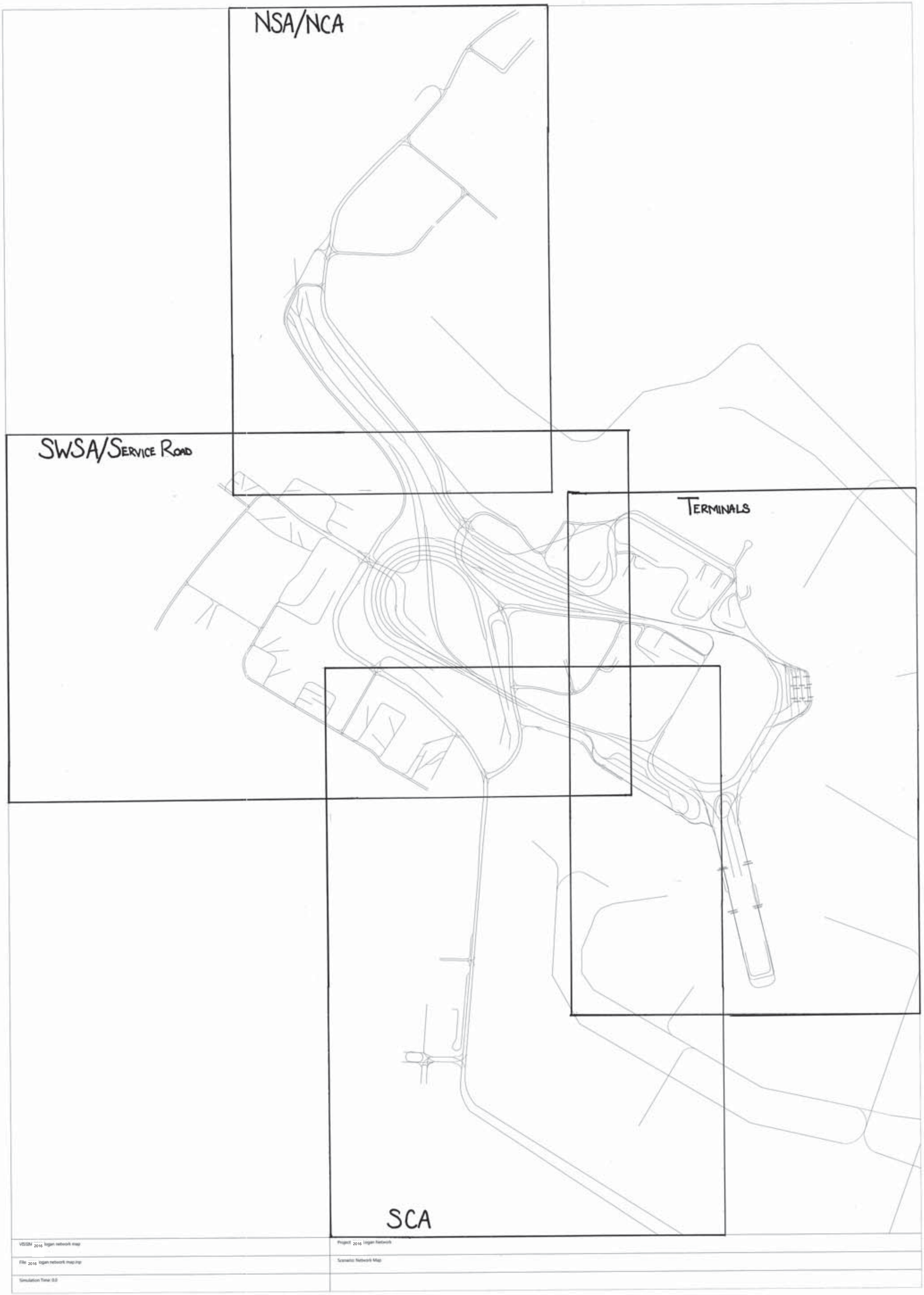
Table G-7 2016 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

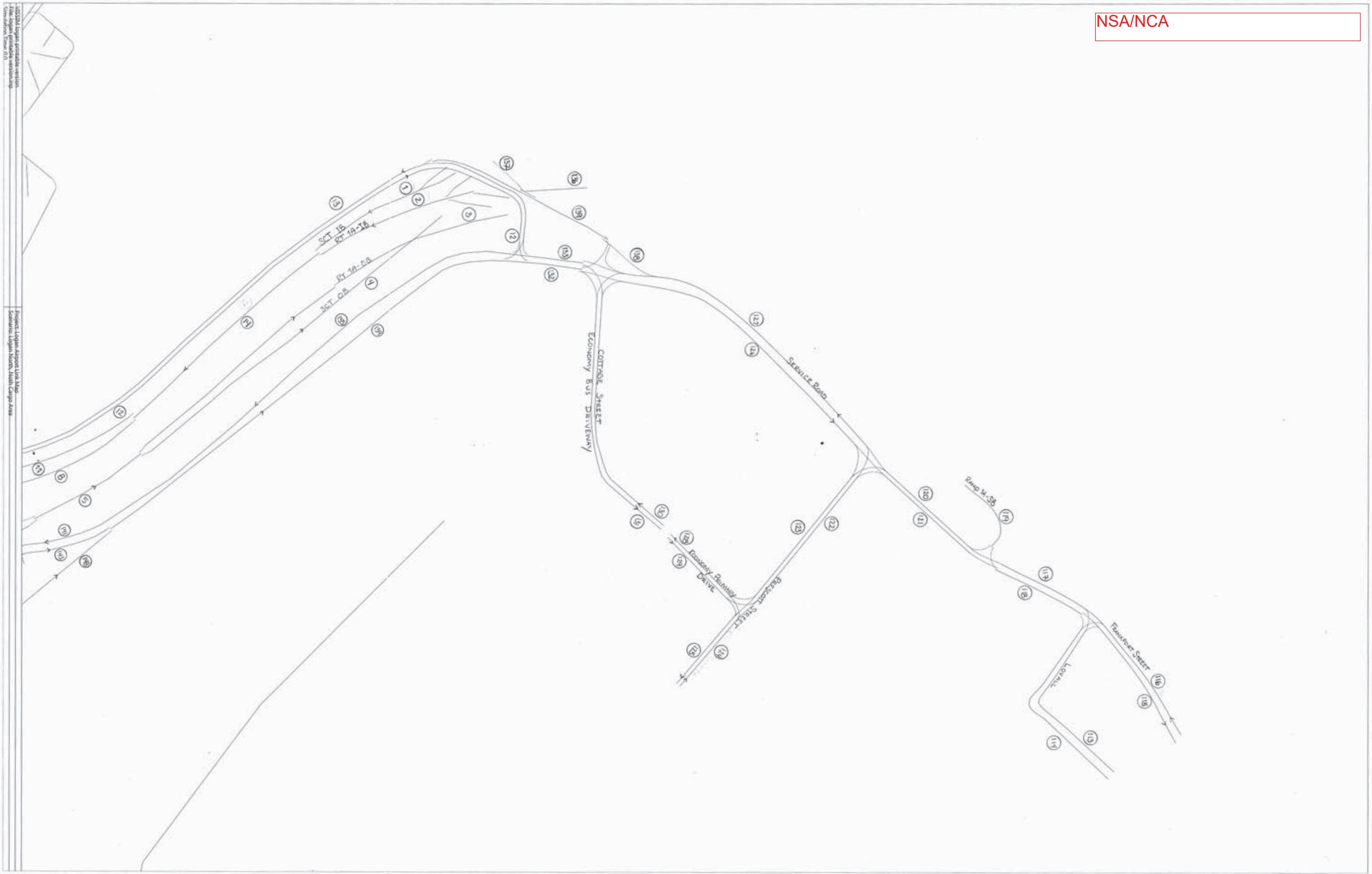
Link Name	Link Distance (ft)	Link Speed (mph)	VOLUME				VMT			
			AM Peak	PM Peak	High 8-Hour	AWDT	AM Peak	PM Peak	High 8-Hour	AWDT
344	82	12	34	42	300	669	0.53	0.65	4.67	10.41
345	25	5	76	94	671	1497	0.36	0.45	3.18	7.09
346	121	5	75	92	657	1466	1.71	2.10	15.00	33.48
347	303	10	108	133	949	2119	6.20	7.63	54.44	121.56
348	146	6	496	611	4361	9734	13.73	16.91	120.72	269.45
349	67	6	237	292	2084	4652	3.00	3.69	26.34	58.81
350	446	5	234	288	2056	4588	19.75	24.31	173.57	387.33
351	335	5	31	38	271	605	1.97	2.41	17.22	38.44
352	430	5	218	268	1913	4269	17.74	21.81	155.66	347.38
353	360	5	43	53	378	844	2.93	3.61	25.74	57.47
354	50	14	108	133	949	2119	1.02	1.26	8.99	20.07
355	88	5	232	286	2041	4556	3.87	4.78	34.08	76.08
356	113	5	493	607	4333	9670	10.55	12.99	92.76	207.02
358	463	5	0	0	0	0	0.00	0.00	0.00	0.00
359	229	12	4	5	36	80	0.17	0.22	1.56	3.47
360	245	13	4	5	36	80	0.19	0.23	1.67	3.72
361	248	17	45	56	400	892	2.11	2.63	18.77	41.86
362	199	8	45	55	393	876	1.70	2.07	14.82	33.04
363	230	22	50	61	435	972	2.18	2.65	18.93	42.30
364	256	19	49	60	428	956	2.38	2.91	20.76	46.38
365	201	23	15	19	136	303	0.57	0.72	5.17	11.53
366	201	10	71	88	628	1402	2.71	3.35	23.93	53.43
367	337	31	620	764	5453	12171	39.58	48.77	348.11	776.97
368	868	11	353	435	3105	6930	58.06	71.55	510.69	1139.81
369	167	5	323	398	2841	6340	10.24	12.62	90.06	200.98
370	96	10	429	528	3769	8411	7.77	9.57	68.28	152.39
371	141	25	761	937	6688	14927	20.31	25.01	178.49	398.38
372	283	17	249	307	2191	4891	13.34	16.45	117.37	262.01
373	283	24	168	207	1478	3298	9.00	11.09	79.18	176.67
			Logan Airport VMT				**9,009**	**11,101**	**79,234**	**176,841**

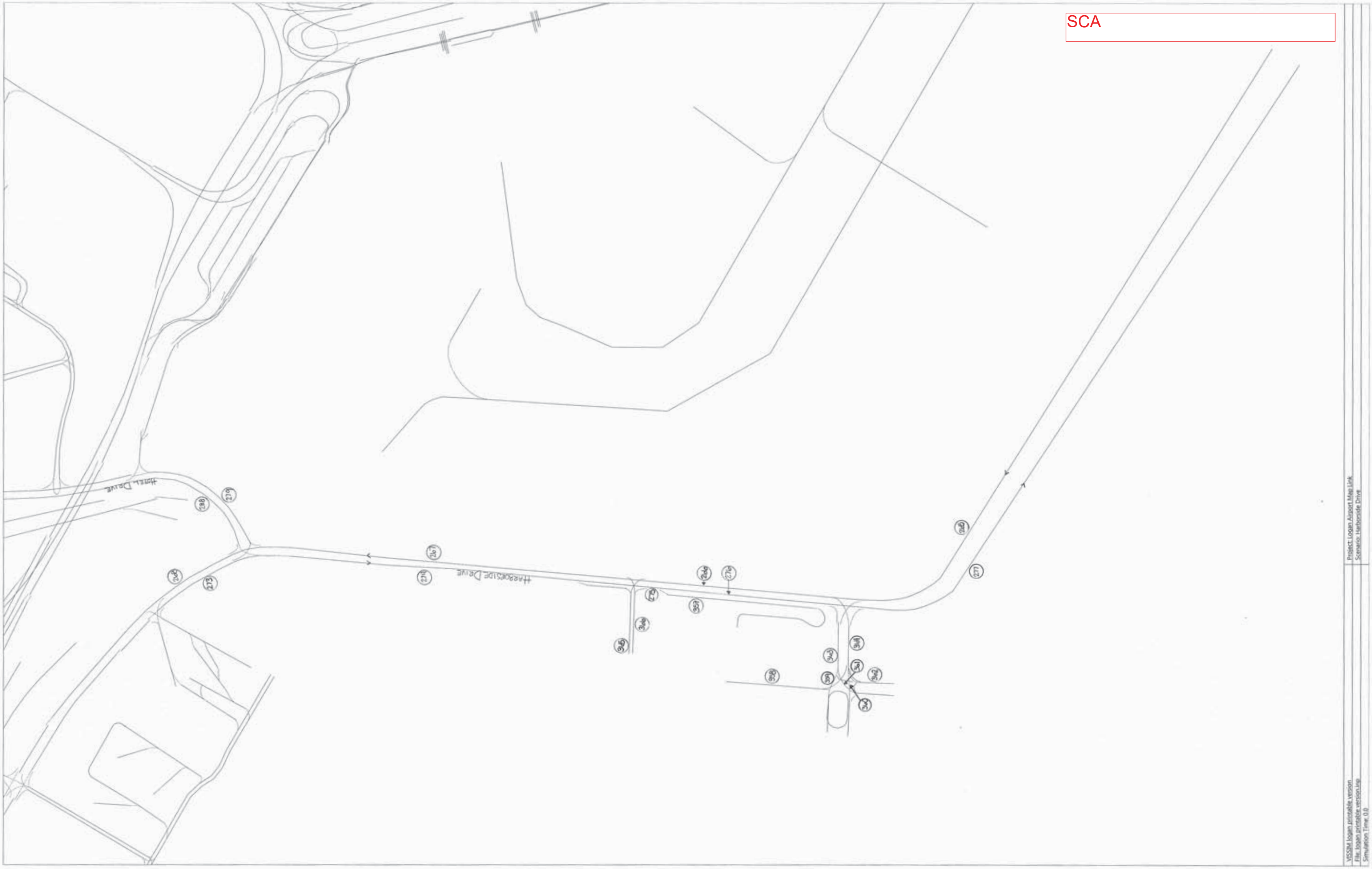
Source: VHB.

Notes:

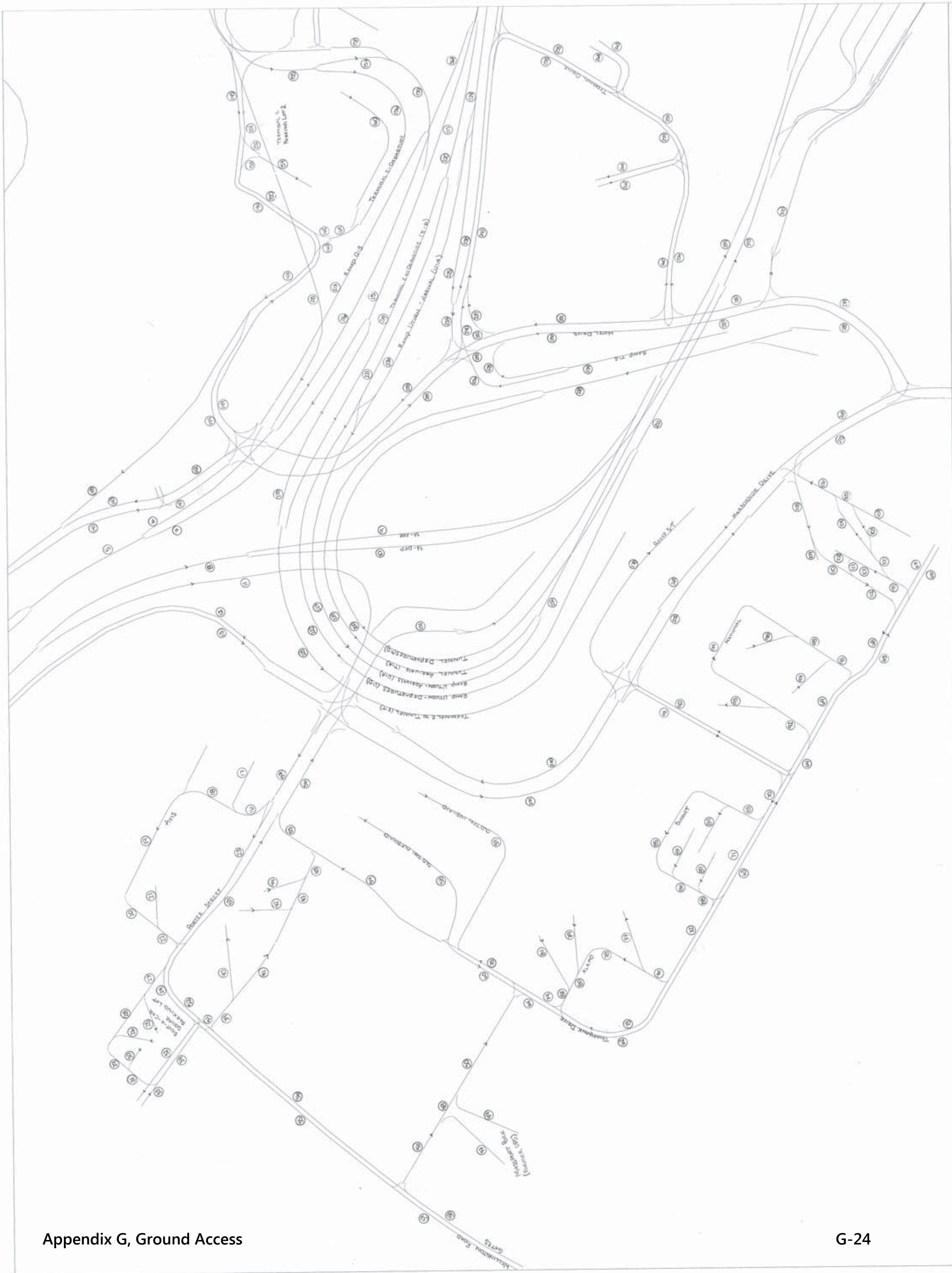
AWDT = Average annual weekday daily traffic

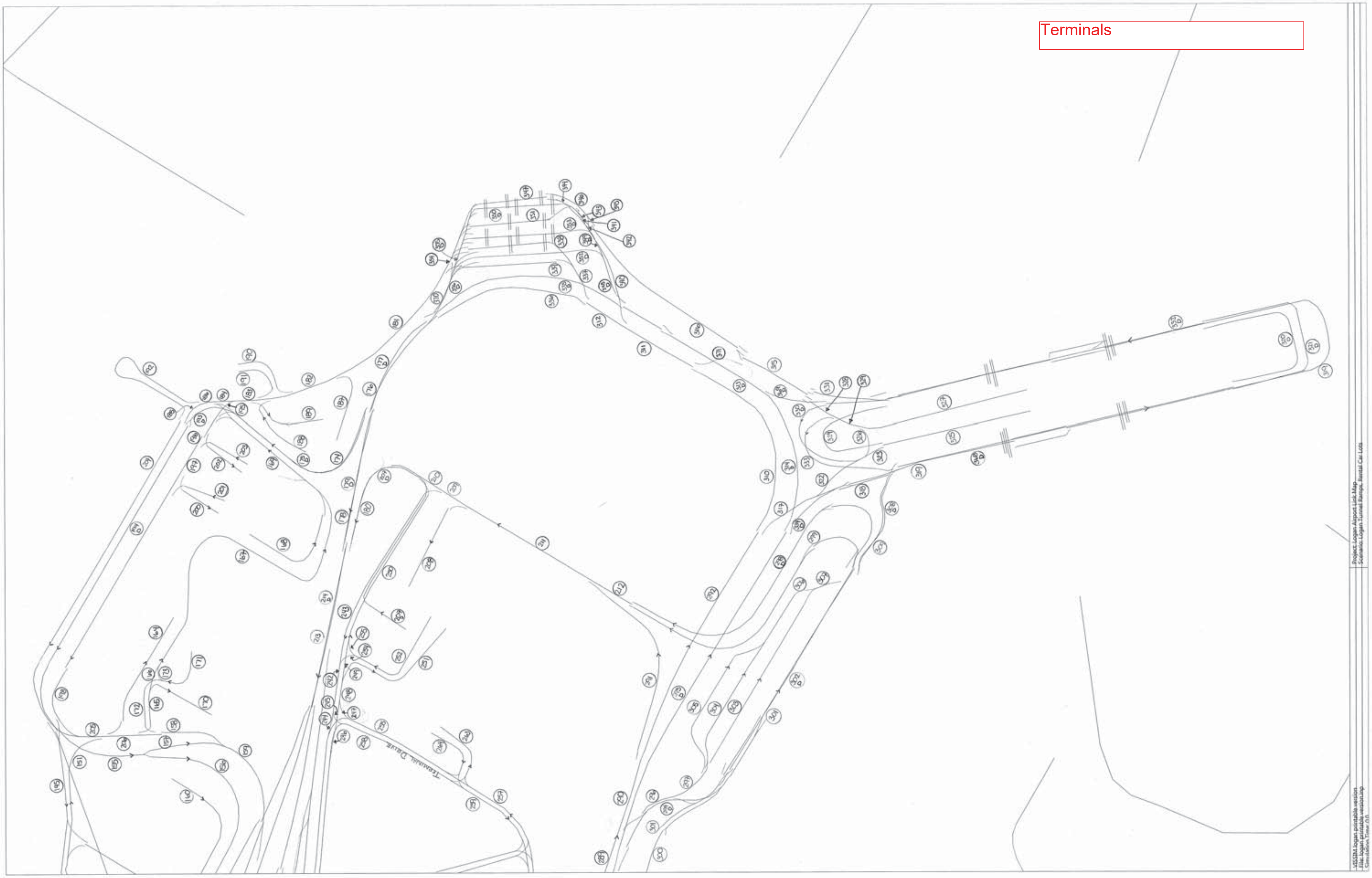

NSA/NCA
SWSA/Service Road
Terminals
SCA
VISSIM 2016 logan network map
Project: 2016 logan Network
File: 2016 logan network map.inp
Scenario: Network Map
Simulation Time: 0.0


NSA/NCA
SCT 1B
RT 1A-1B
RT 1A-0A
SCT 0A
COTTAGE STREET
ECONOMY BUS DRIVEWAY
SERVICE ROAD
ECONOMY PARKWAY DRIVE
PRESCOTT STREET
RAMP 1A-3B
FRANKFORT STREET
LOVELL


SCA

SWSA/Service Roadways




Terminals

Massachusetts Port Authority
One Harborside Drive, Suite 200-S
East Boston, MA 02128-2909
Telephone: 617-568-5000
www.massport.com

April 15, 2016

Christine Kirby, Director, Air & Climate Division
Massachusetts Department of Environmental Protection
Bureau of Air & Waste
One Winter Street
Boston, MA 02108

Re: Logan Airport Parking Space Inventory

Dear Ms. Kirby:

In compliance with the reporting requirements of 310 CMR 7.30 (3)(d), enclosed are the following Massachusetts Port Authority (Massport) submissions for Logan Airport:

- Commercial Parking Space Inventory
- Employee Parking Space Inventory
- Location Map

The attachments provide the quantity, physical distribution, and allocation of commercial and employee parking spaces on the airport, as defined by 310 CMR 7.30, as amended. These inventory tables represent information provided by the Aviation Department and are supported by comprehensive field checks and counts conducted in late February and March 2016.

The Commercial Parking Space Inventory totals 18,640 spaces; the Employee Parking Space Inventory totals 2,448 parking spaces; the total inventory of spaces at Logan Airport is 21,088. For your information, we continue to provide information on rental car spaces.

As noted in our September letter, Massport consolidated all remaining (i.e., designated) parking spaces allowed under the freeze into the central terminal area's West Garage. The garage expansion is currently operating and the revised capacity is presented in the attached tables.

Page 2

The attached Logan Airport Parking Space Inventory reflects Massport's successful management of its parking program, within the requirements of 310 CMR 7.30, as amended. If you have any questions, please call me at 617-568-3689.

Sincerely,

Hayes Morrison
Deputy Director - Maritime, Land Use, and Transportation Planning
Strategic & Business Planning Department

cc: D. Conroy, EPA
S. Dalzell, MPA
B. Desrosiers, MPA
H. Morrison, MPA
I. Wallach, MPA

Employee Parking Space Inventory
Logan International Airport
April 15, 2016 Submission

As of 2014: space count excludes spaces designate

Employee Parking Spaces

Area		Map ID#	Location of Employee Parking Areas	Jan-16 Number of Spaces	Aug-15 Number of Spaces
Terminal	Terminal Area	E81	West Garage	98	98
Terminal	Terminal Area	E26	Airport Tower/Administration (parking in Central Garage)	521	521
Terminal	Terminal Area	E20	Terminal C Pier A (Old Terminal D) (two lots)	122	122
Terminal	Terminal Area	E18	Massport Facilities 1 (Heating Plant)	92	92
Terminal	Terminal Area	E34	Hilton Hotel employee lot	28	28
Terminal	Terminal Area	E86	Gulf Gas Station	4	4
North	North Service Area	E68a	LSG Sky Chefs (Bldg. 68), main lot	25	25
North	North Service Area	E68b	LSG Sky Chefs (Bldg. 68), overflow lot	126	126
North	North Service Area	E1	Flight Kitchen Building 1 (and nearby lot)	80	80
North	North Service Area	E40	Lovell Street Lot (contractor trailer)	25	25
North	North Service Area	E53	Green Bus Depot (Bus Maintenance Facility)	12	12
North	North Service Area	E11a	North Cargo Building 11, TSA lot	93	93
North	North Service Area	E11b	North Cargo Building 11, State Police lot	136	136
North	North Service Area	E43	North Gate & EMS Trailer (EMS Station A7)	21	21
North	North Service Area	E8	North Cargo Building 8	114	114
North	North Service Area	E5	US Airways Administration/Hangar (Bldg. 5)	75	75
airside	North Service Area	*N/A*	Massport Facilities 2 (airside, Bldg. 3)	0	0
North	North Service Area	E4	Massport Facilities 3 (landside, Bldg. 4)	69	69
North	North Service Area	E13	UPS (Cargo Building 13)	44	44
North	North Service Area	E94	United Aircraft Maintenance (Buildings 93 & 94)	56	56
SW	SWSA	E59	Bus/Limo Pool Lot	4	4
SW	SWSA	E60	Rental Car Center (Customer Service Center)	4	4
SW	SWSA	E72	Taxi Pool Lot	8	8
South	South Service Area	E84	Bird Island Flats / Logan Office Center (LOC) Garage	416	416
South	South Service Area	E63	South Cargo Building 63	16	16
South	South Service Area	E62	South Cargo Building 62	43	43
South	South Service Area	E58	South Cargo Building 58	23	23
South	South Service Area	E57	South Cargo Building 57	44	44
South	South Service Area	E56	South Cargo Building 56	39	39
South	South Service Area	E78	Fire-Rescue HQ & Amelia Earhart Terminal/Hangar	84	84
airside		*N/A*	*ARFF Satellite Station* [1]	0	0

[1] This facility is located on the airfield and is not shown in the map. No employee parking spaces are provided.

	Jan-16	Aug-15
Total In-Service Employee Parking Spaces	2,422	2,422
Total Designated Employee Parking Spaces	26 *	251
Total Employee Parking Spaces	2,448	2,673
Total Commercial Parking Spaces *(see table on previous page)*	18,640	18,415
TOTAL PARKING SPACES	21,088	21,088
TOTAL PARKING FREEZE SPACES		

SUMMARY

TOTAL COMMERCIAL PARKING SPACES	18,415
TOTAL EMPLOYEE PARKING SPACES	2,673
TOTAL PARKING FREEZE SPACES	21,088

* Total Designated Employee Parking Space Calculation	Total Parking Freeze Spaces - Total Commercial		
Total Designated Employee Parking Space		26	251

Commercial Parking Space Inventory
Logan International Airport
April 15, 2016 Submission

Commercial Parking Spaces

Old Map ID#	Map ID#	Location of Commercial Parking Areas	Jan-16 Number of Spaces	Difference	Aug-15 Number of Spaces
		Terminal Area and Economy Spaces			
C1a	C1	Central Garage	7179	(34)	7,213
C1b	C2	West Garage	3076	(51)	3,127
		West Garage Expansion	1699	1,699	
C2	C3	Terminal B Garage	2212	11	2,201
C8a	C5	Terminal E Lot 1	237	0	237
C8b	C6	Terminal E Lot 2	249	0	249
C9	C7	Terminal E Lot 3 (fka "Gulf Station" Lot)	217	0	217
		Blue Lot	367	367	
C6	C8	Economy Garage	2864	0	2,864
		subtotal	18100	1,992	*16,108*
		Overflow Commercial Spaces			
	C11	Red Lot (Tomahawk Dr.)		(282)	282
	C12	Blue Lot (Harborside Dr.)		(339)	339
	C13	Green Lot (Wood Island)		(242)	242
		subtotal	0	(863)	*863*
		Hotel Spaces			
C4	C4a & ~~C4b~~	Logan Airport Hilton Hotel (one lot)	235	200	35
C7a	C10	Harborside Hyatt Conference Center	270	0	270
		subtotal	505	200	*305*
		General Aviation Spaces			
C5	C9	Signature (General Aviation Terminal)	35		35
		subtotal	35		*35*
		Total In-Service Commercial Parking Spaces	**18,640**	**1,329**	**17,311**
		Total Designated Commercial Parking Spaces	**0**	**(1,104)**	**1,104**
		Total Commercial Parking Spaces	**18,640**	**225**	**18,415**
		Total Employee Parking Spaces *(see table on next page)*	**2,448**	**(225)**	**2,673**
		TOTAL PARKING FREEZE SPACES	**21,088**	**-**	**21,088**
			18,100		*18,075*

For Information Only:
Rental Car Spaces Inventory
Logan International Airport
April 15, 2016 Submission

Rental Car Company Parking Spaces

Map ID#		Number of Spaces
R1	Rental Car Center (RCC)	5,020
Total Rental Car Spaces		**5,020**

Massachusetts Port Authority
One Harborside Drive, Suite 200-S
East Boston, MA 02128-2909
Telephone: 617-568-5000
www.massport.com

September 29, 2016

Christine Kirby, Director, Air & Climate Division
Massachusetts Department of Environmental Protection
Bureau of Air & Waste
One Winter Street
Boston, MA 02108

Re: Logan Airport Parking Space Inventory

Dear Ms. Kirby:

In compliance with the reporting requirements of 310 CMR 7.30 (3)(d), enclosed are the following Massachusetts Port Authority (Massport) submissions for Logan Airport:

- Commercial Parking Space Inventory
- Employee Parking Space Inventory
- Location Map

The attachments provide the quantity, physical distribution, and allocation of commercial and employee parking spaces on the airport, as defined by 310 CMR 7.30, as amended. These inventory tables represent information provided by the Aviation Department and are supported by comprehensive field checks and counts conducted in late September 2016.

The Commercial Parking Space Inventory totals 18,640 spaces; the Employee Parking Space Inventory totals 2,448 parking spaces; the total inventory of spaces at Logan Airport is 21,088. For your information, we continue to provide information on rental car spaces.

The attached Logan Airport Parking Space Inventory reflects Massport's successful management of its parking program, within the requirements of 310 CMR 7.30, as amended. If you have any questions, please call me at 617-568-3689.

Sincerely,

Hayes Morrison
Deputy Director - Maritime, Land Use, and
Transportation Planning
Strategic & Business Planning Department

cc:

D. Conroy, EPA
L.O'Connor, MPA
S. Dalzell, MPA
B. Desrosiers, MPA
M. Kalowski, MPA

Commercial Parking Spaces

Old Map ID#	Map ID#	Location of Commercial Parking Areas	Number of Spaces (Sep-16)
	Terminal Area and Economy Spaces		
C1a	C1	Central Garage	7179
C1b	C2	West Garage	3076
		West Garage Expansion	1699
C2	C3	Terminal B Garage	2212
C8a	C5	Terminal E Lot 1	237
C8b	C6	Terminal E Lot 2	249
C9	C7	Terminal E Lot 3 (fka "Gulf Station" Lot)	217
		Blue Lot	367
C6	C8	Economy Garage	2864
		subtotal	18100
	Overflow Commercial Spaces		
	C11	Red Lot (Tomahawk Dr.)	
	C12	Blue Lot (Harborside Dr.)	
	C13	Green Lot (Wood Island)	
		subtotal	0
	Hotel Spaces		
C4	C4a ~~& C4b~~	Logan Airport Hilton Hotel (one lot)	235
C7a	C10	Harborside Hyatt Conference Center	270
		subtotal	505
	General Aviation Spaces		
C5	C9	Signature (General Aviation Terminal)	35
		subtotal	35

Total In-Service Commercial Parking Spaces	**18,640**
Total Designated Commercial Parking Spaces	**0**
Total Commercial Parking Spaces	**18,640**
Total Employee Parking Spaces *(see table on next page)*	**2,448**
TOTAL PARKING FREEZE SPACES	**21,088**

As of 2014: space count excludes

Employee Parking Spaces

Area		Map ID#	Location of Employee Parking Areas	Number of Spaces Sep-16
Terminal	Terminal Area	E81	West Garage	98
Terminal		E26	Airport Tower/Administration (parking in Central Garage)	521
Terminal		E20	Terminal C Pier A (Old Terminal D) (two lots)	122
Terminal		E18	Massport Facilities 1 (Heating Plant)	92
Terminal		E34	Hilton Hotel employee lot	28
Terminal		E86	Gulf Gas Station	4
North	North Service Area	E68a	LSG Sky Chefs (Bldg. 68), main lot	25
North		E68b	LSG Sky Chefs (Bldg. 68), overflow lot	126
North		E1	Flight Kitchen Building 1 (and nearby lot)	80
North		E40	Lovell Street Lot (contractor trailer)	25
North		E53	Green Bus Depot (Bus Maintenance Facility)	12
North		E11a	North Cargo Building 11, TSA lot	93
North		E11b	North Cargo Building 11, State Police lot	136
North		E43	North Gate & EMS Trailer (EMS Station A7)	21
North		E8	North Cargo Building 8	114
North		E5	US Airways Administration/Hangar (Bldg. 5)	75
airside		*N/A*	Massport Facilities 2 (airside, Bldg. 3)	0
North		E4	Massport Facilities 3 (landside, Bldg. 4)	69
North		E13	UPS (Cargo Building 13)	44
North		E94	United Aircraft Maintenance (Buildings 93 & 94)	56
SW	SWSA	E59	Bus/Limo Pool Lot	4
SW		E60	Rental Car Center (Customer Service Center)	4
SW		E72	Taxi Pool Lot	8
South	South Service Area	E84	Bird Island Flats / Logan Office Center (LOC) Garage	416
South		E63	South Cargo Building 63	16
South		E62	South Cargo Building 62	43
South		E58	South Cargo Building 58	23
South		E57	South Cargo Building 57	44
South		E56	South Cargo Building 56	39
South		E78	Fire-Rescue HQ & Amelia Earhart Terminal/Hangar	84
airside		*N/A*	*ARFF Satellite Station* [1]	0

[1] This facility is located on the airfield and is not shown in the map. No employee parking spaces are provided

Total In-Service Employee Parking Spaces	**2,422**
Total Designated Employee Parking Spaces	**26**
Total Employee Parking Spaces	**2,448**
Total Commercial Parking Spaces *(see table on previous page)*	**18,640**
TOTAL PARKING SPACES	**21,088**
TOTAL PARKING FREEZE SPACES	21,088

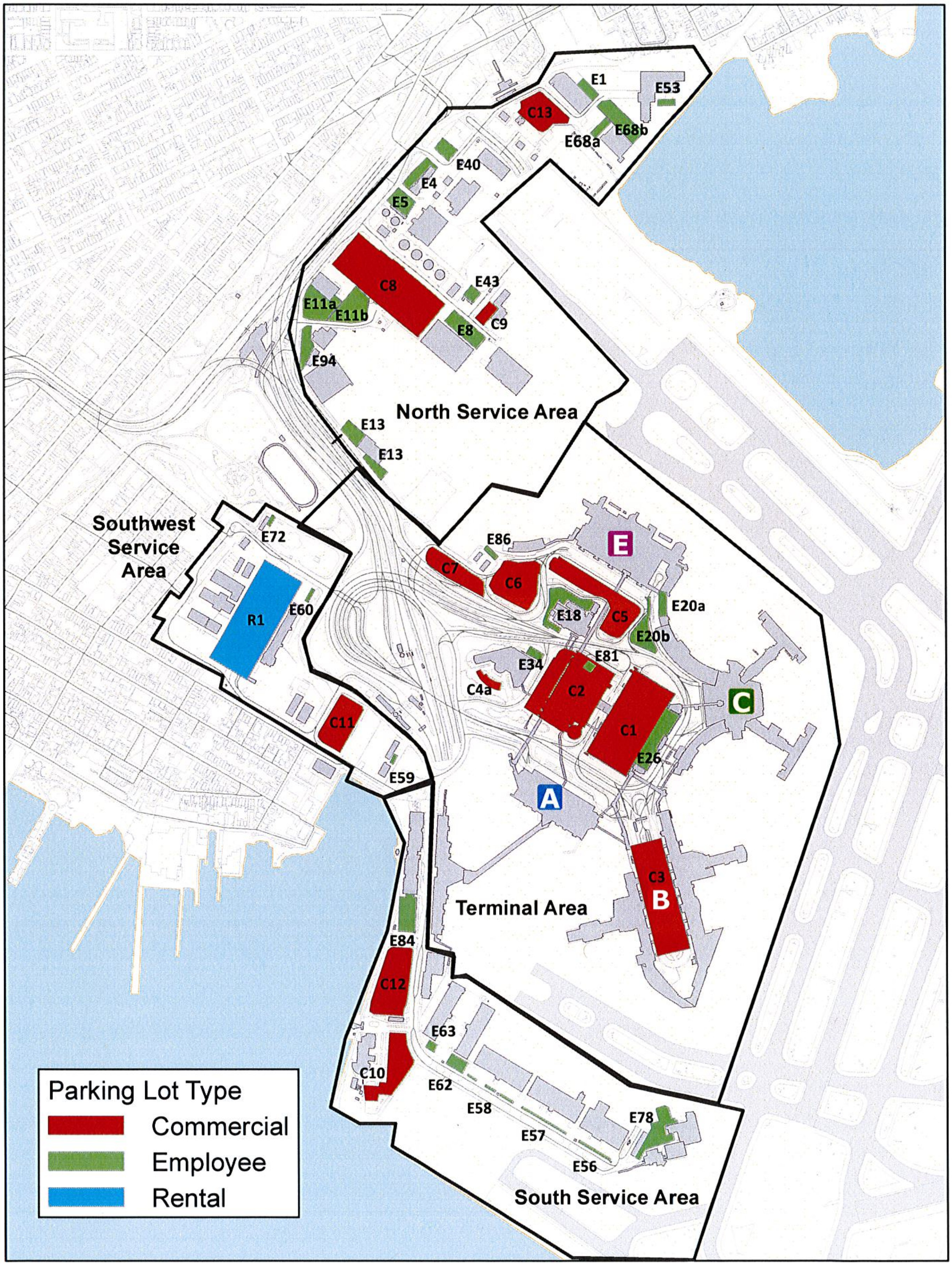
SUMMARY

TOTAL COMMERCIAL PARKING SPACES	***18,640***
TOTAL EMPLOYEE PARKING SPACES	***2,448***
TOTAL PARKING FREEZE SPACES	***21,088***

Rental Car Company Parking Spaces

Map ID#		Number of Spaces
R1	Rental Car Center (RCC)	5,020
Total Rental Car Spaces		**5,020**

Logan Airport Parking Space Inventory



Date: September 27, 2016
Projection: Lambert Conformal Conic
Coordinate System: NAD 1983 State Plane Massachusetts Mainland FIPS 2001 (Meter)

H

Noise Abatement

This appendix provides detailed information, tables, and figures in support of Chapter 6, *Noise Abatement*. The contents of this appendix are summarized below.

- Massport and FAA correspondence letters regarding AEDT modeling adjustments
  - Massport AEDT Non-Standard Modeling Request dated July 12, 2017
  - FAA Response to AEDT Non-Standard Modeling Request dated August 18, 2017
  - Massport Letter and memorandum to FAA Regarding AEDT Model Results dated November 16, 2016
  - FAA Response Letter Responding dated November 28, 2016
- Massport and FAA correspondence letter regarding RNAV Pilot Test: Request that FAA adopt the JetBlue Airways RNAV Visual Approach Procedure to Runway 33L
- Massport and FAA correspondence letter regarding Massport recommended procedural changes to RNAV
- Fundamentals of Acoustics and Environmental Noise
  - Figure H-1 Frequency-Response Characteristics of Various Weighting Networks
  - Figure H-2 Common Environmental Sound Levels, in dBA
  - Figure H-3 Variations in the A-Weighted Sound Level Over Time
  - Figure H-4 Sound Exposure Level (SEL)
  - Figure H-5 Example of a One Minute Equivalent Sound Level (L_{eq})
  - Figure H-6 Daily Noise Dose
  - Figure H-7 Examples of Day-Night Average Sound Levels (DNL)
  - Figure H-8 Outdoor Speech Intelligibility
  - Figure H-9 Probability of Awakening at Least Once from Indoor Noise Event
  - Figure H-10 Percentage of People Highly Annoyed
  - Figure H-11 Community Reaction as a Function of Outdoor DNL
- Regulatory Framework
- Logan Airport RealContours™ and RC for AEDT™ Data Inputs
  - Figure H-12 Schematic Noise Modeling Process (Standard INM vs. RC for AEDT™)
  - Table H-1a 2015 Annual Modeled Operations
  - Table H-1b 2016 Annual Modeled Operations
  - Table H-2a 2015 Modeled Runway Use by Aircraft Group

  - Table H-22b Runways 22R and 22L Shoreline Crossings Above 6,000 Feet for 2016
  - Table H-23a Runway 27 Corridor Percent of Tracks Through Each Gate for 2015
  - Table H-23b Runway 27 Corridor Percent of Tracks Through Each Gate for 2016
  - Table H-24a Runway 33L Gates – Passages Below 3,000 Feet for 2015
  - Table H-24b Runway 33L Gates – Passages Below 3,000 Feet for 2016
  - Table H-25 Runway Usage by Runway End
- Logan Airport Census Block Group Noise Levels
  - Table H-26 Logan Census Block Group Noise Levels
- Dourado, E. and Russell, R. October 2016. "Airport Noise NIMBYism: An Empirical Investigation." *Mercatus on Policy: Mercatus Center at George Mason University*.

Massport AEDT Non-Standard Modeling Request dated July 12, 2017

HMMH
77 South Bedford Street
Burlington, Massachusetts 01803
781.229.0707
www.hmmh.com

TECHNICAL MEMORANDUM

To:	Flavio Leo Massport One Harborside Drive, Suite 2005 East Boston, MA 02128
From:	Robert Mentzer Jr., HMMH
Date:	July 12, 2017
Subject:	BOS AEDT Non-Standard Modeling Request
Reference:	HMMH Project Number 307500.003.004

1. INTRODUCTION

HMMH and Massport met with the Federal Aviation Administration (FAA) New England region on October 17, 2016 to review the Aviation Environmental Design Tool (AEDT) and Integrated Noise Model (INM) results for Logan Airport. Massport had received approval from FAA for adjustments to the INM model for the Logan Airside EIS and has included those adjustments each year in their annual DNL contour submittal to the Massachusetts Environmental Policy Act (MEPA). It was decided at that meeting for Massport to submit a list of adjustments/modifications for the new AEDT model to the FAA Office of Environment & Energy (AEE) so that a discussion between the groups could begin.

HMMH and Massport submitted a request for non-standard modeling for AEDT to the FAA on November 17, 2016. The intent of this letter was to start the dialog with AEE on how to best use AEDT at Logan Airport with modifications that Massport has used in the past.

FAA AEE responded on 11/28/2016. AEE responded that they would need additional information including specific details on the proposed methodologies before any determination can be made. AEE suggests that a dialog between AEE, Massport and Massport consultants may be the most efficient way to address what if any of the methods will be appropriate for AEDT.

Massport and HMMH met with FAA NE and AEE on January 31, 2017 to review the non-standard request for AEDT and to discuss options for each proposal. AEE suggested Massport provide an outline of their revised approach to each proposal for AEE to review. This way AEE can assist Massport with developing non-standard proposals for AEDT that they can approve.

AEDT 2C Service Pack 2 (SP2) was released on March 13, 2017 and is the version expected to be used for the upcoming DNL contour development. HMMH completed a review of AEDT 2C SP2 and then provided the non-standard outline for AEE on April 5, 2017. Massport and HMMH met with FAA NE and AEE on May 5, 2017 to review and discuss the revised non-standard outline.

The following is the non-standard modeling request memorandum for AEE seeking formal concurrence for modifications to AEDT data to develop DNL contours to support the Residential Sound Insulation Program (RSIP). The current year that Massport has data for is 2015. This data was published as part of the 2015 Environmental Data Report (2015 EDR). Massport understands if it decides to use this modeling for a different project, it will have to resubmit the letter for individual project approval.

2. MASSPORT REQUESTED ADJUSTMENTS

2.1 Overwater Adjustment

Like INM, AEDT currently includes a lateral attenuation adjustment to account for the effects of lateral aircraft directivity and for acoustic propagation over soft ground. Both models do not account for mixed surfaces or hard surfaces such as water. This issue was identified at Logan Airport in the 1990's and to address it Massport conducted a noise measurement program and developed an adjustment for the INM model to account for the hard surface. At that time, the measurements indicated as much as a 6 dB difference between measured and modeled data. The adjustment was approved by FAA for use during the Logan Airside Improvements Project[1]. It has been in use for more than a decade with INM at Logan Airport and is designed to account for the water surface surrounding Logan Airport. The INM process involves adjusting the Start of Takeoff roll thrust values for all jet aircraft to achieve a 6 dB increase along the takeoff roll. This adjustment is ended when the aircraft reaches 100' and returns to standard INM profile data.

As part of this process, Massport evaluated other possible methods including other noise models. Other aircraft noise models such as the Department of Defense Noisemap model have the ability to incorporate a hard surface (such as water) but Noisemap lacks a current civil aircraft database and would not provide a suitable adjustment grid for the current fleet mix at Logan Airport.

The Airport Cooperative Research Project ACRP 02-52, *Improving AEDT Noise Modeling of Ground Surfaces* has been evaluating this issue and just released its final report. The study evaluated data for several airports including Logan Airport and methods employed in other noise models. The ACRP report proposes a method for FAA to incorporate into AEDT; however it is unknown when that will occur. Until such time that this option is available in AEDT, we request to use a method similar to the one previously developed for INM.

Requested Approach

Massport proposes to modify the Initial takeoff roll noise level to increase the noise level along the runways. Increasing the noise level while the aircraft is on the runway was the method approved previously by FAA for the INM model.

To accomplish this Massport proposes the following:

- For each INM type, the takeoff roll thrust will be determined.
- If the takeoff roll thrust is greater than the highest thrust available then add a new higher thrust departure Noise-Power-Distance (NPD) curve (10% higher) which will be 6 dB higher than the highest AEDT standard NPD curve for each aircraft. A new curve is necessary to allow for the NPD extrapolation limit to be increased at Start-of-Takeoff Roll (STR).
- If the takeoff roll thrust is less than the highest thrust available then adjust the highest thrust departure Noise-Power-Distance (NPD) curve by adding 6 dB to each distance provided in that curve. A new curve will be added with a thrust value 10% below the STR thrust and each noise value will be the interpolated value for that thrust level from the original NPD curves.
- In most cases, this upper NPD curve is only used by aircraft employing "Maxtakeoff" thrust on departure and would not be used in other phases of flight.

The following graphics display how the SEL contours are modified by this process. Figure 1 displays the Embraer 195 (EMB195) aircraft departing on Runway 4R. The increase due to the proposed adjustments is shown in the red SEL contour along Start-of-Takeoff roll. The black SEL contour line is the standard AEDT departure SEL. Figure 2 displays the Boeing 737-800 (737800) aircraft departing on Runway 4R. The increase due to the proposed adjustments is shown in the red SEL contour along Start-of-Takeoff roll. The black SEL contour line is the standard AEDT departure SEL.

[1] The approval was for the Logan Airport Improvement Program EIS, Massport has included the adjustment in annual contours submitted to the State of Massachusetts since then.

Flavio Leo
July 11, 2017
Page 3

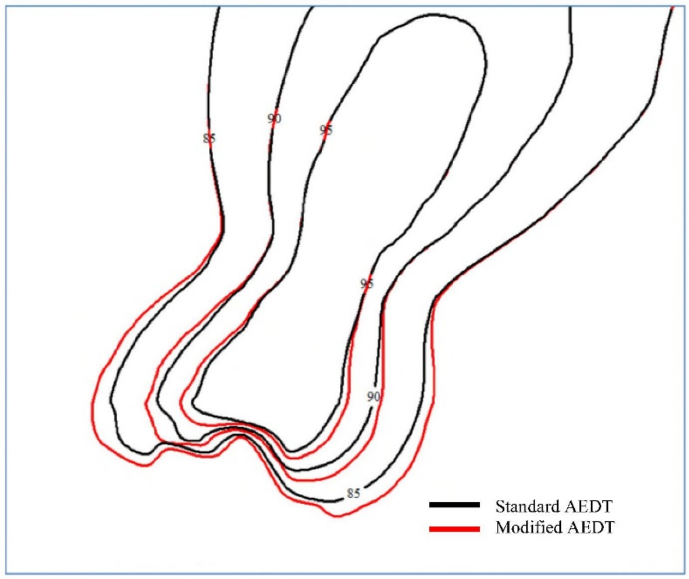


Figure 1 – Embraer 195 Departure SEL

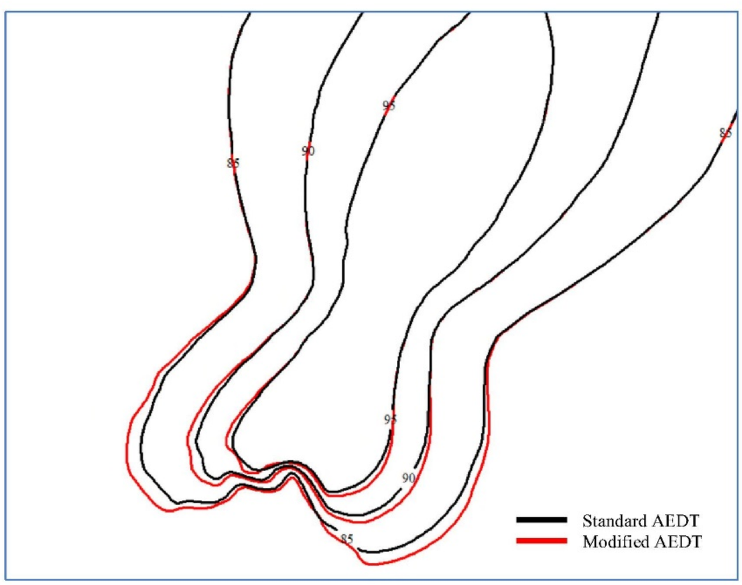


Figure 2 Boeing 737-800 Departure SEL

2.2 Hill Effects Adjustment

In response to community concerns regarding the possible influence of terrain elevation on Logan Airport's annual noise contours, Massport undertook a study of hill effects in the vicinity of the airport. In December of 1999, Massport requested approval for a Hill Effects Adjustment for Logan Airport. After completion of a measurement program, review by both FAA AEE and the Department of Transportation's Volpe Center, FAA approved the use of this adjustment for INM in June 2000[2].

Since then the INM model was updated to include refined terrain data and modifications were made to the terrain algorithms. However, the updates to INM and AEDT have not included adjustments to the ground-to-ground propagation algorithms for situations in which the terrain causes a direct line of sight between aircraft on runway and the noise-sensitive receiver located on a hill at higher elevation relative to the aircraft. Therefore, versions of the current models (both INM and AEDT) do not offer the capability that is addressed by the Hill Effects Adjustment. .

ACRP 02-79, *AEDT Noise Model Improvements to Account for Terrain and Man-made Structures* is anticipated to begin in 2017. It is expected that this project will evaluate this issue and Massport plans to cooperate with the study if possible. Until such time that this study is completed and an option is added to the AEDT to account for this condition, we request to use the existing Hill Effects adjustment grid.

Requested Approach

We propose to use the new grid combine tool in the AEDT model to incorporate the existing Hill Effects adjustment grid.

To include this in the modeling:

- The AEDT modeling grid will be exported to a grid file
- Using the data from the prior approved adjustment grid we will increase the DNL value at each location over Orient Heights
- Where there is no increase, the DNL at that point will be reduced by 30 dB (this is done to ensure that when the grid is combined with the original grid the AEDT value is not changed)
- Where there is an increase the DNL will be raised to result in the proper increase using decibel addition. For example: we want to add 4dB to a grid point that is at 60 dB, we would set the point in the grid to 61.79518 dB to get to 64 dB when they are combined.
- The modified grid will be imported into AEDT and combined using the AEDT grid combine tool

2.3 Stage length Selection

The city-pair method for stage length selection is standard industry practice and is the method required to use for AEDT. Members of the community have raised questions as to whether the city-pair selection is correct for the fleet operating at Logan Airport due to high load factors and lower flight profiles[3]. Massport undertook an evaluation of departure takeoff weights to determine if any of the city-pair stage lengths should be modified. Massport utilized U.S. Department of Transportation (US DOT) T100 Data to compare to the Aviation Environmental Design Tool (AEDT) data.

The purpose of this comparison is to advise if there was evidence to adjust the weights compared to the default profiles available in AEDT. In recent years, passenger load factors at BOS have been over 80%.[4]

[2] The Hill Effects approval was for the development of DNL contours using INM for Logan Airport.
[3] The majority of the radar profile is lower than the AEDT standard profile
[4] US DOT Bureau of Transportation Statistics http://www.transtats.bts.gov/Data_Elements.aspx?Data=1

However, the AEDT weight assumptions, documented in the AEDT Technical Manual Version 2c Service Pack 1 states "Load Factor - 65% Total Payload", though a prior document, the Integrated Noise Model (INM) 6.2 release notes, were more specific and said based on "65% Total Payload of the Maximum Certificated weight sold to airlines".[5] The term "load factor" is based on the number of seats (passengers) whereas payload is based on weight. Specifically, the US DOT defines these terms as follows.

- Load Factor = "passenger-miles as a proportion of available seat-miles in percent (%)"[6]
- Payload = "Equal to the certificated takeoff weight of an aircraft, less the empty weight, less all justifiable aircraft equipment, and less the operating load (consisting of minimum fuel load, oil, flight crew, steward's supplies, etc)."[7]

Therefore average weight calculation *includes more than passenger load factor*. AEDT has a payload factors built into the model. It also includes passenger load and the weight of the aircraft, cargo, and fuel.

The analysis reviewed all of the available 2015 data and concluded that in general the AEDT standard weights are representative of the departures from BOS for 2015. However, the analysis has indicated about six percent of operations could be represented by profiles at higher weights within AEDT and that about four percent could be represented by profiles at lower weights within AEDT.

Even though an aircraft may have be carrying an operating revenue weight greater than the "65% of total payload" mentioned in AEDT, that incremental increase in weight needs to be sufficient to justify using the next available weight available in the included AEDT database. An analysis of the differences between the operating revenue weight, the 65% Total Payload, and the available profiles weights found in AEDT, yielded 31 airline/aircraft/stage length combination that could be represented by a higher weight profile in AEDT.

Combined, these 31 combinations represent 9,651 departures out of the total 171,660 departures reported in the US DOT data, or six percent. These operations also represent seven percent of the revenue operating weight for the year. Of these combinations, 29 would increment to the next highest available weight. Eight of these 29 are already at the maximum available profile weight. The remaining two combinations, both wide-body aircraft on relatively short trips, display differences in weight made up by freight and mail rather than passengers and would both increment two available profile weights.

The same analysis of the differences between the operating revenue weight, the 65% Total Payload, and the available profiles weights found in AEDT, yielded 21 airline/aircraft/stage length combination that could be potentially represented by a lower weight profile in AEDT. Combined, these 21 combinations represent 6,412 departures or about four percent of operations.

Of these combinations, 12 would increment to the next lowest available weight, four would increment two profiles down. The remaining five initially indicated that the aircraft could go down three more profiles. All five of these combinations were compared to manufactures data. In each of the five cases, the DOT T100 over reported the available payload by a significant margin compared to the variant in INM. In three cases, the recommendation is to leave the aircraft at its recommended stage length profile. In two cases, the recommendation is to decrease the weight, but not as much as suggested by the DOT T100 data.

Attachment A to this memorandum details the process to determine the airline, aircraft, stage-length combinations to be modified. Table 1 summarizes the operations to be increased.

[5] The Aviation Environmental Design Tool (AEDT), Technical Manual Version 2c Service Pack 1 December 2016 11.2.3.2.3 Guidance for Default Weights and Procedures" pp 318-321 is less specific and says "65% of payload". INM Version 6.2 Software Update, 05/19/2006, Appendix A. INM Version 6.2 also mentions an assumption of 200 lb per passenger.
[6] See footnote 4.
[7] http://www.transtats.bts.gov/databaseinfo.asp?DB_ID=111

Flavio Leo
July 11, 2017
Page 6

Table 1 – Airline, Aircraft Stage-length combinations to be modified

UNIQUE_CARRIER_NAME	Description	Stage Length	CY 2015 Departures	Proposed Stage Length	Note
a	b	c	d		
American Airlines Inc.	McDonnell Douglas DC9 Super 80/MI	4	3	4	MAX
American Airlines Inc.	Airbus Industrie A330-300	2	1	3	+1
Alaska Airlines Inc.	Boeing 737-800	5	563	5	MAX
Alaska Airlines Inc.	Boeing 737-900	5	60	5	MAX
Alaska Airlines Inc.	Boeing 737-900ER	5	74	5	MAX
British Airways Plc	Boeing 777-200ER/200LR/233LR	1	1	2	+1
British Airways Plc	Boeing 777-300/300ER/333ER	1	1	2	+1
Delta Air Lines Inc.	McDonnell Douglas MD-90	2	1,557	3	+1
Delta Air Lines Inc.	McDonnell Douglas MD-90	3	283	4	+1
ExpressJet Airlines Inc.	Embraer-145	1	165	2	+1
ExpressJet Airlines Inc.	Embraer-145	2	1,337	3	+1
Lan-Chile Airlines	B787-900 Dreamliner	1	1	**3**	+2
Lufthansa German Airlines	Boeing 777-200ER/200LR/233LR	2	1	**4**	+2
Lufthansa German Airlines	McDonnell Douglas MD-11	2	1	3	+1
Spirit Air Lines	Airbus Industrie A320-100/200	2	386	3	+1
Spirit Air Lines	Airbus Industrie A320-100/200	3	511	4	+1
Spirit Air Lines	Airbus Industrie A319	1	147	2	+1
SkyWest Airlines Inc.	Canadair CRJ 900	2	146	3	+1
SkyWest Airlines Inc.	Embraer ERJ-175	2	106	2	MAX
United Air Lines Inc.	Boeing 737-700/700LR/Max 7	3	1	4	+1
United Air Lines Inc.	Boeing 737-800	2	273	3	+1
United Air Lines Inc.	Boeing 737-800	3	5	4	+1
United Air Lines Inc.	Boeing 737-800	5	803	5	MAX
United Air Lines Inc.	Boeing 757-300	2	6	3	+1
United Air Lines Inc.	Boeing 757-300	5	807	5	MAX
United Air Lines Inc.	Boeing 767-400/ER	5	1	6	+1
United Air Lines Inc.	Boeing 737-900	5	679	5	MAX
United Air Lines Inc.	Airbus Industrie A320-100/200	2	490	3	+1
United Air Lines Inc.	Airbus Industrie A319	3	1	4	+1
Southwest Airlines Co.	Boeing 737-800	4	325	5	+1
Southwest Airlines Co.	Boeing 737-300	1	916	2	+1

Note: MAX – means that the Proposed stage-length profile is equivalent to the maximum weight profile available for that type

Flavio Leo
July 11, 2017
Page 7

2.4 Non-standard weather data

The AEDT model contains historical average data for each airport and the data within the model is required for use unless approved by FAA AEE. Massport is requesting to use the weather data representing the actual year, in this case 2015.

The data was obtained from the National Climatic Data Center (NCDC). Integrated Surface data (TD 3505) was downloaded for Weather Bureau Army Navy (WBAN) location 14739, Logan Airport for 2015.

Annual Average Data was computed from the hourly data resulting in the following averages:

Temperature	51.5 degrees (F)
Pressure	30.04 inHG
Relative Humidity	65.7%

FAA Response to AEDT Non-Standard Modeling Request dated August 18, 2017

U.S. Department of Transportation
Federal Aviation Administration

Office of Environment and Energy

800 Independence Ave., S.W.
Washington, D.C. 20591

8/18/2017

Richard Doucette
Airports Division
Federal Aviation Administration, New England Region
1200 District Avenue
Burlington, MA 01803

Dear Richard,

The Office of Environment and Energy (AEE) has received the memo dated July 12th 2017, requesting FAA-AEE concurrence on non-standard AEDT modeling adjustments and inputs for noise modeling at Boston Logan International Airport as submitted by HMMH on behalf of Massachusetts Port Authority (HMMH Project Number 307500.003.004).

As highlighted in the request and understood by FAA-AEE, this memo requests concurrence and not approval for the non-standard modeling elements presented. A specific project requiring FAA review and use of the proposed non-standard elements has not been identified; therefore any findings of concurrence detailed in this response are for reference only as they relate to a level of understanding and capability with AEDT 2c SP2 and at the time of this response.

Any findings of concurrence detailed here are therefore subject to change under future updates to AEDT or any relevant technical or policy updates. Formal approval of any proposed non-standard elements will require additional project specific approval by FAA-AEE.

Section 2.1 Overwater Adjustment: Adjustments to departure Noise-Power-Distance curves for Start-of-Takeoff Roll (STR) noise to emulate acoustic overwater propagation.

AEE **DOES NOT CONCUR** with the proposed process as it is not adequately supported through the presentation of a defensible technical analysis or current research findings and is therefore not suitable for use with AEDT.

<u>Section 2.2 Hill Effects Adjustment</u>: Contour grid adjustments to emulate ground propagation effects in the presence of terrain.

AEE **DOES NOT CONCUR** with the proposed process as it is not adequately supported through the presentation of a defensible technical analysis or current research findings and is therefore not suitable for use with AEDT.

<u>Section 2.3 Stage Length Selection</u>: Modified Stage Lengths Selection Based on US DOT BTS T100 Data

AEE **CONCURS IN PRINCIPAL** with the use of US DOT BTS T100 data as a method to evaluate stage length selections. However, due to the specific nature of matching annual flight operations to T100 data, any approval would still require evaluation on a case by cases basis. AEE agrees that the T100 data is a reasonable reference to complete this review, but cautions that since the data may only provide supporting information for existing conditions that there could be concerns when applying any proposed stage length modification assumptions to future year modeling cases. Further supporting information may therefore be required for proposed use with future case modeling conditions. In order to ensure consistent stage length considerations for all modeling cases, it remains AEEs recommendation to continue use of the industry standard city-pair method.

<u>Section 2.4 Non-standard Weather Data</u>: Average Calendar Year 2015 Weather Data Parameters for Temperature, Pressure and Relative Humidity from the National Climatic Data Center (NCDC) are requested for use with Calendar Year 2015 modeling inputs.

AEE **CONCURS IN PRINCIPAL** with the use of the NCDC data to determine appropriate annual average weather data parameters. Please note however that the format of weather parameter inputs for AEDT has been updated compared with INM. Each of the following parameters, in the units specified, must be provided when a formal review for approval is requested:

Temperature (°F)
Pressure (millibars)
Sea Level Pressure (millibars)
Relative humidity (%)
Dew Point (°F)
[Average] Wind Speed (knots)

As described above please understand that this memo provides a record of concurrence and not approval for the non-standard modeling elements presented; and that a specific project, AEDT model version and timeframe would need to be identified before formal approval could be granted. Findings of concurrence are therefore for reference only as they relate to a level of understanding and capability with AEDT 2c SP2 and at the time of this response.

Sincerely,

Rebecca S Cointin

Rebecca Cointin
Manager
AEE/Noise Division

cc: Jim Byers, Jean Wolfers-Lawrence (APP)

Massport Letter and Memorandum to FAA Regarding AEDT Model Results dated November 16, 2016

Massachusetts Port Authority
One Harborside Drive, Suite 200S
East Boston, MA 02128-2090
Telephone (617) 568-1003
www.massport.com

November 16, 2016

Richard Doucette
Airports Division
Federal Aviation Administration, New England Region
1200 District Avenue
Burlington, MA 01803

Dear Mr. Doucette:

Following up to our October 17th meeting where we discussed the FAA's new AEDT model for noise and air emissions, I am writing to you to request that FAA review the AEDT model results as applied to Boston Logan International Airport (Boston Logan) both related to noise and air quality. We also request that the FAA work with Massport and our consultants to develop Logan specific modification to the AEDT so that the model more accurately reflects the local noise and air quality environment.

As you are aware, Massport produces and circulates an annual environmental and planning report for Boston Logan to state officials and the interested public. FAA noise and air quality models form the basis of much of these reports. Massport also seeks to maintain with the FAA an updated Noise Exposure Map that supports our soundproofing efforts of eligible homes. As a result, Massport publishes annually Boston Logan specific noise and air quality data based on the latest FAA approved models (previously the INM and EDMS models). Overtime, Massport has worked closely with the FAA, and USDOT Volpe Center, to enhance the INM including, for example, Logan-specific modifications for "hill effects" and "over water propagation".

For the 2015 calendar year EDR, Massport's noise and air quality consultants utilized the FAA's new AEDT model (Version 2B Service Pack 2). Based on preliminary results, we have strong concerns on the general applicability of the noise module to accurately reflect Boston Logan's noise environment. To assist with the development of a Boston Logan specific modeling process, we have asked our consultant to put together a request (attached) to be sent to FAA AEE for review and approval of AEDT Non-standard modeling and methods. Finally, we also have a narrower concern on the AEDT's estimate of Particulate Matter (PM) which we would also like to discuss.

We look forward to working with you on reviewing and modifying the AEDT to better reflect Boston Logan's noise and air quality footprint.

Very truly yours,

Flavio Leo
Director, Aviation Planning & Strategy

CC: Mary Walsh (FAA), Gail Latrell (FAA), Stewart Dalzell (Massport)

Operating | Boston Logan International Airport • Port of Boston general cargo and passenger terminals • Hanscom Field • Boston Fish Pier • Commonwealth Pier (site of World Trade Center Boston) • Worcester Regional Airport

HMMH
77 South Bedford Street
Burlington, Massachusetts 01803
781.229.0707
www.hmmh.com

TECHNICAL MEMORANDUM

To:	Flavio Leo Massport One Harborside Drive, Suite 2005 East Boston, MA 02128
From:	Robert Mentzer Jr., HMMH Bradley Dunkin, HMMH
Date:	November 16, 2016
Subject:	Logan International Airport Annual DNL Noise Contours - Requested Review and Approval of Aviation Environmental Design Tool Non-Standard Modeling
Reference:	HMMH Project Number 307260.002

1. INTRODUCTION

Harris Miller Miller & Hanson Inc. (HMMH) is assisting the Massachusetts Port Authority (Massport) in the preparation of their annual DNL noise contours for the Massachusetts Environmental Policy Act (MEPA) review. Massport will also potentially use the updated DNL contour to submit to FAA for additional sound insulation funding. We plan to use the Aviation Environmental Design Tool (AEDT) Version 2c (released September 2016) for all future aircraft noise modeling. Consistent with Federal Aviation Administration (FAA) policies and procedures, any changes to the standard AEDT modeling procedures require prior written approval from the FAA Office of Environment and Energy Noise Division (AEE-100). This requirement applies to the use of custom adjustments to the model and use of non-standard data.

As part of the preparation of Massport's annual Environmental Data Review (EDR) for 2015, an AEDT study using the latest version available at the time (Version 2b, Service Pack 2) was conducted in order to assess consistency with an INM study of the same data, as well as INM results for previous years. The judgment was made that the results were not consistent, and that this was largely due to unique conditions at Logan Airport that have, in the past, been addressed by specific FAA-approved adjustments to the INM process. Massport seeks to work with the FAA to develop and implement approved methods to address these conditions in future AEDT studies.

Massport has historically strived to provide an accurate DNL contour to the public. This has resulted in several model methods and adjustments that are Logan-specific:

- 1996 – Overwater adjustment approved for INM model
- 1999 – Hill Effects adjustment approved for the INM model
- 2004 – All radar tracks used for modeling - RealContours & RealProfiles
    - Stagelength selected by Profile match
    - Custom Profile developed for each flight
- 2007 Incorporation of daily weather averages for modeling

Massport has consistently used the updated INM version in the year of or the year after its release. The Overwater and Hill Effects adjustments were also approved for use in the Logan Airside EIS (LAIP) completed in 2001.

On behalf of Massport, HMMH is evaluating the options and data available in AEDT and is in the process of developing recommended adjustments and non-standard data for AEDT. Massport is requesting AEE review and concurrence of this process to develop and implement adjustments and the use of non-standard data for AEDT for Logan International Airport.

Flavio Leo
November 16,2016
Page 2

2. OVERWATER ADJUSTMENT

2.1 Background

Logan Airport is surrounded on three sides by water. Massport has several permanent noise monitoring sites located near the edge of the Harbor that have consistently measured noise and reported levels higher than modeled with the standard INM. Massport commissioned additional noise measurement data and along with their consultants developed a method to increase the thrust of aircraft in the INM on takeoff roll to more accurately reflect the monitoring results.

2.2 Current Method

The current method involves the development of an adjustment grid to increase the noise levels from aircraft departing on the runways at Logan Airport. The adjustment generally results in a 6 dB increase from departing aircraft up to 100 feet above the runway. A point is inserted in the profile at 100 feet to return the aircraft to its normal model thrust and climb.

All jet departures for each year are run in the model with the adjustment and then without. The grid without the increase is subtracted from the grid with the increased thrust. This results in an adjustment grid which can be applied to the annual INM result. This results in increased noise levels on the west sides of Runway 15R-33L and portions of Runway 4L-22R that are not adjacent to water however most of this area is airport property.

2.3 Proposed Method

We are aware that ACRP 02-52, *Improving AEDT Noise Modeling of Ground Surfaces* is underway and is designed to provide a method for incorporating modeling of mixed surfaces within the AEDT. Until such time that this option is available in AEDT, we propose to use the GIS capabilities of the AEDT and modify noise levels over identified hard water surfaces. This method will also eliminate noise increases over areas of non-water surfaces as was done by the previous method. The existing Department of Defense NOISEMAP model has a method for modeling mixed surfaces once they have been identified using mapping however its civil aircraft database is very limited (Lear35, older 747, DC9 aircraft). The NOISEMAP model also uses the NMPLOT grid format which can easily be applied to the AEDT NMPLOT result grid.

HMMH has been evaluating this method and propose to incorporate a representative current fleet of aircraft into the Noisemap database to develop an adjustment grid for AEDT. Using the representative fleet, we will model a set of prototypical flight tracks for arrivals and departures in the model both with and without the mixed surfaces adjustment turned on. The grid without the adjustment will be subtracted from the grid with the adjustment and the result added to the AEDT NMPLOT result grid.

As this approach incorporates the effects of surface reflections directly rather than using increased thrust as a proxy, the results should have equal or better accuracy than the former method if implemented correctly.

Please let us know if you concur with this approach or suggest an alternate method.

3. HILL EFFECTS ADJUSTMENT

3.1 Background

This adjustment has been used since 1999 and was developed and approved by FAA for use in the INM (was used in LAIP EIS). Orient Heights just to the northwest of Runway 22R has a rapid increase in elevation and residents look down onto the runway and start of takeoffs from Runway 22R.

Massport conducted a measurement program for this area and an adjustment grid was developed. FAA and the Volpe Center reviewed and ultimately approved for INM at Logan Airport. This resulted in a grid adjustment that shifted the DNL contour up the hill and the adjustment area only applies to the area of the hill.

3.2 Current Method

After the annual DNL contour is completed, the Hill Effects grid is applied to the INM results. This grid increases the DNL values on the side of the hill facing the airport.

3.3 Proposed Method

ACRP 02-79, *AEDT Noise Model Improvements to Account for Terrain and Man-made Structures* is anticipated to begin in 2017. Massport plans to cooperate with the study if possible. Until such time that this study is completed and an option is added to the AEDT to account for this condition, we propose to use the existing Hill Effects adjustment grid. It is a NMPLOT adjustment grid and is easily applied to the AEDT NMplot result grid.

Since this adjustment is unchanged from the former approach, the results should be identical.

Please let us know if you concur with this approach or suggest an alternate method.

4. STAGELENGTH SELECTION

4.1 Background

Logan Airport has a diverse set of operations including domestic and international traffic. The INM modeling since 2004 has includes stagelength selection based on radar profile matching instead of city pair assignments.

4.2 Current Method

For INM, each radar ground track is imported into the study for modeling. The flight profile up to 3,000 feet is compared to the set of available standard profiles in the INM for that aircraft type. Using a least squares fit method; the best match stagelength is selected.

4.3 Proposed Method

For AEDT, following FAA guidance, each city pair would be used to select the stagelength. This generally results in a lower stagelength than the method historically used and does not take advantage of the available radar data. Since, for the Logan Airport modeling each radar ground track is imported into the AEDT database, we propose to use the data to select the stagelength. The flight profile up to 3,000 feet will be compared to the set of available standard profiles in the AEDT for that aircraft type. Using a least squares fit method the best match stagelength is selected. This results in a stagelength best match for each ground track.

This approach is a straightforward port of the former method, and thus should yield identical results.

Please let us know if you concur with this approach or suggest an alternate method.

5. CUSTOM PROFILES

5.1 Background

Since 2004, Logan Airport modeling has used a pre-processor to develop custom profiles for each track based on the radar data. This process uses the SAE 1845 equations and procedure step data available in the model. AEDT now provides a method for developing custom profiles without additional FAA approval.

5.2 Current Method

The current INM modeling for Logan Airport processes each radar track through a pre-processor. This pre-processor uses the radar data, procedure step data and the SAE 1845 equations to develop a custom profile to closely match the radar data profile. This allows the mode to account for ATC level segments and low departure climbs where necessary. If a custom profile cannot be constructed, the flight is modeled using the best match INM standard profile that is available.

5.3 Proposed Method

The AEDT model now has the ability to use altitude control codes (ACC) to allow the model to develop custom profiles. However, there is no guidance on how to use these options in the model. Massport would like to use this option to the extent possible especially since the local community is accustomed to this type of modeling and every radar track is being modeled. Does FAA have any guidance on how best to add the codes? Should they be added every x number of miles in distance or every 1000 feet in altitude? The ACC = 2 (Match) frequently results in errors which then discard the operation instead of defaulting to another method to allow the flight to continue. With hundreds or thousands of tracks, this results in an enormous amount of effort by the modeler to correct these errors in order to retain these tracks. Does the FAA have any suggestions to reduce this effort? We did encounter odd results with AEDT 2B Service Pack 2 but understand these have been corrected in AEDT 2C. Are there other known issues with the custom profile construction and use?

hmmmh

As there are currently many unknowns with this approach, the results are uncertain and Massport looks forward to collaboration with the FAA to ensure that a method can be developed that is robust, repeatable, and automated.

We will be using AEDT 2C to evaluate the application of this method to Logan Airport modeling and any assistance you can provide will be helpful.

6. NON-STANDARD WEATHER DATA

6.1 Background

Since 2007, the daily DNL modeling conducted for BOS has used daily weather averages. The current version of AEDT does not appear to have this capability except for when using High Fidelity weather. The FAA guidance also requires the use of the 30-year normal weather data built into the model or the modeler can request use of other data from the FAA.

6.2 Current Method

The prior INM modeling was run for each day and daily weather averages were used in the INM model to adjust aircraft performance and atmospheric absorption. These daily DNL results were then averaged to develop the annual average DNL.

6.3 Proposed Method

The AEDT only allows for one set of average weather data for the study. Even though, the model can be setup to use a detailed flight schedule which includes the date and time, the weather is fixed to this average unless detailed High Fidelity weather data is selected. We expect that the High Fidelity weather data will further reduce processing times and increase database size therefore we would prefer to just use the daily average.

FAA guidance requires the use of the 30 –year normal data built into the model. Since contours for BOS are developed for each specific year at a minimum we request the use of annual average weather data (acquired from the National Climatic Data Center (NCDC)) for the year being modeled. We also would appreciate any suggestions for using daily average values without having to use the High Fidelity weather data.

Approval of the use of annual weather will improve accuracy for an annual study by removing the effects of long-term weather trends. If a method for using daily weather can be developed, this will allow for equal accuracy to the former approach by modeling performance using existing conditions.

FAA Response Letter dated November 28, 2016

U.S. Department of Transportation
Federal Aviation Administration

Office of Environment and Energy

800 Independence Ave., S.W.
Washington, D.C. 20591

Date 11/28/2016

Richard Doucette
Airports Division
Federal Aviation Administration, New England Region
1200 District Avenue
Burlington, MA 01803

Dear Richard,

The Office of Environment and Energy (AEE) has received the memo dated November 16, 2016 forwarded from Flavio Leo, Director of Aviation Planning and Strategy, Massachusetts Port Authority requesting consideration of non-standard noise modeling adjustments in AEDT at Boston Logan International Airport.

After review of the methods outlined, AEE will require additional information including specific details on the proposed methodologies before any determinations or recommendations can be made. It should also be considered that due to the significant updates introduced with AEDT, to enhance modeling capability, any prior approvals for these methods under the legacy INM or EDMS tools are no longer valid.

Due to the complexity and history of these methods we recognize however, that a dialog between AEE and MassPort with their consultants may be the most efficient way to start a discussion on addressing what if any of these methods are still appropriate applications within AEDT.

To address each of the proposed methods in brief:

Overwater Adjustment:
AEDT currently only supports "soft" ground surfaces in the calculation of sound propagation, however ongoing development including AEE involvement in **ACRP 02-52:** ***Improving AEDT Noise Modeling of Hard, Soft, and Mixed Ground Surfaces*** is aimed at including additional functionality for variable surfaces within AEDT.

Hill Effects Adjustment:

Terrain data is supported within AEDT and can be used internally to adjust noise calculations in order to better model local elevation variation. Additionally AEE is supporting involvement in research to enhance modeling while considering terrain through **ACRP 02-79:** ***AEDT Noise Model Improvements to Account for Terrain and Man-made Structures***

Stagelength Selection:

Due to uncertainties in directly matching radar altitude profiles to AEDT flight profiles, only city-pair to stage length mapping is approved for use within AEDT. Variations due to aircraft weight and reduced thrust takeoffs therefore make a direct least squares fit to available profile stagelenghts unappropriated. Ongoing AEE supported research including **ASCENT 035**: ***Airline Flight Data Examination to Improve flight Performance Modeling*** and **ACRP 02-55:** ***Enhanced AEDT Modeling of Aircraft Arrival and Departure Profiles*** are exploring future enhancements to AEDT for custom profile selection.

Custom Profiles:

The use of custom profiles is allowed within AEDT, however only with prior AEE approval. Conversely the use of AEDT altitude control codes does not required AEE approval, however care must be taken by the modeler to ensure that control codes are being assigned appropriately and that any resulting errors generated are understood and addressed. Due to the myriad conditions which may be result it is not possible to create guidance to address the application of altitude control codes in all cases. Any specific concerns on the functionality of altitude control codes may be best addressed first by AEDT support, however we are open to having a larger "best practices" discussion as well.

Non-Standard Weather Data

Within AEDT only one set of weather data parameters, for noise modeling purposes, are currently allowed per airport definition. It may be feasible in the future however, to allow weather data parameters to be defined at the operations group level within AEDT; allowing the option for providing multiple weather data parameters within a single animalization. This concept would first have to be reviewed and considered for feasibility against existing AEDT development priorities.

Non-Volatile Particulate Matter (NVPM) modeling

A note on discussing estimates of Particulate Matter was made in the letter, however specifics were not provided. If you could please provide additional clarification on we can look to provide a better response to the concern.

Please let us know how you would like to discuss these options in more detail and where available if you could also please provide additional information supporting any of the proposed methodologies prior to any discussions.

Sincerely,

Rebecca Cointin
Manager
AEE/Noise Division

cc: Jim Byers

Massport and FAA correspondence letter regarding RNAV Pilot Test: Request that FAA adopt the JetBlue Airways RNAV Visual Approach Procedure to Runway 33L

massport

Massachusetts Port Authority
One Harborside Drive
East Boston, MA 02128-2909
Telephone (617) 568-5000
www.massport.com

April 7, 2017

Todd Friedenberg
Deputy Regional Administrator
Federal Aviation Administration
New England Region
1200 District Avenue
Burlington, MA 01803-5299

Re: FAA\MPA RNAV Pilot Test: Request that FAA adopt the jetBlue RNAV Visual Approach Procedure to Boston Logan Runway 33L

Dear Mr. Friedenberg:

As a follow up to our ongoing work on the joint Massport and FAA RNAV Pilot Test, I'm writing to request that the FAA adopt and refine for public use the existing jetBlue Airways (jetBlue) RNAV Visual to Boston Logan's Runway R33L. We believe that by making this procedure more readily available to all national airspace users, there will be an increase in the utilization of the RNAV Visual to R33L during the late night period, providing greater noise abatement benefits to communities near Boston Logan.

Recall that one outcome of the Boston Logan Overflight Noise Study was the design of a noise abatement approach to R33L that avoids the Town of Hull and other South Shore communities by taking advantage of overflying Boston Harbor during the late night time period. Consistent with this goal, in November 2014, jetBlue published a RNAV Visual procedure and agreed to make this "public" and therefore available to the broader Boston Logan air carrier community.

Massport has been working with the FAA's NextGen Eastern Branch to advocate and encourage air carriers to adopt the JetBlue RNAV Visual procedure. However, the most recent data (March 2017) from Massport shows that only about 26% of R33L jet arrivals from midnight to 5AM took advantage of this noise reduction procedure. We believe that if the FAA adopts this procedure the utilization rate of the RNAV Visual to R33L will increased when demand and weather allow.

Please feel free to contact me with any further questions.

Sincerely,

Flavio Leo
Director, Aviation Planning and Strategy
Massachusetts Port Authority

Cc: Amy Corbett (FAA), Ed Freni (Massport)

Massport and FAA correspondence letter regarding Massport recommended procedural changes to RNAV

massport
Massachusetts Port Authority
One Harborside Drive
East Boston, MA 02128-2909
Telephone (617) 568-5000
www.massport.com

December 20, 2017

Ms. Amy Corbett
Regional Administrator
Federal Aviation Administration
New England Region
1200 District Avenue
Burlington, MA 01803-5299

RE: FAA\MPA RNAV MOU Block 1 Ideas: Request for FAA Review and Implementation for Boston Logan International Airport

Dear Ms. ~~Corbett~~: Amy

I am writing to request that the Federal Aviation Administration (FAA) review and implement the Block 1 procedure recommendations by the Massachusetts Institute of Technology (MIT) study team as a result of the Memorandum of Understanding (MOU) between the FAA and the Massachusetts Port Authority (Massport). The MOU, executed in September 2016, commits the FAA and Massport to undertake a unique, pilot testing of ideas to reduce noise from the FAA's implementation of Precision Based Navigation (PBN) procedures including RNAV at Boston Logan International Airport (Boston Logan).

Consistent with the MOU, the testing of ideas has involved a technical team of FAA and Massport staff, supported by subject matter experts lead by MIT's International Center for Air Transportation. The work included extensive public outreach, feedback through public hearings, and briefings to and feedback from the Massport Community Advisory Committee (MCAC) and local, state and federal elected officials.

After an initial investigation, the MIT team proposed segregating ideas to be evaluated into two blocks. Block 1 ideas would provide noise benefits while not generating major equity issues (moving noise from one community to another) and would have minimal operational/ technical implementation barriers. Block 2 ideas would result in shifting of noise, or would have substantial technical hurdles and, therefore, require further analysis and review.

MIT has completed its work on Block 1 and issued its final report "Block 1 Procedure Recommendations for Logan Airport Community Noise Reduction" to Massport and the FAA. MIT's technical feasibility analysis of Block 1 includes an examination of flight safety, aircraft performance, navigation and flight management systems (FMS) limitations, pilot workload, Air Traffic Control workload, and procedure design criteria. Representatives from MIT, Massport and the FAA have briefed the public and the MCAC throughout the process, and feasible feedback from the public has been included into MIT's recommendations. On December 7, 2017, the MCAC voted to support and recommend implementation of the Block 1 procedures.

The table below from the MIT report summarizes MIT's recommendations and highlights the primary benefits.

Block 1 Procedure Recommendations

Proc. ID D = Dep. A = Arr.	Procedure	Primary Benefits
1-D1	Restrict target climb speed for jet departures from Runways 33L and 27 to 220 knots or minimum safe airspeed in clean configuration, whichever is higher.	Reduced airframe and total noise during climb below 10,000 ft (beyond immediate airport vicinity)
1-D2	Modify RNAV SID from Runway 15R to move tracks further to the north away from populated areas.	Departure flight paths moved north away from Hull
1-D3	Modify RNAV SID from Runway 22L and 22R to initiate turns sooner after takeoff and move tracks further to the north away from populated areas.	Departure flight paths moved north away from Hull and South Boston
1-D3a	*Option A*: Climb to intercept course (VI-CF) procedure	
1-D3b	*Option B*: Climb to altitude, then direct (VA-DF) procedure	
1-D3c	*Option C*: Heading-based procedure	
1-A1	Implement an overwater RNAV approach procedure with RNP overlay to Runway 33L that follows the ground track of the jetBlue RNAV Visual procedure as closely as possible.	Arrival flight paths moved overwater instead of over the Hull peninsula and points further south
1-A1a	*Option A*: Published instrument approach procedure	
1-A1b	*Option B*: Public distribution of RNAV Visual procedure	

Source: MIT

We understand that the FAA will also need to undertake its own internal review including safety, operational feasibility and environmental impacts. It is our hope that the FAA will be able to adopt these recommendations as expeditiously as possible.

On behalf of Massport, I want to thank the FAA for its commitment to this very important and unique initiative. Please feel free to contact me directly or Flavio Leo, Director of Aviation Planning and Strategy, with any further questions.

Sincerely,

Edward C. Freni
Director of Aviation

cc: Todd Friedenberg (FAA), David Carlon (MCAC), Tom Glynn (Massport), John Hansman (MIT), Liz Becker (Massport), Flavio Leo (Massport)

Fundamentals of Acoustics and Environmental Noise

This section introduces the fundamentals of acoustics and noise terminology as well as the effects of noise on human activity and community annoyance.

Introduction to Acoustics and Noise Terminology

Chapter 6, *Noise Abatement* of this *2016 Environmental Data Report (EDR)* relies largely on a measure of cumulative noise exposure over an entire calendar year, in terms of a metric called the Day-Night Average Sound Level (DNL). However, DNL does not always provide a sufficient description of noise for many purposes. Other measures are available to address essentially any issue of concern. This section introduces the following acoustic metrics, which are all related to DNL, but provide bases for evaluating a broad range of noise situations. These metrics include:

- Decibel (dB)
- A-Weighted Decibel (dBA)
- Sound Exposure Level (SEL)
- Equivalent Sound Level (Leq)
- Time Above (TA)
- Time Above, Night (TAN)
- DNL

The Decibel (dB)

All sounds come from a sound source – a musical instrument, a voice speaking, or an airplane that passes overhead. It takes energy to produce sound. The sound energy produced by any sound source is transmitted through the air in the form of sound waves – tiny, quick oscillations of pressure just above and just below atmospheric pressure. These oscillations, or sound pressures, impinge on the ear, creating the sound we hear.

Our ears are sensitive to a wide range of sound pressures. The loudest sounds that we hear without pain have about one million times more energy than the quietest sounds we hear. However, our ears are incapable of detecting small differences in these pressures. Thus, to match how we hear this sound energy, we compress the total range of sound pressures to a more meaningful range by introducing the concept of sound pressure level (SPL). SPL is a measure of the sound pressure of a given noise source relative to a standard reference value (typically the quietest sound that a young person with good hearing can detect). SPLs are measured in decibels (abbreviated dB). Decibels are logarithmic quantities – logarithms of the squared ratio of two pressures, the numerator being the pressure of the sound source of interest, and the denominator being the reference pressure (the quietest sound we can hear).

The logarithmic conversion of sound pressure to SPL means that the quietest sound we can hear (the reference pressure) has a SPL of about zero decibels, while the loudest sounds we hear without pain have SPLs of about 120 dB. Most sounds in our day-to-day environment have SPLs from 30 to 100 dB.

Because decibels are logarithmic quantities, they do not behave like regular numbers with which we are more familiar. For example, if two sound sources each produce 100 dB and they are operated together, they produce only 103 dB – not 200 dB as we might expect. Four equal sources operating simultaneously result in a total SPL of 106 dB. In fact, for every doubling of the number of equal sources, the SPL goes up another three decibels. A tenfold increase in the number of sources makes the SPL go up 10 dB. A hundredfold increase makes the level go up 20 dB, and it takes a thousand equal sources to increase the level 30 dB.

If one source is much louder than another source, the two sources together will produce the same SPL (and sound to our ears) as if the louder source were operating alone. For example, a 100-dB source plus an 80-dB source produces 100 dB when operating together. The louder source "masks" the quieter one, but if the quieter source gets louder, it will have an increasing effect on the total SPL. When the two sources are equal, as described above, they produce a level 3 dB above the sound of either one by itself.

From these basic concepts, note that one hundred 80 dB sources will produce a combined level of 100 dB; if a single 100-dB source is added, the group will produce a total SPL of 103 dB. Clearly, the loudest source has the greatest effect on the total decibel level.

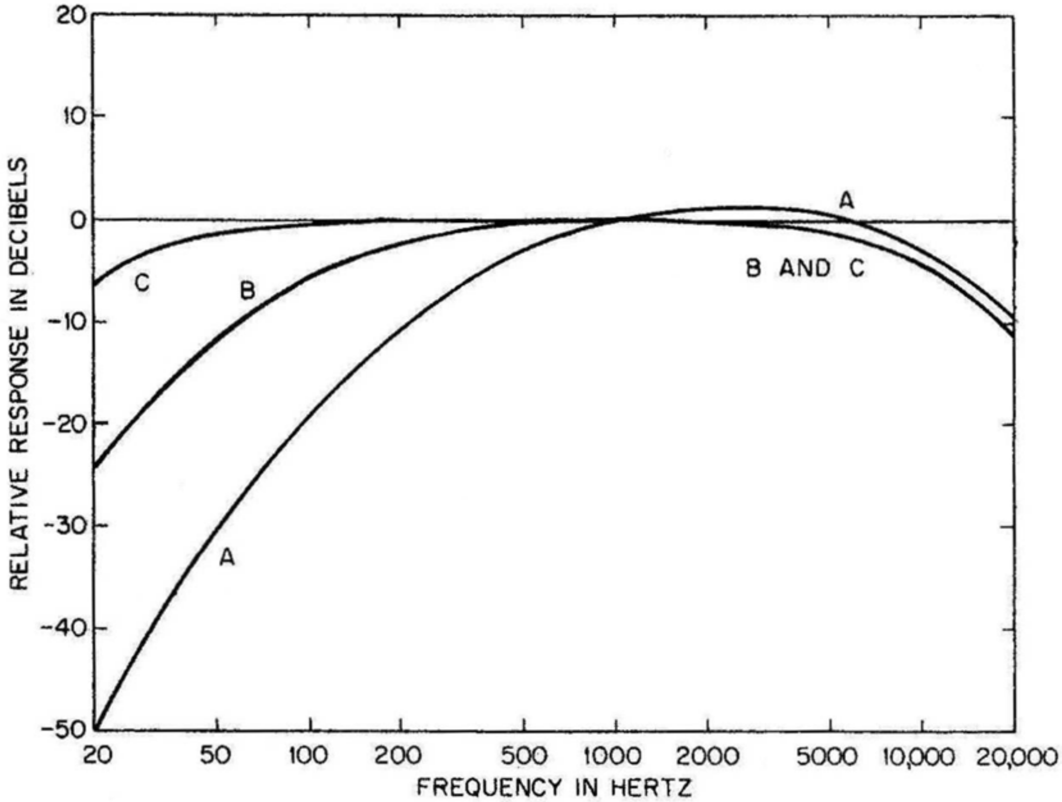
A-Weighted Decibel, dBA

Another important characteristic of sound is its frequency, or "pitch." This is the rate of repetition of the sound pressure oscillations as they reach our ear. Formerly expressed in cycles per second, frequency is now expressed in units known as Hertz (Hz).

Most people hear from about 20 Hz to about 10,000 to 15,000 Hz. People respond to sound most readily when the predominant frequency is in the range of normal conversation, around 1,000 to 2,000 Hz. Acousticians have developed "filters" to match our ears' sensitivity and help us to judge the relative loudness of sounds made up of different frequencies. The so-called "A" filter does the best job of matching the sensitivity of our ears to most environmental noises. SPLs measured through this filter are referred to as A-weighted levels (dBA). A-weighting significantly de-emphasizes noise at low and very high frequencies (below about 500 Hz and above about 10,000 Hz) where we do not hear as well. Because this filter generally matches our ears' sensitivity, sounds having higher A-weighted sound levels are usually judged louder than those with lower A-weighted sound levels, a relationship which does not always hold true for unweighted levels. It is for these reasons that A-weighted sound levels are normally used to evaluate environmental noise.

Other weighting networks include the B and C filters. They correspond to different level ranges of the ear. The rarely used B-weighting attenuates low frequencies (those less than 500 Hz), but to a lesser degree than A-weighting. C weighting is nearly flat throughout the audible frequency range, hardly de-emphasizing low frequency noise. C-weighted levels can be preferable in evaluating sounds whose low-frequency components are responsible for secondary effects such as the shaking of a building, window rattle, or perceptible vibrations. Uses include the evaluation of blasting noise, artillery fire, and in some cases, aircraft noise inside buildings. **Figure H-1** compares these various weighting networks.

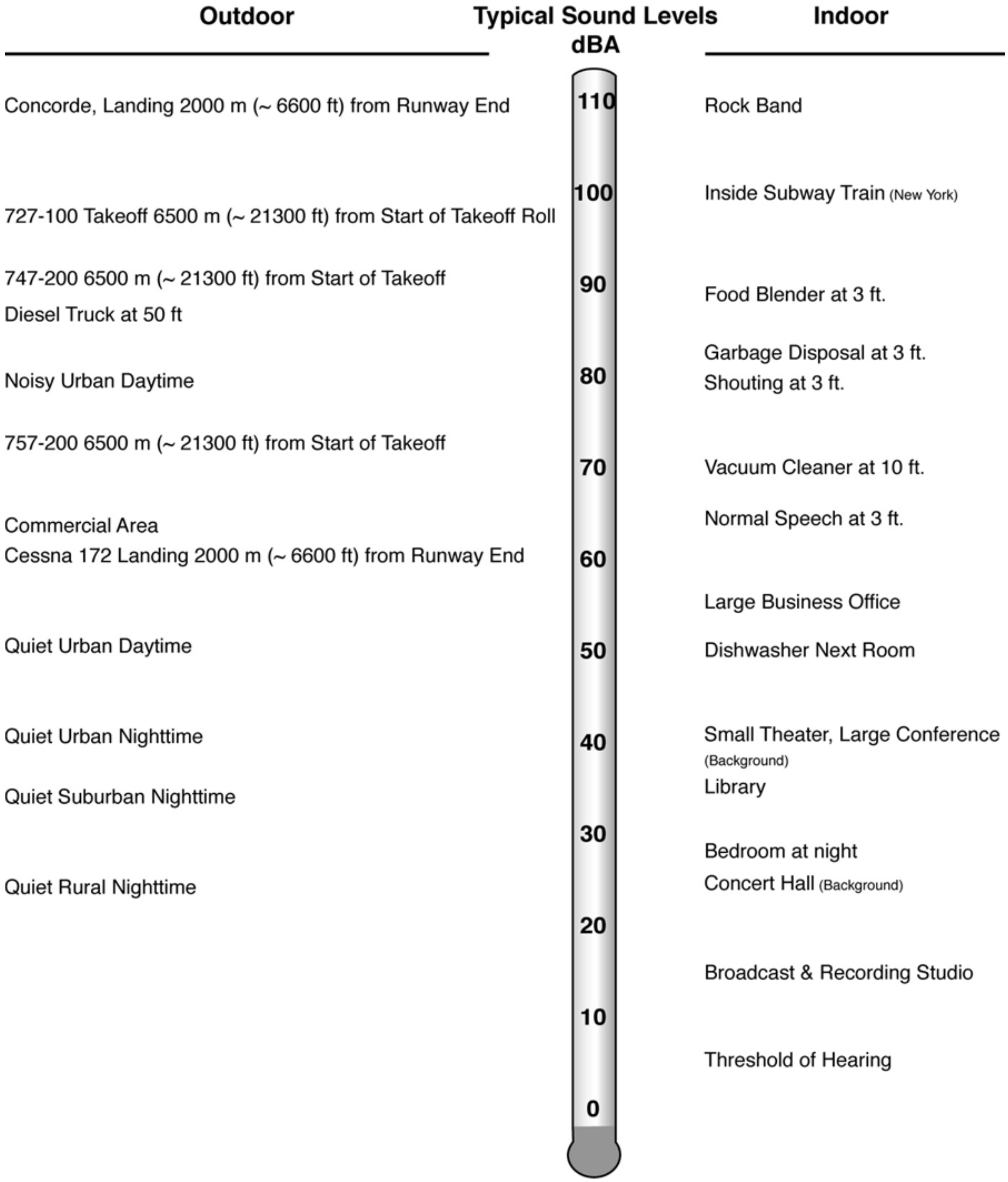
Figure H-1 Frequency-Response Characteristics of Various Weighting Networks



Source: Harris, Cyril M., editor; Handbook of Acoustical Measurements and Noise Control, (Chapter 5, "Acoustical Measurement Instruments"; Johnson, Daniel L.; Marsh, Alan H.; and Harris, Cyril M.); New York; McGraw-Hill, Inc.; 1991; p. 5.13.

Because of the correlation with our hearing, the A-weighted level has been adopted as the basic measure of environmental noise by the U.S. Environmental Protection Agency (EPA) and by nearly every other federal and state agency concerned with community noise. **Figure H-2** presents typical A-weighted sound levels of several common environmental sources.

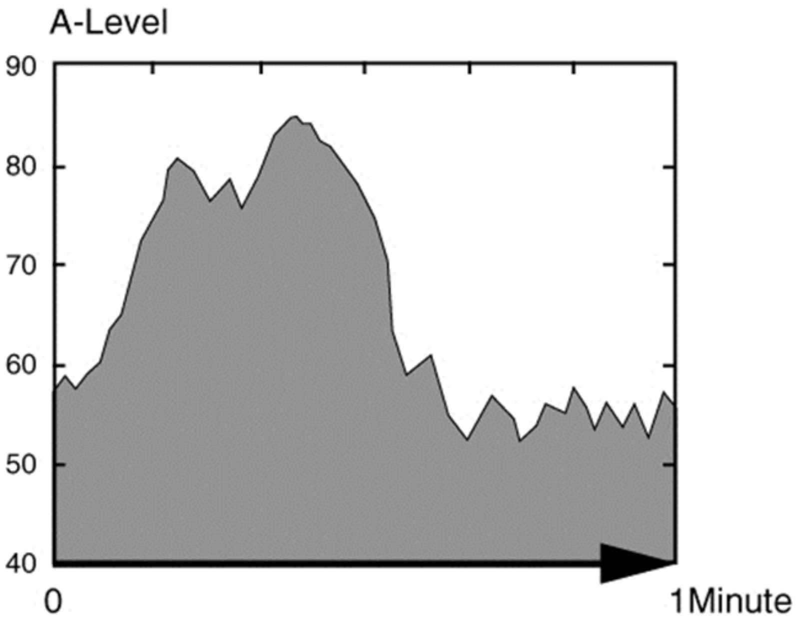
Figure H-2 Common Environmental Sound Levels, in dBA



Source: HMMH (Aircraft noise levels from FAA Advisory Circular 36-3H)

An additional dimension to environmental noise is that A-weighted levels vary with time. For example, the sound level increases as an aircraft approaches, then falls and blends into the background as the aircraft recedes into the distance (though even the background varies as birds chirp or the wind blows or a vehicle passes by). **Figure H-3** illustrates this concept.

Figure H-3 Variations in the A-Weighted Sound Level Over Time



Source: HMMH

Maximum A-Weighted Noise Level, L_{max}

The variation in noise level over time often makes it convenient to describe a particular noise "event" by its maximum sound level, abbreviated as L_{max}. In the figure above, it is approximately 85 dBA.

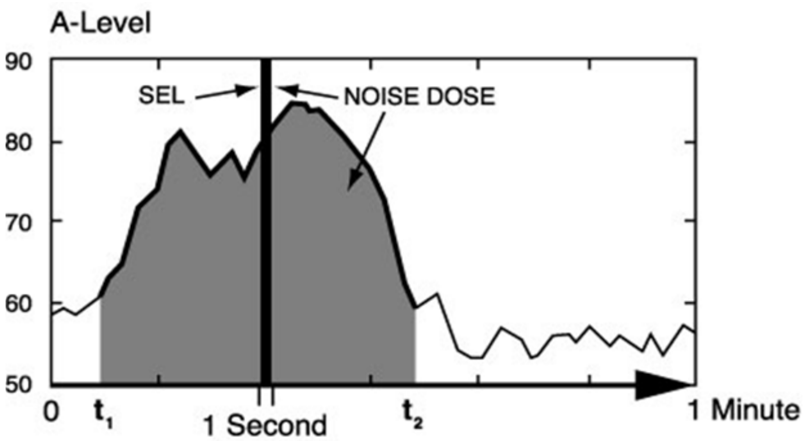
The maximum level describes only one dimension of an event; it provides no information on the cumulative noise exposure. In fact, two events with identical maxima may produce very different total exposures. One may be of very short duration, while the other may continue for an extended period and be judged much more annoying. The next measure corrects for this deficiency.

Sound Exposure Level (SEL)

The most frequently used measure of noise exposure for an individual aircraft noise event (and the measure that Part 150 specifies for this purpose) is the SEL. SEL is a measure of the total noise energy produced during an event, from the time when the A-weighted sound level first exceeds a threshold level (normally just above the background or ambient noise) to the time that the sound level drops back down below the threshold. To allow comparison of noise events with very different durations, SEL “normalizes” the duration in every case to one second; that is, it is expressed as the steady noise level with just a one-second duration that includes the same amount of noise energy as the actual longer duration, time-varying noise. In lay terms, SEL “squeezes” the entire noise event into one second.

Figure H-4 depicts this transformation. The shaded area represents the energy included in an SEL measurement for the noise event, where the threshold is set to 60 dBA. The dark shaded vertical bar, which is 90 dBA high and just one second long (wide), contains the same sound energy as the full event.

Figure H-4 Sound Exposure Level (SEL)



Source: HMMH

Because the SEL is normalized to one second, it will always be larger than the L_{max} for an event longer than one second. In this case, the SEL is 90 dB; the L_{max} is approximately 85 dBA. For most aircraft overflights, the SEL is normally on the order of 7 to 12 dB higher than L_{max}. Because SEL considers duration, longer exposure to relatively slow, quiet aircraft, such as propeller models, can have the same or higher SEL than shorter exposure to faster, louder planes, such as corporate jets.

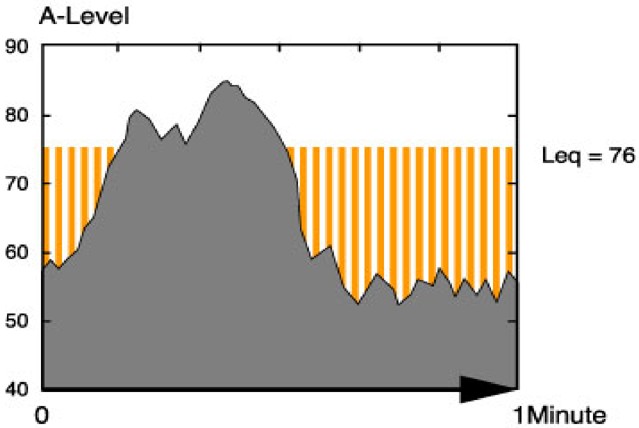
Equivalent Sound Level (L_{eq})

The L_{max} and SEL quantify the noise associated with individual events. The remaining metrics in this section describe longer-term cumulative noise exposure that can include many events.

The Equivalent Sound Level (L_{eq}) is a measure of exposure resulting from the accumulation of A-weighted sound levels over a particular period of interest (e.g., an hour, an eight-hour school day, nighttime, or a full 24-hour day). Because the length of the period can differ, the applicable period should always be identified or clearly understood when discussing the metric. Such durations are often identified through a subscript, for example $L_{eq(8)}$ or $L_{eq(24)}$.

L_{eq} is equivalent to the constant sound level over the period of interest that contains as much sound energy as the actual time-varying level. This is illustrated in **Figure H-5**. Both the solid and striped shaded areas have a one-minute L_{eq} value of 76 dB. It is important to recognize, however, that the two signals (the constant one and the time-varying one) would sound very different in real life. Also, be aware that the "average" sound level suggested by L_{eq} is not an arithmetic value, but a logarithmic, or "energy-averaged" sound level. Thus, loud events dominate L_{eq} measurements.

Figure H-5 Example of a One Minute Equivalent Sound Level (L_{eq})



Source: HMMH

In airport noise studies, L_{eq} is often presented for consecutive one-hour periods to illustrate how the exposure rises and falls throughout a 24-hour period, and how individual hours are affected by unusual activity, such as rush hour traffic or a few loud aircraft.

Time Above (TA)

TA is a metric that gives the duration, in minutes, for which aircraft-related noise exceeds a specified A-weighted sound level during a given period. The measure is referred to generally as TA. For this *2016 EDR*, three threshold sound levels are used in the analysis: 65, 75, and 85 dBA. These times are computed using the Federal Aviation Administration (FAA)-approved Integrated Noise Model (INM).

Time Above Night (TAN)

Identical to TA, except it is computed for only the 9-hour period between 10:00 PM and 7:00 AM. The TAN is also developed using three threshold sound levels 65, 75, and 85 dBA.

Day-Night Average Sound Level (DNL)

Virtually all studies of aircraft noise rely on a slightly more complicated measure of noise exposure that describes cumulative noise exposure during an average annual day: the DNL. The EPA identified DNL as the most appropriate means of evaluating airport noise based on the following considerations:[1]

1. The measure should be applicable to the evaluation of pervasive long-term noise in various defined areas and under various conditions over long periods.

2. The measure should correlate well with known effects of the noise environment and on individuals and the public.

1 Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety," U. S. EPA Report No. 550/9-74-004, March 1974

3. The measure should be simple, practical, and accurate. In principal, it should be useful for planning as well as for enforcement or monitoring purposes.

4. The required measurement equipment, with standard characteristics, should be commercially available.

5. The measure should be closely related to existing methods currently in use.

6. The single measure of noise at a given location should be predictable, within an acceptable tolerance, from knowledge of the physical events producing the noise.

7. The measure should lend itself to small, simple monitors, which can be left unattended in public areas for long periods.

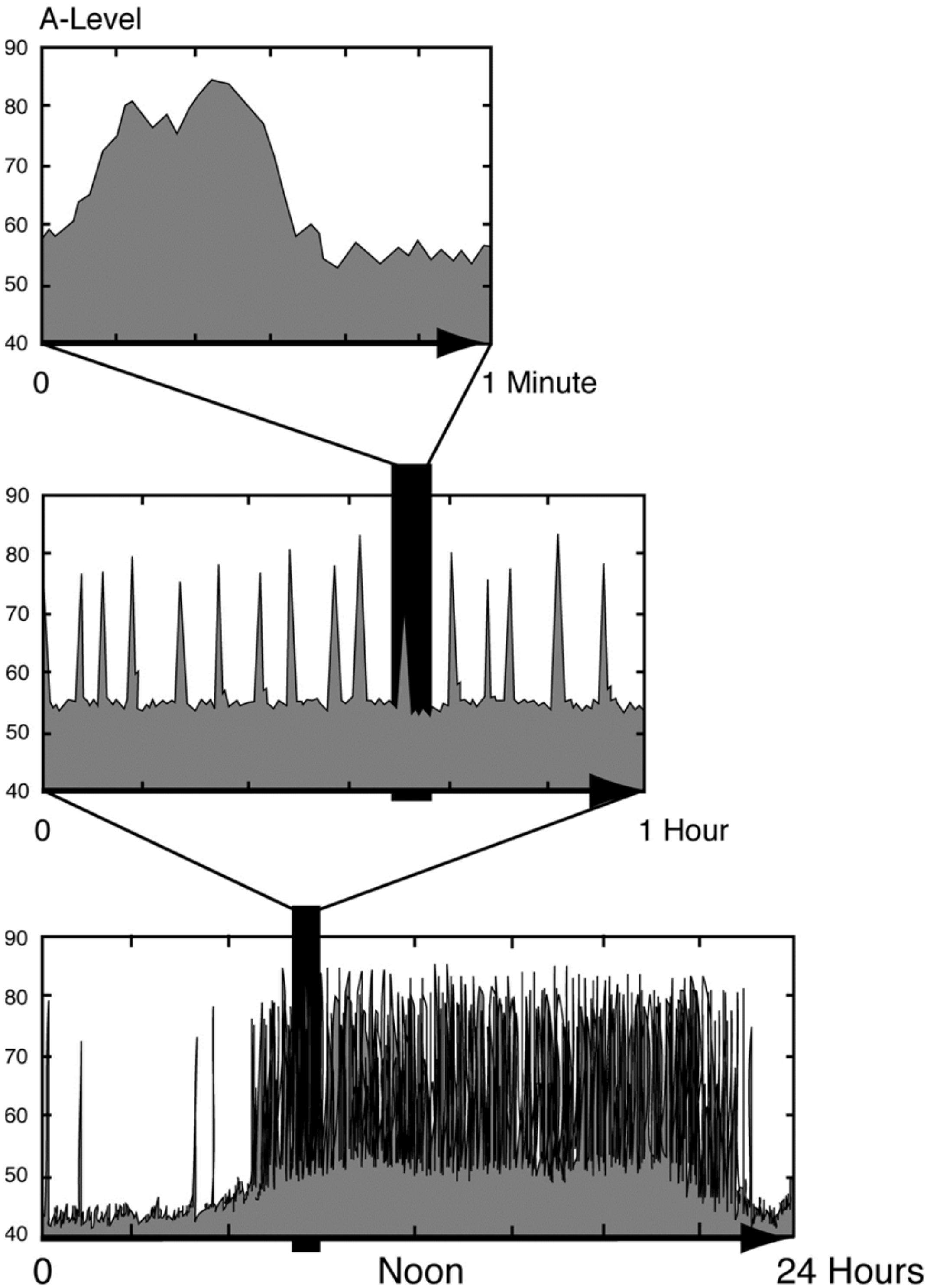
Most federal agencies dealing with noise have formally adopted DNL. The Federal Interagency Committee on Noise (FICON) reaffirmed the appropriateness of DNL in 1992. The FICON summary report stated; "There are no new descriptors or metrics of sufficient scientific standing to substitute for the present DNL cumulative noise exposure metric."

The DNL represents noise as it occurs over a 24-hour period, with one important exception: DNL treats nighttime noise differently from daytime noise. In determining DNL, it is assumed that the A-weighted levels occurring at night (defined as 10:00 PM to 7:00 AM) are 10 dB louder than they really are. This 10-dB penalty is applied to account for greater sensitivity to nighttime noise, and the fact that events at night are often perceived to be more intrusive because nighttime ambient noise is less than daytime ambient noise.

Figure H-4 illustrated the A-weighted sound level due to an aircraft fly-over as it changed with time. The top frame of **Figure H-6** repeats this figure. The shaded area reflects the noise dose that a listener receives during the one-minute period of the sample. The center frame of **Figure H-4** includes this one-minute sample within a full hour. The shaded area represents the noise during that hour with 16 noise events, each producing an SEL. Similarly, the bottom frame includes the one-hour interval within a full 24 hours. Here the shaded area represents the listener's noise dose over a complete day. Note that several overflights occur at a time when the background noise drops some 10 dB, to approximately 45 dBA.

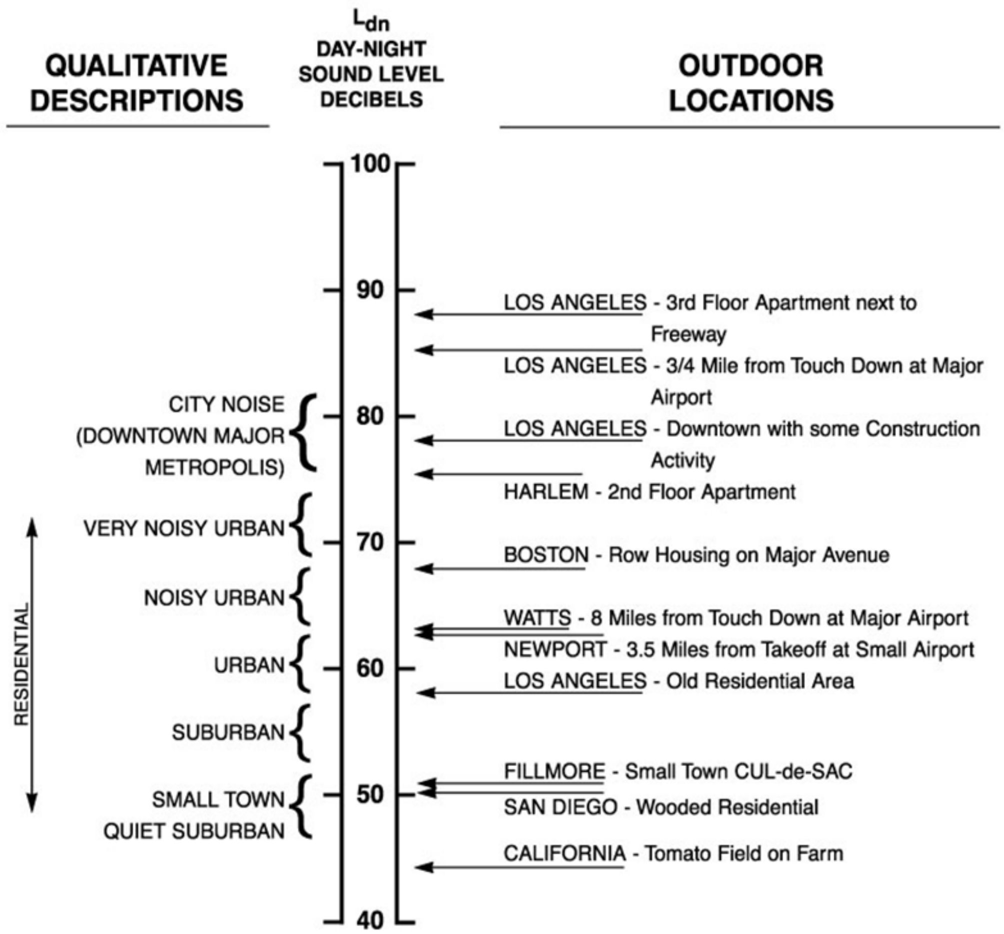
DNL can be measured or estimated. Measurements are practical only for obtaining DNL values for relatively limited numbers of points, and, in the absence of a permanently installed monitoring system, only for relatively short time periods. Most airport noise studies are based on computer-generated DNL estimates, determined by accounting for all the SELs from individual events, which comprise the total noise dose at a given location. Computed DNL values are often depicted in terms of equal-exposure noise contours (much as topographic maps have contours of equal elevation). **Figure H-7** depicts typical DNL values for a variety of noise environments.

Figure H-6 Daily Noise Dose



Source: HMMH

Figure H-7 Examples of Day-Night Average Sound Levels (DNL)



Source: EPA, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, March 1974, p. 14.

As of May 2015, FAA is beginning work on the next step in a multi-year Noise Research Program that will update the scientific evidence on the relationship between aircraft noise exposure and its effects on communities around airports. If changes are warranted, FAA will propose revised policy and related guidance and regulations, subject to interagency coordination, as well as public review and comment.

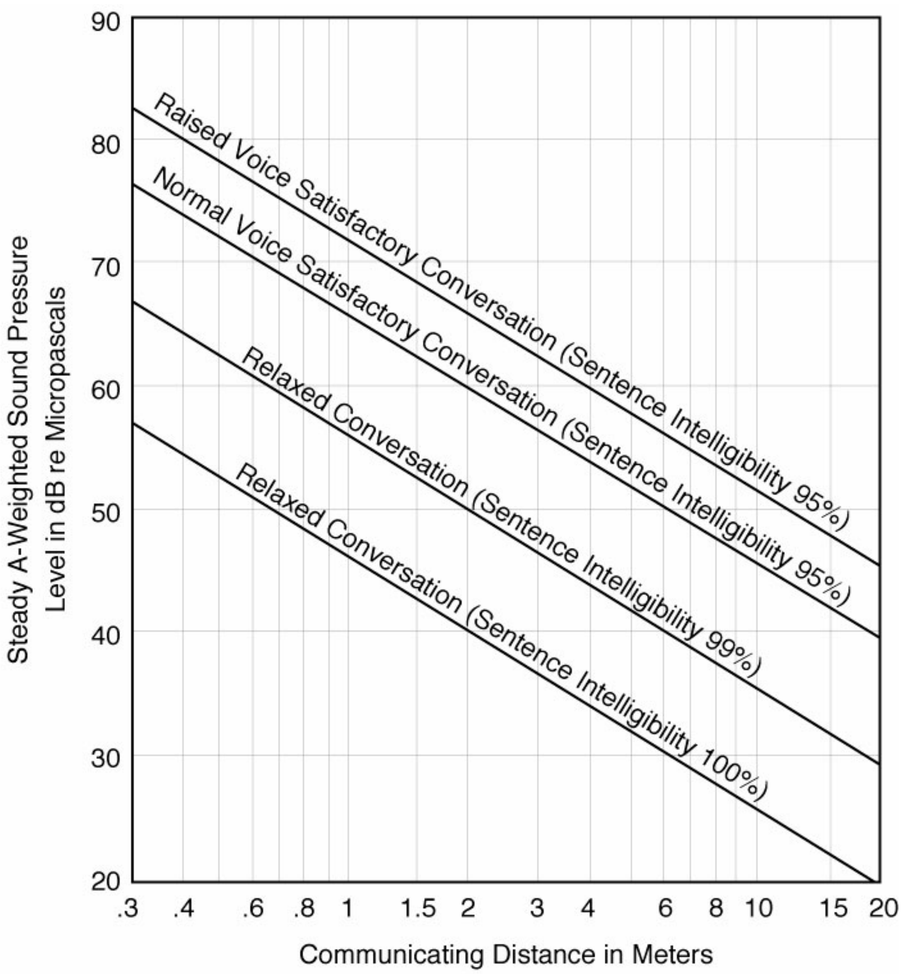
The Effects of Aircraft Noise on People

To residents around airports, aircraft noise can be an annoyance and a nuisance. It can interfere with conversation and listening to television, it can disrupt classroom activities in schools, and it can disrupt sleep. Relating these effects to specific noise metrics helps in the understanding of how and why people react to their environment.

Speech Interference

A primary effect of aircraft noise is its tendency to drown out or "mask" speech, making it difficult to carry on a normal conversation. The sound level of speech decreases as the distance between a talker and listener increases. As the background sound level increases, it becomes harder to hear speech. **Figure H-8** presents typical distances between talker and listener for satisfactory outdoor conversations, in the presence of different steady A-weighted background noise levels for raised, normal, and relaxed voice effort. As the background level increases, the talker must raise his/her voice, or the individuals must get closer together to continue talking.

Figure H-8 Outdoor Speech Intelligibility



Source: EPA, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, March 1974, p. D-5.

As indicated in the figure, "satisfactory conversation" does not always require hearing every word; 95 percent intelligibility is acceptable for many conversations. Listeners can infer a few unheard words when they occur in a familiar context. However, in relaxed conversation, we have higher expectations of hearing speech and generally require closer to 100 percent intelligibility. Any combination of talker-listener distances and background noise that falls below the bottom line in **Figure H-8** (thus assuring 100 percent intelligibility) represents an ideal environment for outdoor speech communication and is considered necessary for acceptable indoor conversation as well.

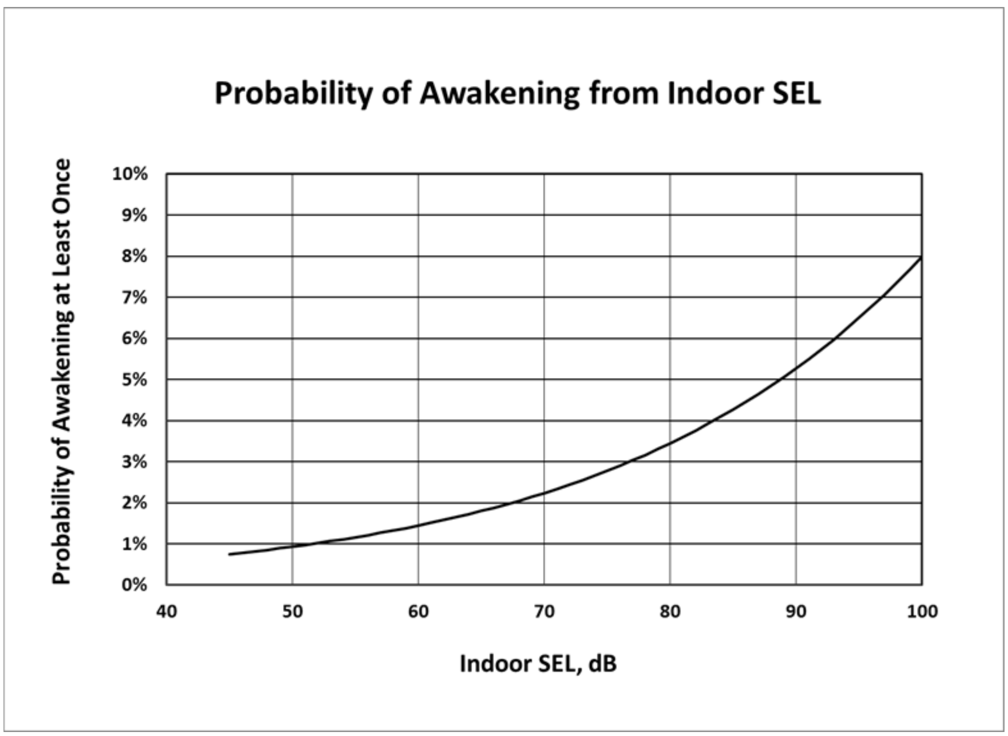
One implication of the relationships in **Figure H-8** is that for typical communication at distances of 3 or 4 feet (1 to 1.5 meters), acceptable outdoor conversations can be carried on in a normal voice as long as the background noise outdoors is less than about 65 dBA. If the noise exceeds this level, as might occur when an aircraft passes overhead, intelligibility would be lost unless vocal effort were increased or communication distance were decreased.

Indoors, typical distances, voice levels, and intelligibility expectations generally require a background level less than 45 dBA. With windows partly open, housing generally provides about 12 dBA of interior-to-exterior noise level reduction. Thus, if the outdoor sound level is 60 dBA or less, there is a reasonable chance that the resulting indoor sound level will afford acceptable conversation inside. With windows closed, 24 dB of attenuation is typical.

Sleep Interference

Research on sleep disruption from noise has led to widely varying observations. In part, this is because (1) sleep can be disturbed without awakening, (2) the deeper the sleep the more noise it takes to cause arousal, and (3) the tendency to awaken increases with age, and other factors. **Figure H-9** shows one such relationship from recent research conducted in the U.S. – the probability that a group of people will be awakened at least once when exposed to a given indoor SEL.

Figure H-9 Probability of Awakening at Least Once from Indoor Noise Event



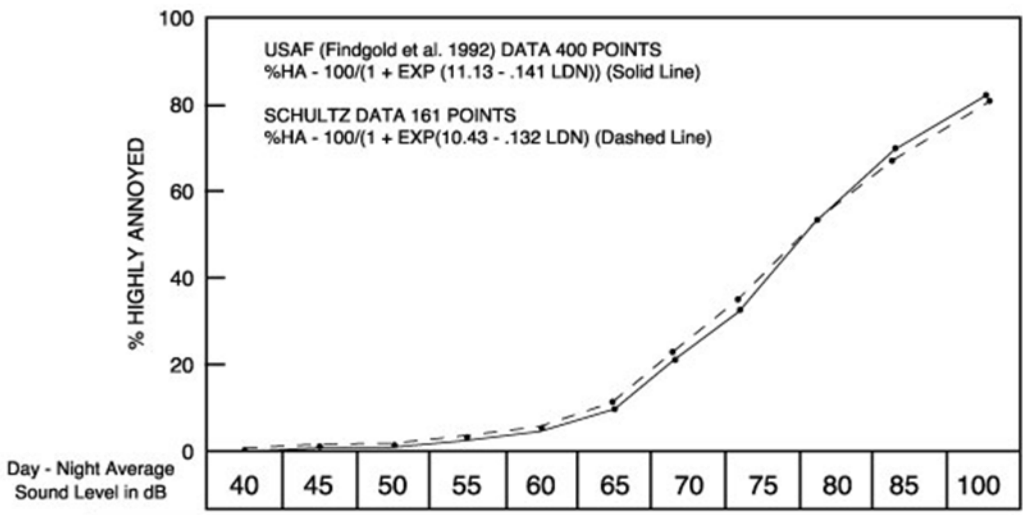
Source: ANSI S12.9-2008/Part 6, Quantities and Procedures for Description and Measurement of Environmental Sound — Part 6: Methods for Estimation of Awakenings Associated with Outdoor Noise Events Heard in Homes; Equation 1

For example, an indoor SEL of 80 dB results in approximately 3.5 percent of the exposed population being awakened. If windows are open in the bedroom on a warm evening and a house provides a typical outside-to-inside noise level reduction of around 15 dB, which suggests it takes an SEL of about 95 dB outdoors to awaken 3.5 percent of the population. The American National Standards Institute (ANSI) has extended this concept further and developed a standard (ANSI S12.9-2008/Part 6) for computing the percentage of the population that is likely to be awakened by multiple noise events occurring throughout the night. The Federal Interagency Committee on Aviation Noise (FICAN) subsequently endorsed the standard as the best available means of estimating behavioral awakenings from aircraft noise.

Community Annoyance

Social survey data make it clear that individual reactions to noise vary widely for a given noise level. Nevertheless, as a group, people's aggregate response is predictable and relates well to measures of cumulative noise exposure such as DNL. **Figure H-10** shows a widely recognized relationship between environmental noise and annoyance.

Figure H-10 Percentage of People Highly Annoyed



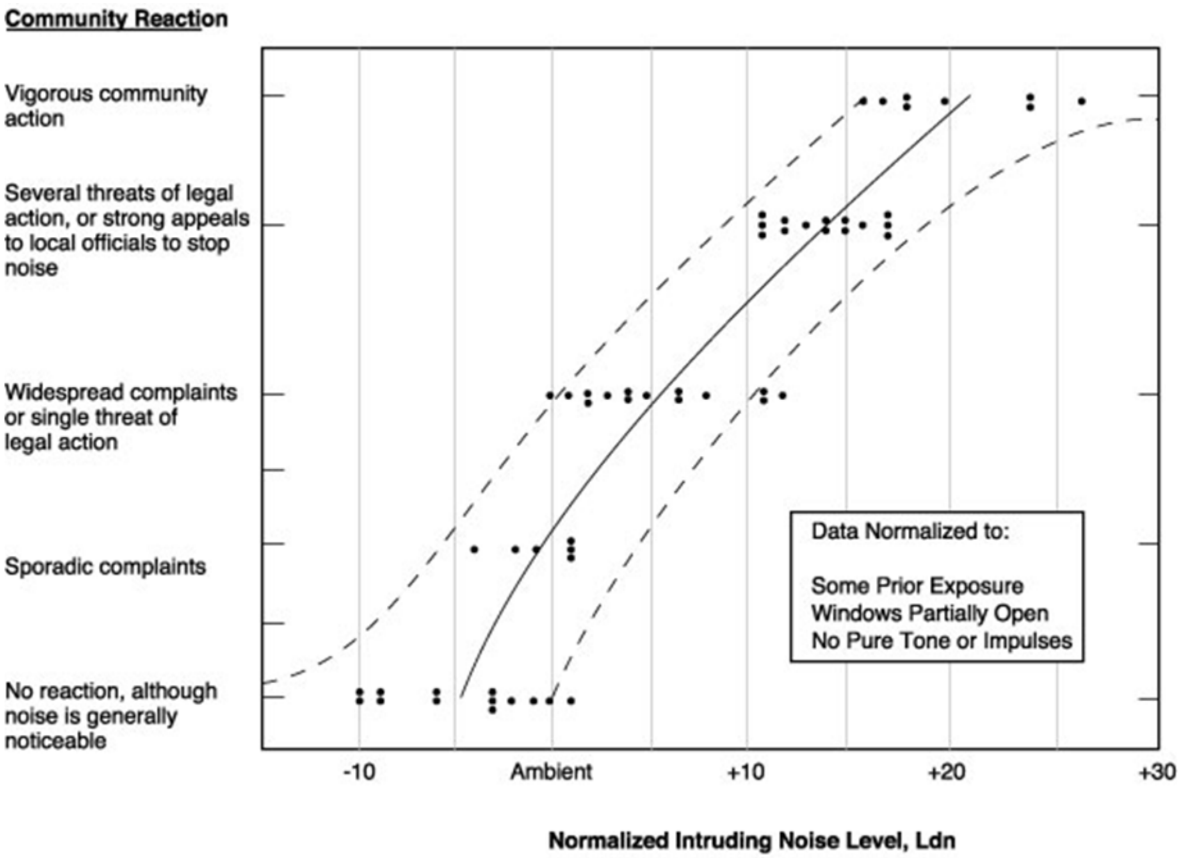
Calculated %HA Points	40	45	50	55	60	65	70	75	80	85	100
USAF	0.41	0.831	1.66	3.31	6.48	12.29	22.1	36.47	53.74	70.16	82.64
SCHULTZ	0.576	1.11	2.12	4.03	7.52	13.59	23.32	37.05	53.25	68.78	81

Source: FICON. "Federal Agency Review of Selected Airport Noise Analysis Issues." August 1992. (From data provided by USAF Armstrong Laboratory). pp. 3-6.

Based on data from 18 surveys conducted worldwide, the curve indicates that at levels as low as DNL 55, approximately 5.0 percent of the people will still be highly annoyed, with the percentage increasing more rapidly as exposure increases above DNL 65.

Separate work by the EPA has shown that overall community reaction to a noise environment can also be related to DNL. This relationship is shown in **Figure H-11**. Levels have been normalized to the same set of exposure conditions to permit valid comparisons between ambient noise environments. Data summarized in **Figure H-11** suggest that little reaction would be expected for intrusive noise levels five decibels below the ambient, while widespread complaints can be expected as intruding noise exceeds background levels by about five decibels. Vigorous action is likely when the background is exceeded by 20 dB.

Figure H-11 Community Reaction as a Function of Outdoor DNL



Source: Wyle Laboratories, "Community Noise," prepared for the U.S. Environmental Protection Agency, Office of Noise Abatement and Control, Washington, D.C., December 1971, pg. 63

Regulatory Framework

Logan Airport Noise Abatement Rules and Regulations

Massport's primary mechanism for reducing noise impacts from Logan Airport's operations is the Noise Rules.[2] The Noise Rules were designed to reduce noise impacts by encouraging use of quieter aircraft by requiring decreased use of noisier aircraft and by limiting nighttime activity by louder Stage 2 types. Many secondary goals aimed at limiting noise in specific areas also were stated.

Specific provisions of the Noise Rules, which continue to serve these goals, include:

- Limiting cumulative noise exposure at Logan Airport (as measured by Massport's CNI) to a maximum of 156.5 Effective Perceived Noise Decibels (EPNdB);
- Maximizing use of Stage 3 aircraft;

---

2 The Logan International Airport Noise Abatement Rules and Regulations, effective July 1, 1986, are codified at 740 Code of Massachusetts Regulations (CMR) 24.01 et seq (also known as the Noise Rules).

- Restricting nighttime operations by Stage 2 aircraft;
- Placing limitations on times and locations of engine run-ups and use of auxiliary power units (APU); and
- Restricting use of certain runways by noisier aircraft and time of day.

These restrictions and limitations are subject to FAA implementation and safe operation of the airport and airspace.

Federal Aviation Regulation (FAR) Part 36

Logan Airport operates within a framework of federal aviation regulations that limits an airport operator's ability to control noise. For example, FAA's FAR Part 36[3] sets noise limits for aircraft certification and the procedures by which aircraft noise emission levels must be measured to determine compliance. The regulation defines noise emission limits for turbojets, turboprops, and helicopters, classifying turbojets into categories referred to as stages based on noise levels at each of three locations: takeoff, landing, and to the side of the runway during takeoff (sideline). The stages are:

- Stage 1 aircraft are the oldest and usually have the loudest operations, having preceded the existence of any noise emission regulation. Rare examples include old, restored civil or military aircraft. There are no Stage 1 aircraft operating at Logan Airport.
- Stage 2 aircraft are less old and less noisy than Stage 1; they were the first aircraft types required to meet a noise limit. A subsequent regulation, FAR Part 91 (described in the next section), prohibits the operation of a Stage 2 aircraft in the continental U.S. unless its takeoff weight is 75,000 pounds or less. FAA Reauthorization bill of 2012 also mandated the phase out of Stage 2 aircraft with a takeoff weight less than 75,000 pounds by the end of 2015. Thus, there were no Stage 2 operations at Logan Airport for all of 2016.
- Stage 3 aircraft were certified for service before 2006 and have relatively quiet jets, although some are Stage 2 aircraft that have been re-engined, or have been fitted with hushkits, enabling them to meet Stage 3 noise limits.
- Stage 4 aircraft are required to operate with a cumulative noise level at least 10 dB quieter than Stage 3 aircraft at three prescribed measurement points. Jet aircraft certificated after January 1, 2006 must meet the Stage 4 limits. Although not required, the majority of aircraft in the 2016 Logan Airport fleet would also meet the Stage 4 noise limits if they were recertificated.
- Stage 5 aircraft are the newest and quietest aircraft. Starting January 1, 2018, all aircraft certificated must meet Stage 5 limits which are a cumulative 7 dB below Stage 4 and 17 dB below Stage 3 aircraft. The Boeing 787, 747-8 and Airbus A350 and A380 are examples of aircraft that meet the new limits.

FAR Part 150

First implemented in February 1981, FAR Part 150[4] defines procedures that an airport operator must follow if it chooses to conduct and implement an airport noise and land use compatibility plan. Part 150 Noise Compatibility studies require the use of DNL to evaluate the airport noise environment. FAR Part 150 identifies noise compatibility guidelines for different land uses depending on their sensitivity. Key

3 14 CFR Part 36, "Noise Standards: Aircraft Type and Air Worthiness Certification."

4 14 CFR Part 150, "Airport Noise Compatibility Planning."

values include a DNL of 75 dB, above which no residences, schools, hospitals, or churches are considered compatible, and a DNL of 65 dB, above which those land uses are considered compatible only if they are sound insulated.

Noise abatement or mitigation measures that an airport operator must consider in a Part 150 study include acquisition of incompatible land, construction of noise barriers, sound insulation of buildings, implementation of a preferential runway program, use of noise abatement flight tracks, implementation of airport use restrictions, and any other actions that would have a beneficial effect on the public.

While Massport has implemented variations of these and additional measures at Logan Airport, Massport has not filed an official Part 150 noise compatibility study with FAA because all of Logan Airport's program elements, while regularly reviewed and updated, preceded the promulgation of Part 150 and are effectively grandfathered under the regulation.

FAR Parts 91 and 161

The Airport Noise and Capacity Act of 1990 (ANCA)[5] directed the U.S. Secretary of Transportation to undertake three key noise-related actions:

- Establish a schedule for a phase out of Part 36 Stage 2 aircraft by the year 2000;
- Establish a program for FAA review of all new airport noise and access restrictions limiting operations of Stage 2 aircraft; and
- Establish a program for FAA review and approval of any restriction that limits operations of Stage 3 aircraft, including public notice requirements.

FAA addressed these requirements through amendment of an existing federal regulation, "Part 91,"[6] and establishment of a new regulation, "Part 161."[7] ANCA effectively ended Massport's pursuit of any additional operational restrictions outside of this program.

Amendment to Part 91

FAA establishes and regulates operating noise limits for civil aircraft operation in Subpart I, "Operating Noise Limits," of 14 CFR Part 91, "General Operating and Flight Rules." The noise limits are based on aircraft noise certification criteria set forth in 14 CFR Part 36, "Noise Standards: Aircraft Type and Airworthiness Certification." For transport category "large" aircraft (with maximum takeoff weights of 12,500 pounds or more) and for all turbojet-powered aircraft, Part 36 identifies four "stages" of aircraft with respect to their relative noisiness:

- Stage 1 aircraft, which have never been shown to meet any noise standards, because they have never been tested, or because they have been tested and failed to meet any established standards;
- Stage 2 aircraft, which meet original noise limits, set in 1969;
- Stage 3 aircraft, which meet more stringent limits, established in 1977; and
- Stage 4 aircraft, which meet the most stringent limits, established in 2005.

---

5 Pub. L. No. 101-508, 104 Stat. 1388, as recodified at 49 United States Code 47521- 47533.
6 14 CFR Part 91, "General Operating and Flight Rules."
7 14 CFR Part 161, "Notice and Approval of Airport Noise and Access Restrictions."

In 1976, FAA ordered a phase out of all Stage 1 aircraft with a maximum gross takeoff weight (MGTOW) over 75,000 pounds, to be completed on January 1, 1985. After that date, Stage 1 civil aircraft over 75,000 pounds MGTOW were banned from operating in the U.S. (with limited exemptions related to commercial service at "small communities," which has since expired in 1988). ANCA required a similar phase out of Stage 2 aircraft over 75,000 pounds by December 31, 1999. The 75,000-pound weight limit exempted most "business" (or "corporate") jets and a very small number of the very smallest "air carrier" type jets until December 31, 2015 when a full ban took effect.[8] Aircraft operators responded to the Stage 1 and 2 phase-outs by retiring their non-compliant aircraft or modifying some of their aircraft to meet the more stringent standards. The modifications undertaken include installation of quieter engines, noise-reducing physical modifications to the airframe and/or existing engines, and limitation of operating weights and procedures to meet the applicable Part 36 limits. Some former Stage 2 airline aircraft that were "recertificated" as Stage 3 with these modifications still operate at Logan Airport, but are generally declining due to the aircrafts' age and high operating costs (in particular due to the generally low fuel efficiency of these older aircraft).

From 2006 to 2017, as airlines add new aircraft, Stage 4 aircraft have been added to their fleets. The Stage 4 noise standard applies to any new jet aircraft type designs over 12,500 pounds requiring FAA approval after January 1, 2006. The International Civil Aviation Organization (ICAO) has also adopted the same regulation for international operators, but neither FAA nor ICAO have indicated there will be restrictions on the remaining recertificated Stage 3 aircraft from carrier fleets.

ICAO and FAA have adopted a higher standard of noise classification called Stage 5 (Chapter 14 for ICAO) which will be effective for new aircraft type certification after December 31, 2017 and December 31, 2020, depending on the weight of the aircraft.[9]

Part 161

FAA implemented the ANCA requirements related to notice, analysis, and approval of use restrictions affecting Stage 2 and 3 aircraft through the establishment of a new regulation, 14 CFR Part 161, "Notice and Approval of Airport Noise and Access Restrictions." In simple terms, Part 161 requires an airport operator that proposes to implement a restriction on Stage 2 or 3 aircraft operations to undertake, document, and publicize certain benefit-cost analyses, comparing the noise benefits of the restriction to its economic costs. Operators must obtain specific FAA approvals of the analysis, documentation, and notice processes, and – for Stage 3 restrictions – approval of the restriction itself.

Part 161 and ANCA define more demanding requirements and explicit guidance for Stage 3 restrictions. To implement a Stage 3 restriction, formal FAA approval is required. FAA's role for Stage 2 restrictions is limited to commenting on compliance with Part 161 notice and analysis procedural requirements. Part 161 provides guidance regarding appropriate information to provide in support of these findings. While Part 161 does not require this information for a Stage 2 restriction, Part 161 states that it would be "useful." Moreover, FAA has required airports to provide this same information for Stage 2 restrictions (and even for Stage 1 restrictions pursued under FAR Part 150), on the grounds that they are required for airports to comply with grant assurance 22(a), "Economic Nondiscrimination," which states that an airport

8 FAA Modernization and Reform Act of 2012 sets a January 1, 2016 ban of Stage 2 aircraft less than 75,000 lbs.

9 The Final Rule was published on October 4, 2017.

operator "will make its airport available as an airport for public use on reasonable terms and without unjust discrimination to all types, kinds, and classes of aeronautical activities, including commercial aeronautical activities offering services to the public at the Airport."[10]

Although several (on the order of a dozen) airports have embarked on efforts to adopt both Stage 2 and 3 restrictions in the past two decades, FAA has found that only one, Naples Municipal Airport, a GA airport in Naples, Florida, has fully complied with Part 161 analysis, notice, and documentation requirements for a ban on Stage 2 jet operations. FAA found the airport was in violation of prior to FAA grant assurances. The airport operator successfully sued FAA to overturn that ruling and has implemented the restriction.

ANCA and Part 161 specifically exempt Stage 3 use restrictions that were effective on or before October 1, 1990 and Stage 2 restrictions that were proposed before that date. The Logan Airport Noise Rules were promulgated in 1986; therefore, ANCA and Part 161 have no bearing on their continued implementation in their current form. Any future proposals to make the rules more stringent regarding Stage 2 operations or to restrict Stage 3 operations in any way would almost certainly trigger Part 161 notice, analysis, and approval processes for Stage 3 restrictions. In 2006, Massport requested an opinion from FAA regarding the pursuit of a Part 161 waiver or exemption to allow Massport to implement a curfew of nighttime operations of hush-kitted Stage 3 aircraft. FAA informed Massport that a waiver or exemption from the requirements of Part 161 is not authorized under, or consistent with, federal statutory and regulatory requirements. A copy of FAA's letter to Massport was provided in Appendix H, *Noise Abatement* in the *2005 EDR*.

Logan Airport RC for AEDT™ Data Inputs

To relate portions of the foregoing discussion to the specific noise environment around Logan Airport, for this *2016 EDR*, Massport has produced a set of DNL noise contours, TA noise metrics, and population counts for 2016 using the software pre-processor RC for AEDT™. This software takes radar data from individual flights occurring throughout the year, processes the information, and formats it into a form usable as input to the latest version of FAA's AEDT, which serves as the computational "engine" for calculating noise. Version 2c SP2 was used for 2016. The RC for AEDT™ system used the individual flight tracks taken directly from the Massport Noise and Operations Management System (NOMS) rather than relying on consolidated data summaries. Prior year INM studies used RealContours™ which operated in a similar manner. For 2015, the INM noise model used 370,014 flights from the NOMS that retained suitable data. For 2016, the AEDT noise model used 388,857 flights from the NOMS that retained suitable data.

---

10 FAA Order 5190.6(b), "Airport Compliance Manual" Chapter 13, Section 14, paragraph (a). To be approved, restrictions must meet the following six statutory criteria: 1) The proposed restriction is reasonable, nonarbitrary, and nondiscriminatory. 2) The proposed restriction does not create an undue burden on interstate or foreign commerce. 3) The proposed restriction maintains safe and efficient use of the navigable airspace. 4) The proposed restriction does not conflict with any existing federal statute or regulation. 5) The applicant has provided adequate opportunity for public comment on the proposed restriction. 6) The proposed restriction does not create an undue burden on the national aviation system.

Overview

Standard AEDT input methodology involves development of operational inputs and calculation of the DNL for a prototypical average annual day.[11] This approach requires manually collecting, refining, and entering the enormous amount of data averaged over a full year of activity at an airport. Typically, the model inputs may include an aircraft fleet mix with several dozen representative aircraft types, on the order of 100 to 300 representative flight tracks (common for a facility the size of Logan Airport), and runway use and flight track use percentages for three or four categories of aircraft types with similar performance characteristics.

This normal approach to noise modeling meets accepted professional standards, and reduces the effort and cost that would be associated with manually entering the parameters for every actual operation. However, it represents a significant simplification of the extraordinary diversity of actual aircraft operations over a year. It also does not take full advantage of the investment that Massport has made in installing and maintaining a state-of-the-art radar system,[12] which automatically collects flight track data and flight identification data for all operations at the Airport and feeds the NOMS.

Instead, for this report, Massport has utilized an AEDT pre-processor, RC for AEDT™, which takes maximum possible advantage of both AEDT's capabilities and the investment that Massport has made in operations monitoring. RC for AEDT™ automates the process of preparing the AEDT inputs directly from the actual flight operations, and permits airports to model the full diversity of activity as precisely as possible, at a cost equivalent to the more simplified manual approach. RC for AEDT™ improves the precision of modeling by utilizing operations monitoring results in five key areas:

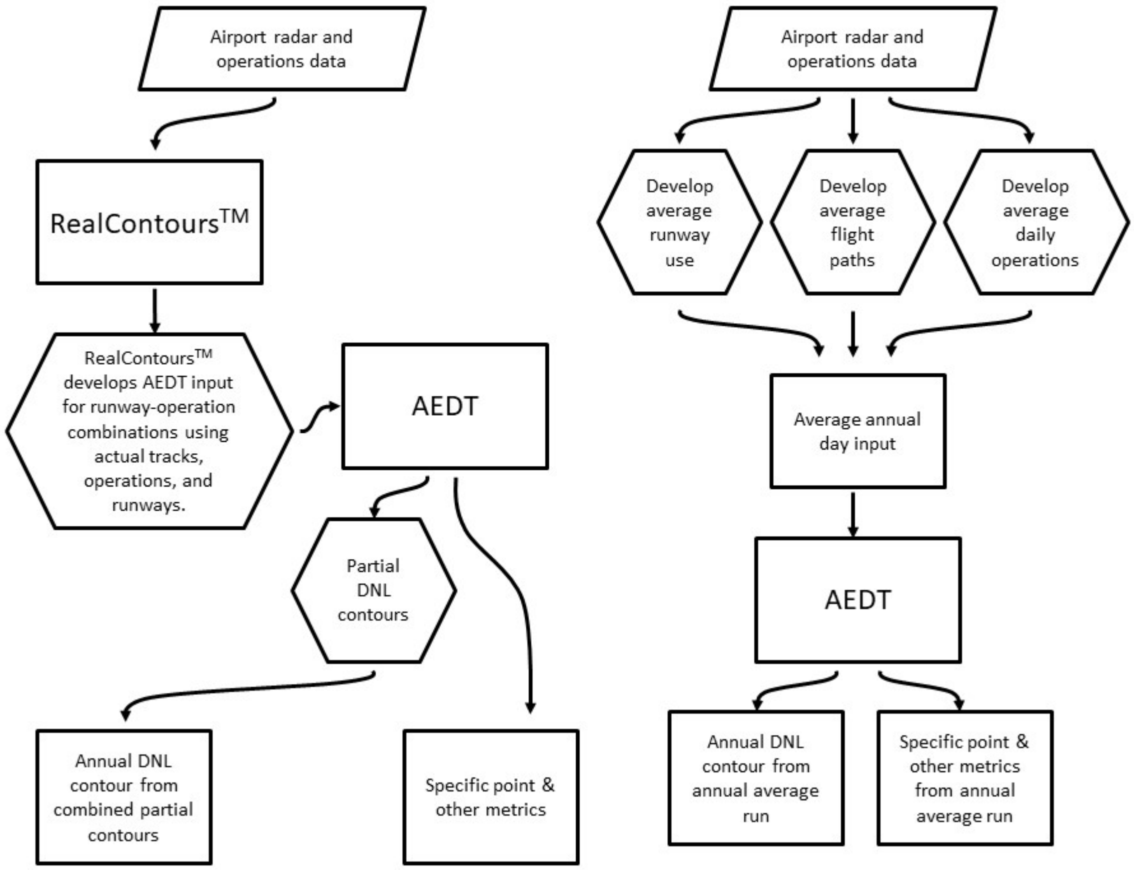
- Directly converts the flight track for every identified aircraft operation to an AEDT track, rather than assigning multiple operations to a limited number of prototypical tracks.
- Models each operation on the specific runway that it actually used, rather than applying a generalized distribution to broad ranges of aircraft types.
- Models each operation in the period that it occurred, which considers delays at the Airport during the year.
- Selects the specific airframe and engine combination to model, on an operation-by-operation basis, based on the registration data for each flight wherever possible; otherwise, the published compositions of the fleets of the specific airlines operating at Logan Airport are used.

Figure H-12 provides a schematic representation of the RC for AEDT™ noise modeling process compared to the standard AEDT process.

11 FAA INM Version 7.0 User's Guide, April 2007, p. 12.

12 Starting in 2010, the Massport system utilized the Airscene.com product of Era Corporation. The radar data source has been updated and the system is now provided by Harris.

Figure H-12 Schematic Noise Modeling Process (Standard AEDT vs. RC for AEDT™)



Source: FAA, HMMH

AEDT 2C SP2 Model

FAA's AEDT version 2c Service Pack 2 (AEDT 2cSP2) was released for general use on March 13, 2017. The latest version has been used for the 2016 DNL contour in this report as the primary analytical tool to assess the noise environment at Logan Airport. This version of the model includes data for the Boeing 787-8R, Embraer E170, and Embraer E190, all types in use at Logan Airport.

The remaining sections of this appendix provide several tables describing the data for 2016. Where possible, the data for 2015 are included for comparison and in general the tables listed as (a) are for 2015 and (b) for 2016.

2016 Radar Data

Logan Airport's radar data provide the key to the RC for AEDT™ system. Since February 2004, Massport has collected Passive Surveillance Radar System (PASSUR) radar data, which supplies information to the Airport's web-based Airport Monitor software. This dataset was used for the *2004 Environmental Status and Planning Report (2004 ESPR)* through the *2008 EDR*. Beginning with the *2009 EDR*, Massport began utilizing the radar data from its Harris NOMS system. These radar data are obtained from a multilateration system of eight sensors deployed around the Airport. The positioning data from these sensors are correlated to provide better, more accurate coverage of aircraft (in areas where the traditional FAA radar has limitations) and provide a more complete set of points to define each track. Traditional radar provides points every four to five seconds where the multilateration system provides data every second.

In 2015, the Massport system switched to FAA's Nextgen data feed, which integrates the Automatic Dependent Surveillance Broadcast (ADS-B) feed with multiple redundant real-time FAA surveillance sources into a single fused data feed. The NextGen data is a "multisensor based" subscription data source that aggregates all available surveillance sources, including:

- FAA En Route Radars;
- FAA Terminal Radars;
- FAA Airport Surface Detection Equipment X Band (ASDE-X) Systems;
- FAA Aircraft Situational Display to Industry (ASDI) Oceanic and Canadian Tracks only; and
- Harris ADS-B Data Feed.

Logan Airport is supported by an FAA ASDE-X system which provides highly accurate one-second data points for aircraft situational awareness on the Airport and within at least 5 miles of the Airport. These data are fused with the other sources and provided to the Massport NOMS system in a geo-referenced data format. The geo-referenced radar data are imported into the AEDT model, which is built on a geo-referenced platform to retain accuracy of the data for modeling.

The system was able to collect 366 complete days of data for 2016 with approximately 98 percent of these tracks usable for the development of the noise exposure contours.

Fleet Mix

The 2016 radar data was first processed to establish a baseline set of operations. After processing the 366 days of radar data (396,615 operations), flight tracks with sufficient operational information were identified to use as the baseline for the 2016 contours. The operations from these tracks were then scaled upwards by airline and aircraft type to match the reported totals provided by Massport for 2016. **Tables H-1a** (2015 for comparison) and **H-1b** (2016) provide the scaled annual operations, by INM aircraft type. Each INM type listed in **Tables H-1a** and **H-1b** is also mapped to a Runway Use group based on its weight and performance characteristics described in the Runway Use section below.

Regional jets (RJ) are defined as those aircraft with 90 or fewer seats, consistent with the categorization in Chapter 2, *Activity Levels*.[13] For years prior to 2010, the RJs in this report were classified as aircraft with less than 100 seats. When RJs first started gaining popularity, the aircraft types available were typically 50 seats or less with the traditional air carrier jet being 100 seats and higher. As newer aircraft types have become available, the smaller 35 to 50 seat types have been replaced by 70 to 99-seat types, with the 90 and above seat types flying many of the traditional air carrier routes. The majority of the newer types fall into two categories: the 70 to 75-seat category, which remain categorized as RJs, and the 91- to 99-seat category, which are categorized as air carrier jets. The Embraer 190 falls into this category and is now in the Light Jet B group.

AEDT Analysis

In 2015, FAA released its next-generation environmental analysis software, the Aviation Environmental Design Tool (AEDT) version 2B.[14] AEDT incorporates the computational engines of the legacy tools INM and the Emissions and Dispersion Modeling System (EDMS), and provides a unified database back end and graphical user interface. With a common set of aircraft and airport data that are updated regularly, AEDT ensures that noise and emissions analyses can be performed with up-to-date information.

Massport first explored the use of AEDT for the *2015 EDR*. Logan Airport presents a set of unique challenges to modeling software, and over the course of several years, Massport has addressed these challenges by developing a series of adjustments and customizations to better represent the operations, conditions, and terrain that affect noise at Logan Airport. These adjustments have historically been incorporated into INM analyses, and an AEDT analysis would need to incorporate equivalent features to continue the modeling accuracy of previous efforts. These unique analysis features include:

- ***Custom profiles***. The analysis has developed custom climbing and descent profiles based on radar altitude data, rather than using default profiles built into INM. This results in more accurate aircraft thrust calculations, which in turn affects an aircraft's noise emissions.
- ***Daily weather data***. Noise calculations have used average weather conditions for each day to determine aircraft performance and sound propagation.
- ***Hill effect adjustment***. Due to discrepancies between noise monitor data and INM calculations in the Orient Heights area close to the Airport, adjustments have been included to improve the accuracy of calculations in areas with direct line-of-sight exposure to the airfield.

---

13 U.S. Code, 2006 Edition, Supplement 3, Title 49 – Transportation Subtitle VII – Aviation Programs Part A – Air Commerce and Safety, Subpart II, Economic Regulation, Chapter 417 - Operations or Carriers, Subchapter III - Regional Air Service Incentive Program, Sec. 41762 – Definitions – defines RJ air carrier service to be aircraft with a maximum of 75 seats. Therefore, this report categorizes aircraft with 70-75 seats and below as RJ and aircraft with 90 seats and higher aircraft as air carrier (Note: there are no types with 75 to 90 seats).

14 AEDT 2A was released in 2013 and replaced the NIRS model for airspace analysis. AEDT 2B replaces, AEDT 2A, INM and EDMS.

- ***Over water adjustment***. The INM calculations assume that noise is absorbed as it propagates over ground. However, Logan Airport is mostly surrounded by water, which reflects rather than absorbs the sound. This results in higher noise levels in areas near the Airport. An adjustment has been used that allows the INM to assume higher aircraft noise emissions when they are close to the ground.

In transitioning from INM to AEDT, Massport has investigated how to implement these adjustments in the new software. At the same time, Massport has coordinated with FAA regarding approval of any adjustments proposed. While the Massachusetts state EDR/ESPR process does not require FAA approval, Massport wishes to perform analysis to FAA standards. Massport has held numerous meetings with FAA since the release of AEDT to get approval for adjustments to AEDT. The final set of formal request memoranda from Massport to FAA, and FAA's responses, are presented at the end of Chapter 6, *Noise Abatement* and the original request and response memoranda are presented at the beginning of this appendix. The following is a summary of the measures proposed to address the adjustments previously implemented in INM, and FAA's response.

- ***Altitude control codes***. This feature of AEDT performs a similar function to the custom profiles used previously, using altitude data to more accurately calculate aircraft thrust levels. Since this is a capability built into AEDT, **FAA approval is implicit** and was not requested.
- ***Aircraft weight adjustment***. It has been determined that aircraft takeoff weights, based on Department of Transportation T-100 data, do not always match the weight assumptions made by AEDT. Consequently, an adjustment has been made to more accurately represent takeoff weight, and therefore aircraft thrust during takeoff. **FAA concurs with this approach**.
- ***Annual weather***. AEDT by default uses 30-year average weather for the Airport. Massport has proposed using an annual average for the year under study to better capture year-to-year variations in weather.[15] **FAA concurs with this approach**.
- ***Hill effects***. Massport has proposed including the adjustments previously used in INM. **FAA does not concur with this approach**. There are ongoing research studies to develop modifications to the AEDT model and FAA recommends waiting until those methods are available.
- ***Over water adjustment***. Massport explored other options including the existing INM adjustment method. Massport proposed including the adjustments previously used in INM. **FAA does not concur with this approach**. There are ongoing research studies to develop modifications to the AEDT model and FAA recommends waiting until those methods are available.

Massport will continue to work with FAA to address these issues and to incorporate enhancements to AEDT as they become available.

At this time, FAA has approved adjustments for annual average weather and aircraft weight correction, but disapproved adjustments for over-water effects and elevated terrain line-of-sight exposure. Massport has performed an AEDT analysis for 2016 using only FAA-approved adjustments.

15 Daily weather is currently not an option in AEDT modeling inputs, however Massport will continue to request that FAA allow for such an option.

Table H-1a 2015 Annual Modeled Operations

		Arrivals		Departures		
INM Type	**Group**	**Day**	**Night**	**Day**	**Night**	**Total**
Commercial Jet Operations						
74720B	Heavy Jet A	1	0	0	1	2
747400	Heavy Jet A	1,260	33	862	431	2,586
7478	Heavy Jet A	156	0	150	5	311
A340-211	Heavy Jet A	564	6	191	379	1,139
A340-642	Heavy Jet A	350	0	230	120	701
767300	Heavy Jet B	976	489	824	641	2,931
767400	Heavy Jet B	282	3	252	33	570
767CF6	Heavy Jet B	69	7	49	27	151
767JT9	Heavy Jet B	95	28	19	104	245
777200	Heavy Jet B	583	110	578	116	1,387
7773ER	Heavy Jet B	581	66	129	518	1,293
7878R	Heavy Jet B	870	0	747	123	1,739
A300-622R	Heavy Jet B	182	448	314	316	1,259
A310-304	Heavy Jet B	240	18	58	200	517
A330-301	Heavy Jet B	1,399	9	1,050	359	2,817
A330-343	Heavy Jet B	553	7	395	165	1,119
DC1010	Heavy Jet B	217	186	218	185	806
DC1030	Heavy Jet B	64	50	53	60	227
MD11GE	Heavy Jet B	32	9	27	15	82
MD11PW	Heavy Jet B	12	12	9	15	48
717200	Light Jet A	3,814	656	3,892	579	8,942
727EM2	Light Jet A	0	2	2	0	4
MD9025	Light Jet A	1,129	114	1,172	72	2,487
MD9028	Light Jet A	554	44	569	30	1,197
737300	Light Jet B	1,963	353	1,939	377	4,633
7373B2	Light Jet B	127	27	128	26	308
737400	Light Jet B	27	14	26	15	82
737500	Light Jet B	0	0	0	0	0
737700	Light Jet B	6,690	2,432	7,468	1,657	18,247
737800	Light Jet B	13,986	5,609	16,305	3,289	39,188
757300	Light Jet B	558	290	615	233	1,696
757PW	Light Jet B	2,193	550	2,392	352	5,487
757RR	Light Jet B	2,677	473	2,670	480	6,300
A319-131	Light Jet B	9,100	2,030	9,717	1,413	22,260
A320-211	Light Jet B	3,809	1,085	4,255	639	9,788
A320-232	Light Jet B	16,664	5,833	19,778	2,719	44,994
A321-232	Light Jet B	2,704	877	2,975	607	7,163
EMB190	Light Jet B	27,031	3,582	26,711	3,908	61,232
EMB195	Light Jet B	1,720	198	1,732	186	3,836
MD82	Light Jet B	15	0	15	0	30

Table H-1a 2015 Annual Modeled Operations (Continued)

		Arrivals		Departures		
INM Type	**Group**	**Day**	**Night**	**Day**	**Night**	**Total**
Commercial Jet Operations						
MD83	Light Jet B	992	33	974	51	2,049
CL600	Light Jet B	2	0	2	0	4
CL601	RJ	4,713	266	4,805	176	9,960
CNA680	RJ	1	3	4	0	9
CRJ9-ER	RJ	3,650	192	3,510	331	7,683
CRJ9-LR	RJ	1,610	75	1,509	176	3,369
EMB145	RJ	114	1	114	1	229
EMB14L	RJ	2,124	14	2,088	49	4,275
EMB170	RJ	2,458	111	2,445	124	5,138
EMB175	RJ	3,744	54	3,695	103	7,595
F10062	RJ	9	0	9	0	17
GV	RJ	1	0	1	0	1
LEAR35	RJ	14	1	13	2	30
Commercial Jets Subtotal		**122,677**	**26,398**	**127,682**	**21,403**	**298,160**
Commercial Non-Jet Operations						
BEC58P	Non-jet	17,650	308	17,864	172	35,994
CNA208	Non-jet	227	0	222	5	454
DHC8	Non-jet	970	2	960	13	1,944
DHC830	Non-jet	2,081	150	2,002	229	4,463
DO228	Non-jet	1	0	1	0	2
SF340	Non-jet	1,873	0	1,875	0	3,747
Commercial Non-Jet Operations Subtotal		**22,801**	**461**	**22,923**	**419**	**46,604**
Commercial Aircraft Total		**145,479**	**26,858**	**150,605**	**21,822**	**344,764**
General Aviation Operations						
74720B	Heavy Jet A	2	2	2	2	8
777200	Heavy Jet B	1	0	1	0	2
A330-301	Heavy Jet B	3	0	2	1	6
DC93LW	Light Jet A	0	1	1	0	2
737700	Light Jet B	12	2	12	1	27
757PW	Light Jet B	10	0	6	4	21
757RR	Light Jet B	3	3	4	1	10
A319-131	Light Jet B	3	2	5	0	10
EMB195	Light Jet B	0	2	1	1	4
MD81	Light Jet B	4	3	4	3	14
MD83	Light Jet B	6	2	7	1	17
1900D	Non-jet	2	0	2	0	4

Table H-1a 2015 Annual Modeled Operations (Continued)

		Arrivals		Departures		
INM Type	**Group**	**Day**	**Night**	**Day**	**Night**	**Total**
General Aviation Operations						
BEC58P	Non-jet	480	22	476	26	1,004
CNA172	Non-jet	84	0	83	1	168
CNA182	Non-jet	59	0	59	0	117
CNA206	Non-jet	97	0	95	2	193
CNA208	Non-jet	1,140	109	1,172	82	2,503
CNA20T	Non-jet	3	1	4	0	8
CNA441	Non-jet	566	76	563	80	1,285
DHC8	Non-jet	7	0	7	0	14
DHC830	Non-jet	12	1	12	1	27
DO228	Non-jet	430	38	442	29	938
DO328	Non-jet	8	0	8	0	16
GASEPF	Non-jet	8	0	8	0	16
GASEPV	Non-jet	512	36	526	23	1,096
PA28	Non-jet	20	2	23	0	45
PA30	Non-jet	1	0	1	0	2
PA31	Non-jet	54	3	54	2	113
SF340	Non-jet	14	0	14	0	29
CIT3	RJ	48	4	50	2	105
CL600	RJ	1,079	83	1,079	85	2,326
CL601	RJ	1,067	84	1,092	61	2,304
CNA500	RJ	72	6	70	8	156
CNA510	RJ	53	7	50	10	121
CNA525C	RJ	346	36	340	42	764
CNA55B	RJ	212	22	215	19	466
CNA560E	RJ	526	44	539	31	1,140
CNA560U	RJ	137	8	129	15	289
GV	RJ	737	68	748	57	1,610
IA1125	RJ	91	2	90	3	187
LEAR25	RJ	6	0	5	1	12
LEAR35	RJ	1,349	127	1,355	120	2,950
MU3001	RJ	553	42	554	41	1,191
General Aviation Total		**12,951**	**1,122**	**13,110**	**983**	**28,166**
Grand Total		**158,430**	**27,980**	**163,715**	**22,805**	**372,930**

Source: HMMH, 2016.
Notes: BEC58P is the AEDT substitution for the Cessna 402.
The CRJ9-ER in the RJ category is the CRJ700 aircraft
Annual operations modeled in the 2015 Annual contour.
Some totals may not match due to rounding.

Table H-1b 2016 Annual Modeled Operations

		Arrivals		Departures		
INM Type	**Group**	**Day**	**Night**	**Day**	**Night**	**Total**
Commercial Jet Operations						
747400	HJA	877	19	491	405	1,792
7478	HJA	274	1	260	15	549
A340-211	HJA	125	0	51	75	250
A340-642	HJA	502	1	400	103	1,006
A380-841	HJA	1	1	2	0	4
A380-861	HJA	1	0	1	0	2
767300	HJB	1,051	582	979	653	3,264
767400	HJB	484	2	480	6	972
767CF6	HJB	70	1	67	3	141
767JT9	HJB	27	0	19	8	54
777200	HJB	775	123	789	109	1,797
777300	HJB	1	0	1	0	2
7773ER	HJB	962	102	452	611	2,127
7878R	HJB	1,224	33	1,141	117	2,515
A300-622R	HJB	188	478	328	338	1,331
A310-304	HJB	190	36	91	135	451
A330-301	HJB	2,354	27	1,654	728	4,764
A330-343	HJB	1,062	7	549	520	2,138
DC1010	HJB	256	188	268	175	886
DC1030	HJB	74	48	74	47	242
MD11GE	HJB	37	20	27	29	113
MD11PW	HJB	22	12	18	16	68
717200	LJA	2,798	413	2,866	345	6,421
727EM2	LJA	1	0	1	0	1
MD9025	LJA	1,064	161	1,064	161	2,450
MD9028	LJA	538	72	536	74	1,220
737300	LJB	1,792	324	1,829	287	4,234
7373B2	LJB	112	25	120	18	274
737400	LJB	11	5	8	8	32
737500	LJB	1	0	1	0	2
737700	LJB	7,262	2,260	7,908	1,613	19,042
737800	LJB	16,665	6,965	19,675	3,954	47,259
737N17	LJB	1	0	1	0	2
757300	LJB	815	436	1,008	242	2,501
757PW	LJB	1,516	547	1,583	480	4,125
757RR	LJB	2,353	481	2,411	423	5,668
A319-131	LJB	9,753	1,822	10,077	1,499	23,151
A320-211	LJB	3,879	900	4,417	362	9,557
A320-232	LJB	17,885	6,357	20,796	3,446	48,484
A321-232	LJB	5,299	1,552	5,750	1,101	13,702
EMB190	LJB	26,332	2,907	25,460	3,779	58,477

Table H-1b 2016 Annual Modeled Operations (Continued)

		Arrivals		Departures		
INM Type	**Group**	**Day**	**Night**	**Day**	**Night**	**Total**
Commercial Jet Operations						
EMB195	LJB	1,608	124	1,549	183	3,464
MD82	LJB	6	0	6	0	12
MD83	LJB	827	135	810	152	1,924
CL601	RJ	5,418	167	5,153	432	11,170
CRJ9-ER	RJ	4,442	282	4,243	481	9,448
CRJ9-LR	RJ	1,446	61	1,390	118	3,014
EMB145	RJ	80	1	81	0	162
EMB14L	RJ	1,516	16	1,514	18	3,064
EMB170	RJ	1,691	218	1,750	159	3,818
EMB175	RJ	2,654	330	2,641	342	5,966
GV	RJ	13	1	12	1	27
LEAR35	RJ	34	11	36	9	89
Commercial Jets Subtotal		**128,363**	**28,250**	**132,832**	**23,782**	**313,227**
Commercial Non-Jet Operations						
BEC58P	Non-Jet	17,559	438	17,787	210	35,994
CNA208	Non-Jet	198	0	198	0	396
CNA441	Non-Jet	4	0	2	2	8
DHC8	Non-Jet	427	4	415	16	861
DHC830	Non-Jet	2,980	146	2,850	275	6,251
SF340	Non-Jet	1,827	4	1,826	5	3,662
Commercial Non-Jet Operations Subtotal		**22,995**	**592**	**23,078**	**509**	**47,173**
Commercial Aircraft Total		**151,358**	**28,842**	**155,911**	**24,290**	**360,401**
General Aviation Operations						
A109	Helicopter	29	1	28	2	59
B206B3	Helicopter	35	5	29	11	80
B206L	Helicopter	23	3	20	7	53
B212	Helicopter	14	0	11	3	29
B222	Helicopter	2	1	1	2	6
B407	Helicopter	25	2	24	4	55
B427	Helicopter	2	0	2	0	4
B429	Helicopter	9	0	7	2	18
BO105	Helicopter	7	0	7	0	14
EC130	Helicopter	14	0	13	1	29
H500D	Helicopter	6	1	6	1	14
R44	Helicopter	13	2	15	0	31
S61	Helicopter	6	0	6	0	12
S70	Helicopter	16	3	17	2	39
S76	Helicopter	61	9	59	10	139

Table H-1b 2016 Annual Modeled Operations (Continued)

		Arrivals		Departures		
INM Type	**Group**	**Day**	**Night**	**Day**	**Night**	**Total**
General Aviation Operations						
SA330J	Helicopter	108	4	105	7	223
SA350D	Helicopter	6	1	5	2	14
SA355F	Helicopter	26	0	21	4	51
SC300C	Helicopter	4	1	5	0	10
A340-211	HJA	2	0	1	1	4
A340-642	HJA	2	1	1	2	6
777200	HJB	0	2	0	2	4
DC93LW	LJA	2	0	0	2	4
737400	LJB	13	7	12	7	39
737700	LJB	16	3	16	3	39
737800	LJB	1	1	2	0	4
737N17	LJB	1	0	1	0	2
757PW	LJB	3	2	3	2	10
757RR	LJB	9	0	7	2	18
A319-131	LJB	2	7	8	1	18
A320-211	LJB	0	2	0	2	4
A320-232	LJB	1	1	2	0	4
EMB190	LJB	2	0	1	1	4
MD81	LJB	2	2	1	2	6
MD83	LJB	5	6	8	2	21
1900D	Non-Jet	2	0	2	0	4
BEC58P	Non-Jet	512	28	511	29	1,079
CNA172	Non-Jet	90	2	89	2	182
CNA182	Non-Jet	68	0	66	1	135
CNA206	Non-Jet	82	0	81	1	164
CNA208	Non-Jet	1,952	205	2,076	81	4,313
CNA20T	Non-Jet	9	0	9	0	18
CNA441	Non-Jet	409	56	398	67	930
DHC6	Non-Jet	1	0	1	0	2
DO228	Non-Jet	618	41	621	38	1,317
DO328	Non-Jet	3	0	3	0	6
GASEPF	Non-Jet	5	0	5	0	10
GASEPV	Non-Jet	406	18	406	18	848
PA28	Non-Jet	50	0	50	0	100
PA31	Non-Jet	72	1	71	2	145
PA42	Non-Jet	0	2	2	0	4
SD330	Non-Jet	15	0	15	0	31
CIT3	RJ	40	2	39	3	84
CL600	RJ	1,219	93	1,224	88	2,624
CL601	RJ	1,094	106	1,140	59	2,398
CNA500	RJ	44	5	46	3	98

Table H-1b 2016 Annual Modeled Operations (Continued)

		Arrivals		Departures		
INM Type	**Group**	**Day**	**Night**	**Day**	**Night**	**Total**
General Aviation Operations						
CNA510	RJ	39	11	39	11	100
CNA525C	RJ	360	43	351	51	805
CNA55B	RJ	159	15	152	22	348
CNA560E	RJ	605	67	628	45	1,346
CNA560U	RJ	118	9	116	11	254
CNA560XL	RJ	890	74	914	49	1,927
CNA680	RJ	441	22	430	33	926
CNA750	RJ	497	54	523	28	1,102
ECLIPSE500	RJ	16	0	16	0	33
EMB145	RJ	37	4	39	2	82
EMB14L	RJ	1	0	0	1	2
F10062	RJ	489	48	490	46	1,073
GIV	RJ	605	50	584	71	1,309
GV	RJ	884	98	904	78	1,964
IA1125	RJ	101	5	103	3	213
LEAR35	RJ	1,197	135	1,221	110	2,662
MU3001	RJ	522	32	523	31	1,108
General Aviation Total		**14,118**	**1,292**	**14,337**	**1,074**	**30,821**
Grand Total		**165,477**	**30,133**	**170,248**	**25,364**	**391,222**

Source: HMMH, 2017.
Notes: BEC58P is the AEDT substitution for the Cessna 402.
The CRJ9-ER in the RJ category is the CRJ700 aircraft
Annual operations modeled in the 2016 Annual contour.
Some totals may not match due to rounding.

Runway Use

RC for AEDT™ determines which runway was used by each aircraft type and whether it was a daytime or nighttime operation directly from the radar data. The summary of daytime and nighttime runway usages presented here is broken into six representative aircraft groups listed below with example aircraft types from each group, grouped in this format to allow comparison with prior years (see **Tables H-2a** and **H-2b**):

- Heavy Jet A – B747s, A340s, DC-8s;
- Heavy Jet B – B767s, B777s, A300s, A310s, A330s, DC-10s, L1011s, MD-11s;
- Light Jet A – B717s, B727s, DC-9s, F100s, MD-90s;
- Light Jet B – B737s, B757s, A319s, A320s, B-146s, MD-80s, E190;
- Regional Jet (RJ) – E135, E145, E170, CRJ2, CRJ7, CRJ9, J328 and Corporate Jets; and
- Turboprops and Piston Aircraft (non-jets).

Table H-2a shows the runway use that was used to model the 2015 noise conditions. **Table H-2b** shows the runway used to model the 2016 noise conditions. As described above, turbojet aircraft in the table were grouped into different categories for reporting purposes. Because the 2015 contours developed using RealContours™ and 2016 contours developed using RC for AEDT™ reflect the individual use of the runways by each INM aircraft type, they accurately represent Logan Airport's noisiest aircraft by modeling them on the actual runways that they used during the year. The modeled runway use for each particular aircraft type may be different from the overall group runway use presented in **Table H-2a** for 2015 and **Table H-2b** for 2016.

Comparing **Table H-2b** (2016) with the similar **Table H-2a** (2015) in this *2016 EDR*, the largest change was a 20 percent decrease in the share of nighttime arrivals of the Heavy Jet B group on Runway 33L. These operations shifted to Runway 22L and Runway 27, with increases of 14 percent and 9 percent, respectively.

Departures on Runway 33L showed the broadest increases. Heavy Jet departures from Runway 33L had increased shares for both nighttime and daytime operations. The share of operations on Runway 22R fell broadly across all aircraft groups, with the largest decrease among Heavy Jet A aircraft.

Table H-2a 2015 Modeled Runway Use Percentages by Aircraft Group

	Heavy Jet A		Heavy Jet B		Light Jet A		Light Jet B		Regional Jets		Turboprops	
							ARRIVALS					
Runway	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**
04L	0.12	0.00	0.37	0.14	4.38	0.48	4.01	0.24	12.19	0.88	26.03	6.79
04R	38.22	30.12	37.97	20.64	30.88	21.47	32.03	19.12	24.13	22.54	10.80	18.79
09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
15L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00
15R	2.02	2.12	1.61	0.76	1.51	2.29	1.39	2.27	1.22	2.11	0.77	1.21
22L	31.61	29.97	26.64	30.61	17.68	37.07	21.87	35.96	22.52	35.94	29.28	38.31
22R	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.06	0.00	3.65	0.97
27	9.80	0.00	17.55	3.06	30.12	19.26	26.60	12.85	22.50	12.41	7.66	7.61
32	0.00	0.00	0.00	0.00	0.00	0.00	0.87	0.00	3.95	0.13	8.19	0.27
33L	18.23	37.80	15.85	44.79	15.40	19.43	13.22	29.57	13.43	25.99	8.43	21.20
33R	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	4.68	4.85
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
							DEPARTURES					
Runway	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**
04L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	19.75	12.19
04R	9.75	7.64	12.31	4.25	1.15	1.25	5.14	3.99	0.94	1.47	4.29	3.61
09	9.02	4.93	15.79	12.78	34.53	25.65	29.41	18.12	36.19	22.01	16.78	11.35
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00
15L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
15R	26.50	34.25	11.91	23.69	1.64	8.72	3.02	18.45	1.05	15.88	2.29	10.86
22L	11.42	4.33	9.34	3.09	0.32	0.15	2.61	1.66	0.06	0.50	0.81	0.32
22R	22.96	23.00	24.48	26.77	33.76	31.56	32.52	25.63	35.84	30.20	35.20	33.48
27	1.09	0.22	6.46	1.59	16.00	27.38	11.55	19.68	11.79	17.18	5.12	7.31
32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
33L	19.27	25.63	19.71	27.83	12.59	5.28	15.76	12.45	14.12	12.76	15.53	20.88
33R	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00
Total	100.0	100.0	100.00	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Massport, HMMH, 2016.
Notes: Night for noise modeling is defined as 10:00 PM to 7:00 AM.
Nighttime runway restrictions are from 11:00 PM to 6:00 AM.
Values may not add to 100 percent due to rounding.

Table H-2b 2016 Modeled Runway Use by Aircraft Group

	Heavy Jet A		Heavy Jet B		Light Jet A		Light Jet B		Regional Jets		Turboprops	
						ARRIVALS						
Runway	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**
04L	0.06	0.00	0.09	0.00	3.31	0.15	3.15	0.15	10.31	0.67	21.94	1.16
04R	42.33	30.39	39.39	22.67	34.49	19.77	34.35	20.51	27.01	23.83	16.74	21.14
09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00
15R	0.95	0.00	0.89	0.96	0.62	1.10	0.80	0.55	0.59	0.74	0.50	0.18
22L	31.07	43.55	25.75	27.69	20.99	30.81	22.67	30.33	23.51	32.15	26.39	37.01
22R	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.02	0.00	3.03	3.12
27	5.46	8.68	18.07	3.97	27.61	28.16	25.91	19.35	19.68	20.03	5.14	10.61
32	0.00	0.00	0.00	0.00	0.00	0.00	1.13	0.00	5.25	0.00	11.97	0.00
33L	20.13	17.37	15.80	44.70	12.96	20.00	11.99	29.11	13.63	22.58	7.77	20.63
33R	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.32	6.15
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
						DEPARTURES						
Runway	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**
04L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.85	11.48
04R	9.16	6.87	10.78	4.05	0.65	1.92	4.94	3.61	0.58	0.71	4.60	4.85
09	8.67	6.70	16.72	11.23	37.90	25.24	31.28	20.45	37.50	25.94	19.94	8.58
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
15L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15R	31.30	33.68	15.41	25.89	2.30	8.66	3.99	15.82	2.25	14.83	2.28	12.62
22L	7.82	3.02	6.57	2.53	0.29	1.04	2.48	2.42	0.17	0.55	0.35	0.54
22R	17.75	18.08	21.50	19.38	29.18	29.58	27.25	22.31	29.80	26.17	29.67	34.91
27	0.58	0.33	6.21	0.94	14.94	29.55	11.73	22.52	12.60	20.82	5.32	7.32
32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.14
33L	24.72	31.32	22.80	35.99	14.75	4.01	18.33	12.87	17.09	10.97	18.82	19.56
33R	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00
Total	100.0	100.0	100.00	100.0	100.00	100.00	100.00	100.00	100.00	100.00	100.0	100.0

Source: Massport, HMMH, 2017.

Notes: Night for noise modeling is defined as 10:00 PM to 7:00 AM.
Nighttime runway restrictions are from 11:00 PM to 6:00 AM.
Values may not add to 100 percent due to rounding.

While **Tables H-2a** and **H-2b** present runway use by aircraft groups, **Tables H-3a** and **H-3b** present the total runway use (jets and non-jets) by runway and time of day. The first section of the table displays the operations by runway and time of day for an average day. The second section displays the same information for the year and the last section displays the percent that each runway is used by operation type and time of day. **Table H-3a** shows that on an average day in 2015 Runway 22R had the most departures (165.6 per day) and Runway 4R had the most arrivals (134.85 per day). At night, Runway 22R had the most departures (16.5 per night) but Runway 22L had the most arrivals (27.42 per night). **Table H-3b** shows that on an average day in 2016, Runway 9 had the most departures (151.7 per day) and Runway 4R had the most arrivals (155.2 per day). At night, Runway 22R had the most departures (15.7 per night) but Runway 22L had the most arrivals (25.1 per night).

Table H-3a Summary of Jet and Non-Jet Aircraft Runway Use: 2015

	Runway												
	4L	**4R**	**9**	**14[2]**	**15L**	**15R**	**22L**	**22R**	**27**	**32**	**33L**	**33R**	**Total**
2015 Daily Operations													
Dep Day	14.3	19.7	126.1	0.1	0.0	13.4	9.3	149.0	46.9	0.0	69.4	0.1	448.4
Dep Night	0.2	2.4	10.8	0.0	0.0	11.9	1.1	16.5	10.2	0.0	9.4	0.0	62.5
Arr Day	38.7	118.9	0.1	0.0	0.3	5.6	101.6	2.8	96.6	11.1	55.2	3.4	434.2
Arr Night	0.4	14.9	0.0	0.0	0.0	1.7	27.4	0.0	9.5	0.0	22.7	0.1	76.7
Total Daily Operations	53.6	156.0	137.0	0.1	0.3	32.5	139.4	168.4	163.2	11.1	156.7	3.5	1,021.7
2015 Annual Operations													
Dep Day	5,228	7,200	46,028	24	6	4,878	3,405	54,397	17,134	0	25,343	17	163,660
Dep Night	82	889	3,927	0	0	4,347	406	6,022	3,713	0	3,418	0	22,804
Arr Day	14,135	43,410	33	0	106	2,027	37,065	1,033	35,259	4,038	20,146	1,233	158,485
Arr Night	126	5,445	0	0	0	602	10,007	8	3456	4	8,295	36	27,979
Total Annual Operations	19,571	56,944	49,988	24	112	11,854	50,884	61,460	59,562	4,042	57,201	1,287	372,930
2015 Percentage Operations													
Dep Day	3%	4%	28%	<1%	<1%	3%	2%	33%	10%	<1%	15%	<1%	100%
Dep Night	<1%	4%	17%	<1%	<1%	19%	2%	26%	16%	<1%	15%	<1%	100%
Arr Day	9%	27%	<1%	<1%	<1%	1%	23%	1%	22%	3%	13%	1%	100%
Arr Night	<1%	19%	<1%	<1%	<1%	2%	36%	<1%	12%	<1%	30%	<1%	100%

Source: Massport Noise Office and HMMH 2017.

Notes: The data reflect actual percentages of aircraft operations on each runway end. They should not be confused with effective runway use, which is used by the Preferential Runway Advisory System (PRAS) to derive recommendations for use of a particular runway.
Runway 14-32 is unidirectional.
Values may not add to 100 percent due to rounding.

Table H-3b Summary of Jet and Non-Jet Aircraft Runway Use: 2016

	Runway												
	4L	**4R**	**9**	**142**	**15L**	**15R**	**22L**	**22R**	**27**	**32**	**33L**	**33R**	**Total**
2016 Daily Operations													
Dep Day	14.2	20.3	138.4	0.0	0.0	18.8	8.9	129.0	49.2	0.0	85.2	0.1	464.1
Dep Night	0.2	2.4	13.2	0.0	0.0	12.0	1.5	15.7	12.8	0.0	11.3	0.0	69.1
Arr Day	32.6	138.1	0.0	0.0	0.1	3.2	106.6	2.3	94.2	15.7	53.5	4.7	451.0
Arr Night	0.2	17.2	0.0	0.0	0.0	0.5	25.1	0.1	15.2	0.0	23.9	0.2	82.2
Total Daily Operations	47.1	177.9	151.7	0.0	0.1	34.5	142.1	147.0	171.4	15.8	173.9	4.9	1,066.5
2016 Annual Operations													
Dep Day	5,179	7,413	50,669	8	0	6,897	3,268	47,196	18,019	14	31,175	25	169,865
Dep Night	86	880	4,836	0	0	4,375	555	5,743	4,699	1	4,130	0	25,305
Arr Day	11,921	50,529	0	0	53	1,185	39,010	837	34,462	5,752	19,597	1,723	165,069
Arr Night	62	6,278	0	0	0	176	9,191	30	5,555	0	8,750	58	30100
Total Annual Operations	17,247	65,101	55,505	8	53	12,633	52,024	53,806	62,736	5,768	63,653	1,806	390,339
2016 Percentage Operations													
Dep Day	3%	4%	30%	<1%	<1%	4%	2%	28%	11%	<1%	18%	<1%	100%
Dep Night	<1%	3%	19%	<1%	<1%	17%	2%	23%	19%	<1%	16%	<1%	100%
Arr Day	7%	31%	<1%	<1%	<1%	1%	24%	1%	21%	3%	12%	1%	100%
Arr Night	<1%	21%	<1%	<1%	<1%	1%	31%	<1%	18%	<1%	29%	<1%	100%

Source: Massport Noise Office and HMMH 2017.

Notes: The data reflect actual percentages of aircraft operations on each runway end. They should not be confused with effective runway use, which is used by the Preferential Runway Advisory System (PRAS) to derive recommendations for use of a particular runway.
Runway 14-32 is unidirectional.
Values may not add to 100 percent due to rounding.

Runway use can also be presented in terms of percent of total operations as shown in **Table H-4** for 2015 and 2016. **Tables H-2a** and **H-2b** total the runway use by aircraft group and time of day. **Tables H-3a** and **H-3b** total the runway use by operation type and time of day. **Table H-4** presents the 2015 and 2016 runway use for all operations which use Logan Airport.

In 2015, Runway 22R was the runway with the highest activity (primarily jet departures) with Runway 27 a very close second (primarily by jet arrivals). For 2016, Runway 04R was the most active, with primarily jet arrivals, followed by Runway 33L, with a mix of arrivals and departures

Each year, non-jet activity makes up approximately 7 percent of the arrivals and 7 percent of the departures at Logan Airport.

Table H-4 Total 2015 and 2016 Modeled Runway Use by All Operations

	Jet Arrivals		Non-Jet Arrivals		Jet Departures		Non-Jet Departures		All Operations
	Day	Night	Day	Night	Day	Night	Day	Night	
Runway	**2015 Operations**								
4L	2.0%	<0.1%	1.8%	<0.1%	<0.1%	<0.1%	1.4%	<0.1%	5.2%
4R	10.9%	1.4%	0.8%	<0.1%	1.6%	<0.1%	<0.1%	<0.1%	15.3%
9	0.0%	0.0%	<0.1%	0.0%	11.2%	1.0%	1.2%	<0.1%	13.4%
14	0.0%	0.0%	<0.1%	0.0%	<0.1%	0.0%	<0.1%	0.0%	<0.1%
15L	0.0%	0.0%	<0.1%	0.0%	0.0%	0.0%	<0.1%	0.0%	<0.1%
15R	<0.1%	<0.1%	<0.1%	<0.1%	1.1%	1.1%	<0.1%	<0.1%	3.2%
22L	7.9%	2.6%	2.1%	<0.1%	0.9%	<0.1%	<0.1%	<0.1%	13.6%
22R	<0.1%	<0.1%	<0.1%	<0.1%	12.1%	1.6%	2.5%	<0.1%	16.5%
27	8.9%	0.9%	0.5%	<0.1%	4.2%	1.0%	<0.1%	<0.1%	16.0%
32	0.5%	<0.1%	0.6%	<0.1%	0.0%	0.0%	<0.1%	0.0%	1.1%
33L	4.8%	2.2%	0.6%	<0.1%	5.7%	0.9%	1.1%	<0.1%	15.3%
33R	<0.1%	0.0%	<0.1%	<0.1%	0.0%	0.0%	<0.1%	0.0%	<0.1%
Total	35.4%	7.3%	7.1%	<0.1%	36.8%	5.9%	7.1%	<0.1%	100.0%
Runway	**2016 Operations**								
4L	1.5%	<0.1%	1.5%	<0.1%	0.0%	0.0%	1.3%	<0.1%	4.4%
4R	11.8%	1.6%	1.2%	<0.1%	1.6%	<0.1%	<0.1%	<0.1%	16.7%
9	0.0%	0.0%	0.0%	0.0%	11.6%	1.2%	1.4%	<0.1%	14.2%
14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	<0.1%	0.0%	<0.1%
15L	0.0%	0.0%	<0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	<0.1%
15R	<0.1%	<0.1%	<0.1%	<0.1%	1.6%	1.1%	<0.1%	<0.1%	3.2%
22L	8.1%	2.3%	1.8%	<0.1%	0.8%	<0.1%	<0.1%	<0.1%	13.3%
22R	<0.1%	0.0%	<0.1%	<0.1%	10.0%	1.4%	2.1%	<0.1%	13.8%
27	8.5%	1.4%	<0.1%	<0.1%	4.2%	1.2%	<0.1%	<0.1%	16.1%
32	0.6%	0.0%	0.8%	0.0%	0.0%	0.0%	<0.1%	<0.1%	1.5%
33L	4.5%	2.2%	0.5%	<0.1%	6.7%	1.0%	1.3%	<0.1%	16.3%
33R	0.0%	0.0%	<0.1%	<0.1%	0.0%	0.0%	<0.1%	0.0%	<0.1%
Total	35.3%	7.5%	7.0%	<0.1%	36.5%	6.3%	7.0%	<0.1%	100.0%

Flight Tracks

RC for AEDT™ converts each radar track to an AEDT model track and then models the scaled aircraft operation on that track. This method keeps the lateral and vertical dispersion of the aircraft types consistent with the radar data, and ensures that anomalies in the departure paths are captured in the RC for AEDT™ system. **Table H-5** lists the number of flight tracks used in the RealContours™ modeling system for 2015 and the RC for AEDT™ modeling system for 2016. A sample of flight tracks from 2016 are displayed in **Figures 6-3** through **6-9** in Chapter 6, *Noise Abatement*.

Table H-5 Total Count of Flight Tracks Modeled in RealContours™ (2015) and RC for AEDT™ (2016)

	Runway											
	4L	**4R**	**9**	**14**	**15L**	**15R**	**22L**	**22R**	**27**	**32**	**33L**	**33R**
2015												
Departures	5,310	8,089	49,955	24	6	9,225	3,811	60,419	20,847	0	28,761	17
Arrivals	14,261	48,855	33	0	106	2,629	47,073	1,041	38,715	4,042	28,440	1,269
2016												
Departures	5,265	8,294	55,505	8	0	11,272	3,823	52,939	22,719	15	35,305	25
Arrivals	11,982	56,807	0	0	53	1,362	48,201	867	40,017	5,752	28,347	1,782

Source: HMMH, 2016/2017; Harris NOMS data.

Fleet Mix

Table H-6 summarizes the numbers of operations by categories of aircraft operating at Logan Airport from 1990 through 2016. Operations are summarized by operator category (commercial/GA), aircraft category, and day or night operation (night defined as 10:00 PM to 7:00 AM, consistent with the definition of DNL). General aviation (GA) operations were not included in the noise modeling prior to 1998 and commercial jet operations were not separated until 1999.

Table H-6 Modeled Daily Operations by Commercial and General Aviation (GA) Aircraft – 1990 to 2016

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Commercial Aircraft											
Stage 2 Jets[2]	Day	312.4		228.89	203.34	189.4	156.9	132.4	108.46	84.93	83.3
	Night	19.99		13.13	7.44	10.1	5.5	4.79	7.75	5.92	6.66
	Total	**332.39**		**242.02**	**210.78**	**199.5**	**162.4**	**137.19**	**116.21**	**90.85**	**89.96**
Stage 3 Jets	Day	288.89		384.49	418.99	425.7	429.4	439.81	505.08	541.43	597.28
	Night	57.25		58.29	65.47	62.8	69	80.16	85.06	95.54	98.59
	Total	**346.14**		**442.78**	**484.46**	**488.5**	**498.4**	**519.97**	**590.14**	**636.97**	**695.87**
Air Carrier Jets	Day	N/A[3]		N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	569.18
	Night	N/A[3]		N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	96.21
	Total	**N/A[3]**		**N/A[3]**	**N/A[3]**	**N/A[3]**	**N/A[3]**	**N/A[3]**	**N/A[3]**	**N/A[3]**	**665.39**
Regional Jets	Day	N/A[3]		N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	28.1
	Night	N/A[3]		NA[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	2.38
	Total	**N/A[3]**		**N/A[3]**	**N/A[3]**	**N/A[3]**	**N/A[3]**	**N/A[3]**	**N/A[3]**	**N/A[3]**	**30.48**
Non-jets	Day	444.41		411.84	598.16	541.97	526.85	505.31	514.7	552.56	448.82
	Night	11.72		69.32	46.84	13.59	11.14	13.73	27.27	21.86	16.63
	Total	**456.13**		**481.16**	**645**	**555.56**	**537.99**	**519.04**	**541.97**	**574.42**	**465.45**
Total Commercial Operations											
Operations	Day	1045.7		1025.22	1220.49	1157.07	1113.15	1077.52	1128.24	1178.92	1129.9
	Night	88.96		140.74	119.75	86.49	85.64	98.68	120.08	123.32	121.88
	Total	**1134.7**		**1,166**	**1340.2**	**1243.6**	**1198.79**	**1176.2**	**1248.3**	**1302.2**	**1251.8**
GA Aircraft											
Stage 2 Jets[2]	Day	N/A[4]		N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	5.25	9.89
	Night	N/A[4]		N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	0.4	0.74
	Total	**N/A[4]**		**N/A[4]**	**N/A[4]**	**N/A[4]**	**N/A[4]**	**N/A[4]**	**N/A[4]**	**5.65**	**10.63**
Stage 3 Jets	Day	N/A[4]		N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	30.54	48.46
	Night	N/A[4]		N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	4.21	6.55
	Total	**N/A[4]**		**N/A[4]**	**N/A[4]**	**N/A[4]**	**N/A[4]**	**N/A[4]**	**N/A[4]**	**34.75**	**55.01**
Non-jets	Day	N/A[4]		N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	37.29	19.36
	Night	N/A[4]		N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	16.28	18.89
	Total	**N/A[4]**		**N/A[4]**	**N/A[4]**	**N/A[4]**	**N/A[4]**	**N/A[4]**	**N/A[4]**	**53.57**	**38.25**
Total GA Operations											
Operations	Day	N/A[4]		N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	73.08	77.71
	Night	N/A[4]		N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	20.89	26.17
	Total	**NA[4]**		**N/A[4]**	**N/A[4]**	**N/A[4]**	**N/A[4]**	**N/A[4]**	**N/A[4]**	**93.97**	**103.88**
Overall totals											
Total	Day	1045.7		1025.22	1220.49	1157.07	1113.15	1077.52	1128.24	1252	1207.61
	Night	88.96		140.74	119.75	86.49	85.64	98.68	120.08	144.21	148.05
	Total[3]	**1134.66**		**1165.96**	**1340.24**	**1243.56**	**1198.79**	**1176.2**	**1248.32**	**1396.21**	**1355.66**

Table H-6 Modeled Daily Operations by Commercial and General Aviation (GA) Aircraft – 1990 to 2016 (Continued)

		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Commercial Aircraft											
Stage 2 Jets[2]	Day	5.13	1.18	0.05	0.08	0.03	0.05	0.03	0.03	0.01	0
	Night	0.26	0.05	0	0	0.01	0.01	0	0.01	0.01	0
	Total	**5.39**	**1.23**	**0.05**	**0.08**	**0.05**	**0.06**	**0.03**	**0.04**	**0.02**	**0**
Stage 3 Jets	Day	727.09	756.24	740.75	717.85	772.39	765.76	767.55	748.13	699.39	668..32
	Night	103.66	109.77	97.04	92.69	113.24	113.66	114.81	118.29	114.3	103.11
	Total	**830.75**	**866.01**	**837.79**	**810.54**	**885.63**	**879.42**	**882.36**	**866.42**	**813.69**	**771.43**
Air Carrier Jets	Day	648.95	569.99	500.7	461.06	518.96	505.48	490.63	472.39	443.15	421.51
	Night	99.79	101.3	83.52	72.69	89.24	91.99	92.71	96.28	89.89	82.19
	Total	**748.74**	**671.29**	**584.22**	**533.75**	**608.2**	**597.47**	**583.34**	**568.66**	**533.04**	**503.7**
Regional Jets	Day	78.14	186.25	240.05	256.8	253.43	260.34	276.95	275.77	256.24	246.81
	Night	3.87	8.47	13.52	19.99	24	21.68	22.11	22.03	24.4	20.93
	Total	82.01	194.72	253.57	276.79	277.43	282.01	299.06	297.8	280.64	267.73
Non-jets	Day	409.62	317.62	165.45	135.18	133.24	148.77	140.81	145.27	132.52	136.45
	Night	21.58	10.97	3.45	2.41	3.03	3.02	3.26	3.47	4	5.54
	Total	**431.2**	**328.58**	**168.89**	**137.59**	**136.28**	**151.79**	**144.07**	**148.73**	**136.52**	**141.99**
Total Commercial Operations											
Operations	Day	1141.84	1075.04	906.25	853.1	905.66	914.59	908.41	893.43	831.92	804.77
	Night	125.51	120.79	100.49	95.1	116.29	116.68	118.09	121.77	118.31	108.65
	Total	**1267.4**	**1195.82**	**1006.7**	**948.2**	**1022**	**1031.27**	**1026.51**	**1015.2**	**950.23**	**913.42**
GA Aircraft											
Stage 2 Jets[2]	Day	7.29	5.15	3.65	2.84	0.94	2.29	1.9	1.24	0.36	0.09
	Night	0.64	0.5	0.41	0.26	0.14	0.25	0.17	0.19	0.03	0.01
	Total	**7.93**	**5.65**	**4.08**	**3.1**	**1.08**	**2.54**	**2.07**	**1.43**	**0.38**	**0.1**
Stage 3 Jets	Day	40.08	34.23	37.83	46.21	53.72	58.84	61.08	54.82	43.98	22.31
	Night	3.21	3.28	6.42	6.98	8.37	9.33	6.57	6.39	4.52	2.28
	Total	**43.29**	**37.51**	**44.25**	**53.19**	**62.09**	**68.16**	**67.65**	**61.21**	**48.49**	**23.59**
Non-jets	Day	34.57	37.31	17.36	17.81	16.95	14	15.05	11.98	15.13	8.19
	Night	1.83	1.92	4.45	4.4	5.2	4.75	1.39	3.61	1.08	0.74
	Total	**36.4**	**39.23**	**21.81**	**22.21**	**22.14**	**18.75**	**16.44**	**15.58**	**16.2**	**8.93**
Total GA Operations											
Operations	Day	81.94	76.68	58.84	66.88	71.6	75.12	78.03	68.04	59.46	30.46
	Night	5.68	5.71	11.29	11.64	13.71	14.33	8.13	10.19	5.62	3.08
	Total	87.62	82.39	70.13	78.52	85.31	89.46	86.15	78.22	65.05	33.54
Overall totals											
Total	Day	1223.78	1151.72	965.09	919.98	977.27	989.71	986.43	961.46	891.39	834.33
	Night	131.19	126.5	111.78	106.74	130	131.02	126.22	131.96	123.93	111.7
	Total[3]	**1354.9**	**1278.2**	**1076.8**	**1026.7**	**1107.2**	**1120.7**	**1112.6**	**1093.4**	**1015.3**	**946.03**

Table H-6 Modeled Daily Operations by Commercial and General Aviation (GA) Aircraft – 1990 to 2016 (Continued)

		2010	2011	2012	2013	2014	2015	2016	Change 2015 to 2016
Commercial Aircraft									
Stage 2 Jets[2]	Day	0.01	0.01	0.01	0.01	0	0	0.00	0.00
	Night	0.01	0	0	0	0	0	0.00	0.00
	Total	**0.02**	**0.01**	**0.01**	**0.01**	**0**	**0**	**0.00**	**0.00**
Stage 3 Jets	Day	674.25	684.19	649.22	667.65	670	685.92	715.35	29.43
	Night	107.92	109.38	106.55	115.91	123.6	130.96	142.53	11.57
	Total	**782.17**	**793.57**	**755.77**	**783.56**	**793.61**	**816.88**	**857.88**	**41.01**
Air Carrier Jets	Day	521.64	571.03	530.76	546.27	556.59	585.55	622.15	36.59
	Night	93.98	99.17	98.68	107.17	115.84	126.36	135.30	8.94
	Totals	**615.62**	**670.2**	**629.44**	**653.44**	**672.43**	**711.92**	**757.45**	**45.53**
Regional Jets	Day	152.61	113.16	118.46	121.38	113.41	100.36	93.20	-7.16
	Night	13.94	10.21	7.87	8.74	7.77	4.6	7.23	2.63
	Total	**166.55**	**123.37**	**126.33**	**130.12**	**121.18**	**104.96**	**100.43**	**-4.53**
Non-jets	Day	138.53	135.18	133.92	132.33	128.45	125.27	125.88	0.61
	Night	5.21	4.73	3.06	3.21	2.28	2.41	3.01	0.60
	Total	**143.74**	**139.91**	**136.98**	**135.54**	**130.73**	**127.68**	**128.89**	**1.21**
Total Commercial Operations									
Operations	Day	812.78	819.39	783.14	799.99	798.45	811.19	841.23	30.04
	Night	113.13	114.11	109.62	119.12	125.88	133.37	145.54	12.17
	Total	**925.91**	**933.5**	**892.76**	**919.12**	**924.33**	**944.56**	**986.77**	**42.21**
GA Aircraft									
Stage 2 Jets[2]	Day	0.27	0.08	0.25	0.31	0	0.28	0.01	-0.27
	Night	0.04	0	0.04	0.02	0	0.02	0.00	-0.02
	Total	**0.3**	**0.08**	**0.29**	**0.33**	**0**	**0.3**	**0.01**	**-0.29**
State 3 Jets	Day	27.8	52.51	52.93	51.21	52.64	51.82	53.97	2.16
	Night	3.21	5.35	7.2	5.1	4.65	4.28	4.85	0.56
	Total	**31.01**	**57.87**	**60.13**	**56.31**	**57.29**	**56.1**	**58.82**	**2.72**
Non-jets	Day	8.19	18.18	15.16	13.06	13.95	19.31	23.77	4.46
	Night	0.72	1.29	1.29	1.15	1.13	1.46	1.62	0.16
	Total	**8.92**	**19.48**	**16.45**	**14.22**	**15.08**	**20.77**	**25.38**	**4.62**
Total GA Operations									
Operations	Day	36.26	70.78	68.35	64.58	66.59	71.4	77.75	6.34
	Night	3.97	6.65	8.52	6.28	5.78	5.77	6.47	0.70
	Total	**40.22**	**77.43**	**76.86**	**70.85**	**72.37**	**77.17**	**84.21**	**7.05**
Overall Totals									
Total	Day	849.03	890.16	851.49	864.57	865.05	882.59	918.98	36.39
	Night	117.1	120.76	118.13	125.4	131.66	139.14	152.00	12.87
	Total[3]	**966.13**	**1,010.92**	**969.61**	**989.97**	**996.7**	**1,021.73**	**1,070.98**	**49.26**

Source: Massport's Noise Monitoring System and Revenue Office numbers, HMMH 2017.
Notes: Data from 1991 not available.
1 Includes scheduled and unscheduled operations.
2 Stage 2 aircraft have not been permitted to operate effective December 31, 2015.
3 RJ operations were not tracked separately prior to 1999.
4 Totals prior to 1998 do not include GA operations.
5 The definition of RJ for the EDR changed between 2009 and 2010. A RJ in 2010 is a jet in commercial service with less than 80 seats. Prior to 2010, a RJ was a jet in commercial service with 100 seats or less.

Commercial Jet Aircraft by Part 36 Stage Category

FAA categorizes jet aircraft currently operating at Logan Airport into three groups: Stage 2, Stage 3, and Stage 4. As described in Chapter 6, *Noise Abatement*, the designation refers to a noise classification specified in Federal Aviation Regulation Part 36 that sets noise emission standards at three measurement locations – takeoff, landing, and sideline – based on an aircraft's maximum certificated weight. The heavier the aircraft, the more noise it is permitted to make within limits. Aircraft are allowed to be recertificated to the higher standard when modifications are made to the aircraft engine or design. Because of the substantial differences in noise between Stage 2, recertificated Stage 3, Stage 3, and Stage 4 aircraft, Massport tracks operations by these separate categories to follow their trends. **Table H-7** shows the percentage of commercial jet operations by stage category from 1999 through 2016. One of the most significant changes occurring after the economic downturn in 2001 was the almost immediate retirement of the re-certificated aircraft from airlines' fleets due to their high operating costs. This type of accelerated retirement is not as prevalent during the 2008 to 2009 economic downturn since it is no longer the major airlines operating these aircraft. However, these aircraft still have high operating costs and are being replaced wherever possible.

Table H-7 Percentage of Commercial Jet Operations by Part 36 Stage Category – 1999 to 2016

	Stage 4 Requirements[3]	Certificated Stage 3[1]	Recertificated Stage 3[2]	Stage 2	Total
1999	N/A	70.0%	21.0%	9.0%	100%
2000	N/A	75.0%	24.0%	1.0%	100%
2001	N/A	86.3%	13.6%	0.1%	100%
2002	N/A	92.8%	7.2%	0.0%	100%
2003	N/A	95.8%	4.1%	0.0%	100%
2004	N/A	97.8%	2.2%	0.0%	100%
2005	N/A	98.0%	2.0%	0.0%	100%
2006	N/A	98.6%	1.4%	0.0%	100%
2007	N/A	98.9%	1.1%	0.0%	100%
2008	N/A	99.1%	0.9%	0.0%	100%
2009	N/A	99.1%	0.9%	0.0%	100%
2010	93.2%[4]	98.9%	1.1%	0.0%	100%
2011	95.5%[4]	99.5%	0.5%	0.0%	100%
2012	95.8%[4]	99.9%	0.1%	0.0%	100%
2013	97.4%[4]	100.0%	<0.1%	<0.1%	100%
2014	97.4%[4]	100.0%	<0.1%	0.0%	100%
2015	96.7%[4]	100.0%	<0.1%	<0.1%	100%
2016	97.0%	100.0%	<0.1%	0.0%	100%

Source: Massport and FAA radar data.

Notes:

1 New Stage 3 aircraft are aircraft originally manufactured as a certified Stage 3 aircraft under Federal Regulation Part 36.

2 Recertificated Stage 3 aircraft are aircraft originally manufactured as a certified Stage 1 or 2 aircraft under Federal Regulation Part 36, which either have been treated with hushkits or have been re-engineered to meet Stage 3 requirements.

3 Aircraft that meet Stage 4 requirements are aircraft that are certificated Stage 4 or would qualify if recertificated. Certificated Stage 4 aircraft were not available until 2006 and the level of aircraft that meet Stage 4 requirements has not been determined prior to 2010.

4 All aircraft listed as meeting Stage 4 requirements are also listed as Stage 3 aircraft.

Nighttime Operations

Massport tracks flights that operate between the broader DNL nighttime periods of 10:00 PM to 7:00 AM, when each flight is penalized 10 dB in calculations of noise exposure. **Table H-8** shows this nighttime activity by different groups of aircraft. Nighttime flights by commercial jet operators increased by 8.9 percent in 2016, following increases of 6.6 percent in 2014 and 5.7 percent in 2015. Commercial non-jet operations increased by 24.9 percent following increases of 29 percent in 2014 and 5.7 percent in 2015. GA traffic increased by 12.3 percent in 2016, following decreases of 8 percent in 2014 and 0.2 percent in 2015. Overall, nighttime operations at Logan Airport increased by 9.3 percent in 2016, after increasing 5.0 percent in 2014 and 5.7 percent in 2015. The majority of nighttime operations (between 10:00 PM and 7:00 AM) occurred either before midnight or after 5:00 AM.

Table H-8 Modeled Nighttime Operations at Logan Airport – 1990 to 2016

	Commercial Jets	Commercial Non-Jets	General Aviation	Total
1990	77.24	11.72	N/A	88.96
1991	NA	NA	N/A	N/A
1992	71.42	69.32	N/A	140.74
1993	72.91	46.84	N/A	119.75
1994	72.90	13.59	N/A	86.49
1995	74.50	11.14	N/A	85.64
1996	84.95	13.73	N/A	98.68
1997	92.81	27.27	N/A	120.08
1998	101.46	21.86	20.89[1]	144.21
1999	105.25	16.63	26.17	148.05
2000	103.92	21.58	5.68	131.19
2001	109.82	10.97	5.71	126.50
2002	97.04	3.45	11.29	111.78
2003	92.69	2.41	11.64	106.74
2004	113.26	3.03	13.71	130.00
2005	113.67	3.02	14.33	131.02
2006	114.81	3.26	8.13	126.22
2007	118.30	3.47	10.19	131.96
2008	114.31	4.00	5.62	123.93
2009	103.05	5.56	3.08	111.70
2010	107.93	5.21	3.97	117.10
2011	109.38	4.73	6.65	120.76
2012	106.55	3.06	8.52	118.13
2013	115.91	3.21	6.28	125.40
2014	123.60	2.28	5.78	131.66
2015	130.96	2.41	5.77	139.14
2016	142.55	3.01	6.48	152.05
Change (2015 to 2016)	**11.59**	**0.6**	**0.71**	**12.91**
Percent Change	**8.85%**	**25.10%**	**12.38%**	**9.28%**

Source: Massport, HMMH, 2017.

Note: N/A = Not available.

1 Previously reported as N/A. 1998 was the first year GA operations were reported and included in the total nighttime operations.

Jet Runway Use

Table H-9 presents a summary of runway use by jets. Since 2009, the radar data have been analyzed with Massport's Harris Noise and Operational Monitoring System (NOMS), data from 2001 through 2008 was compiled with Massport's PreFlight™ software. PreFlight™ was an analysis package used to compile fleet, day/night splits, and runway use information from radar data. Data prior to 2001 were derived from Massport's original noise monitoring system, supplemented with field records. Note that Logan Airport Noise Rules prevent arrivals to Runway 22R and departures from Runway 4L by jet aircraft.

Table H-9 Summary of Jet Aircraft Runway Use – 1990 to 2016

Runway	4L	4R	9	14[1]	15R	22L	22R	27	32[1]	33L
1990										
Departures	0%[2]	3%	21%	N/A	10%	2%	36%	20%	N/A	7%
Arrivals	1%	25%	0%	N/A	2%	14%	0%	28%	N/A	29%
1992[2]										
Departures	0%	6%	31%	N/A	7%	2%	38%	10%	N/A	6%
Arrivals	1%	37%	0%	N/A	3%	12%	0%	30%	N/A	17%
1993										
Departures	0%	9%	33%	N/A	7%	3%	40%	4%	N/A	4%
Arrivals	2%	44%	0%	N/A	1%	11%	0%	28%	N/A	15%
1994										
Departures	0%	9%	33%	N/A	4%	3%	32%	12%	N/A	5%
Arrivals	3%	42%	0%	N/A	1%	8%	0%	27%	N/A	19%
1995										
Departures	0%	8%	36%	N/A	5%	5%	29%	11%	N/A	5%
Arrivals	3%	41%	0%	N/A	2%	8%	0%	27%	N/A	17%
1996										
Departures	0%	8%	32%	N/A	5%	6%	33%	12%	N/A	5%
Arrivals	2%	38%	0%	N/A	2%	11%	0%	29%	N/A	18%
1997										
Departures	0%	8%	30%	N/A	5%	6%	31%	15%	N/A	5%
Arrivals	2%	36%	0%	N/A	2%	9%	0%	30%	N/A	20%
1998										
Departures	0%	8%	35%	N/A	6%	5%	28%	14%	N/A	5%
Arrivals	2%	41%	0%	N/A	2%	7%	0%	28%	N/A	19%
1999										
Departures	0%	8%	31%	N/A	5%	4%	30%	15%	N/A	6%
Arrivals	3%	37%	0%	N/A	2%	10%	0%	28%	N/A	21%
2000										
Departures	0%	8%	35%	N/A	4%	3%	30%	15%	N/A	6%
Arrivals	4%	40%	0%	N/A	1%	7%	0%	28%	N/A	20%

Table H-9 Summary of Jet Aircraft Runway Use – 1990 to 2016 (Continued)

Runway	4L	4R	9	14[1]	15R	22L	22R	27	32[1]	33L
2001										
Departures	0%	7%	34%	N/A	4%	3%	35%	12%	N/A	5%
Arrivals	5%	36%	0%	N/A	1%	8%	0%	32%	N/A	18%
2002										
Departures	0%	4%	31%	N/A	6%	3%	35%	16%	N/A	6%
Arrivals	6%	31%	0%	N/A	1%	12%	0%	30%	N/A	21%
2003										
Departures	0%	4%	33%	N/A	7%	2%	34%	14%	N/A	6%
Arrivals	7%	33%	0%	N/A	1%	14%	0%	28%	N/A	18%
2004										
Departures	0%	5%	34%	N/A	10%	4%	24%	18%	N/A	6%
Arrivals	6%	34%	0%	N/A	1%	12%	0%	24%	N/A	23%
2005										
Departures	0%	5%	36%	N/A	7%	1%	31%	13%	N/A	7%
Arrivals	8%	33%	0%	N/A	1%	11%	0%	29%	N/A	17%
2006										
Departures	0%	4%	33%	0%	3%	1%	40%	13%	-	6%
Arrivals	7%	29%	0%	-	1%	14%	0%	33%	0.2%	16%
2007										
Departures	0%	5%	31%	0%	4%	1%	33%	7%	-	19%
Arrivals	5%	31%	0%	-	1%	15%	0%	36%	2%	11%
2008										
Departures	0%	6%	33%	<1%	3%	<1%	36%	6%	-	16%
Arrivals	6%	30%	-	-	2%	17%	-	33%	2%	11%
2009										
Departures	0%	7%	32%[3]	0%	3%	2%	34%	6%[3]	-	16%
Arrivals	7%	31%	-	-	3%	17%	0%	30%[3]	1%	11%
2010										
Departures	0%	4%	28%	<1%	8%	2%	31%	10%	-	17%
Arrivals	5%	28%	-	-	1%	15%	0%	32%	1%	16%
2011										
Departures	0%	6%	36%	<1%	5%[4]	2%	36%	7%	-	7%[4]
Arrivals	7%	37%	-	-	<1%[4]	16%	0%	28%	1%	11%[4]
2012										
Departures	0%	6%	33%	<1%	5%[4]	3%	38%	6%	-	9%[4]
Arrivals	6%	34%	-	-	1%[4]	16%	0%	33%	<1%	9%[4]
2013										
Departures	<1%	5%	30%	<1%	5%	2%	35%	12%	-	12%
Arrivals	6%	29%	-	-	1%	16%	<1%	32%	1%	15%

Table H-9 Summary of Jet Aircraft Runway Use – 1990 to 2016 (Continued)

Runway	4L	4R	9	14[1]	15R	22L	22R	27	32[1]	33L
2014										
Departures	0%	5%	31%	<1%	5%	2%	28%	13%	-	17%
Arrivals	5%	30%	0%	-	2%	25%	<1%	21%	1%	16%
2015										
Departures	<1%	4%	29%	<1%	5%	2%	32%	12%	-	15%
Arrivals	5%	29%	0%	-	2%	25%	<1%	23%	1%	16%
2016										
Departures	0%	4%	30%	0%	6%	2%	27%	13%	-	18%
Arrivals	4%	31%	0%	-	1%	24%	<1%	23%	1%	16%

Source: HMMH 2017, Massport Noise Office.

Notes: The data reflect actual percentages of jet aircraft operations on each runway end. They should not be confused with effective runway use, which is used by the PRAS to derive recommendations for use of a particular runway. Effective runway percentages include a factor of 10 applied to nighttime operations so that use of a runway at night more closely reflects its effect on total noise exposure.
Jet aircraft are not able to use Runway 15L or 33R due to its length of only 2,557 feet.
Values may not add to 100 percent due to rounding.
N/A = Not available.

1 Runway 14-32 opened in late November 2006. (Runway 14-32 is unidirectional with no arrivals to Runway 14 and no departures from Runway 32).

2 The *1990 Final Generic Environmental Impact Report* was published and submitted to the Secretary of Environmental Affairs in July 1993. It included modeled operations and resulting noise contours for 1987, 1990, and a 1996-forecast year. The *1993 Annual Update* published in July 1994 included operations and contours for 1992 and 1993. 1991 data are not available.

3 Runway 9-27 had extended weekend closings for resurfacing during 2009.

4 Runway 15R-33L was closed for 3 months in 2011 and in 2012.

Annual Model Results and Status of Mitigation Programs

Noise Exposed Population

Table H-10 presents the noise-exposed population by community through 2016. This table includes population within the DNL 60 to 65 dB contours, although a DNL of 65 dB is the federally-defined noise criterion used as a guideline to identify when residential land use is considered incompatible with aircraft noise.

Table H-10 Noise-Exposed Population by Community

Year	Census Data	80+ dB DNL	75+ dB DNL	70-75 dB DNL	65-70 dB DNL[1]	Total (65+)	60-65 dB DNL
BOSTON[2]							
1990	1980	0	0	1,778	28,970	30,748	N/A
1992	1980	0	0	800	4,316	5,116	N/A
1993	1980	0	0	264	2,820	3,084	N/A
1994	1990	0	106	265	7,698	8,069	30,895
1995	1990	0	106	851	8,815	9,772	33,765
1996	1990	0	106	374	8,775	9,255	40,992
1997	1990	0	106	719	13,857	14,682	54,804
1998	1990	0	58	580	10,877	11,515	52,201
1999[3]	1990	0	58	364	11,632	12,054	45,948
2000[3]	1990	0	58	183	7,880	8,121	32,474
2000[3]	2000	0	0	234	9,014	9,248	35,785
2001[3]	2000	0	0	315	6,515	6,700	27,778
2002[3]	2000	0	0	132	2,625	2,757	23,225
2003[3]	2000	0	0	164	1,730	1,894	21,763
2004[3,4]	2000	0	65	192	4,142	4,399	24,473
2005[3,4]	2000	0	65	104	2,020	2,189	17,661
2006[4]	2000	0	65	99	1,054	1,218	14,866
2007	2000	0	0	169	4,094	4,263	21,446
2008	2000	0	5	0	3,487	3,492	18,890
2009	2000	0	5	67	937	1,009	12,284
2010	2000	0	0	67	644	711	14,900
2010	2010	0	0	0	689	689	17,646
2011	2010	0	0	0	331	331	11,600
2012	2010	0	0	0	439	439	12,076
2012	2010	0	0	0	421	421	11,037
2013	2010	0	0	0	612	612	14,835
2014	2010	0	0	34	4,151	4,185	23,343
2015	2010	0	0	110	7,225	7,365	32,309
2016[5]	2010	0	0	0	4,031	4,031	20,806
CHELSEA							
1990	1980	0	0	0	4,813	4,813	N/A
1992	1980	0	0	0	3,952	3,952	N/A
1993	1980	0	0	0	0	0	N/A
1994	1990	0	0	0	0	0	8,510
1995	1990	0	0	0	95	95	9,750
1996	1990	0	0	0	0	0	8,744
1997	1990	0	0	0	0	0	10,001
1998	1990	0	0	0	0	0	9,222

Table H-10 Noise-Exposed Population by Community (Continued)

Year	Census Data	80+ dB DNL	75+ dB DNL	70-75 dB DNL	65-70 dB DNL[1]	Total (65+)	60-65 dB DNL
CHELSEA							
1999	1990	0	0	0	95	95	9,249
2000	1990	0	0	0	0	0	5,622
2000	2000	0	0	0	0	0	7,361
2001	2000	0	0	0	0	0	4,508
2002	2000	0	0	0	0	0	3,995
2003	2000	0	0	0	0	0	3,591
2004[4]	2000	0	0	0	0	0	7,756
2005[4]	2000	0	0	0	0	0	5,772
2006[4]	2000	0	0	0	0	0	2,477
2007	2000	0	0	0	0	0	9,774
2008	2000	0	0	0	0	0	7,793
2009	2000	0	0	0	0	0	5,462
2010	2000	0	0	0	0	0	4,880
2010	2010	0	0	0	0	0	4,897
2011	2010	0	0	0	0	0	0
2012	2010	0	0	0	0	0	0
2012	2010	0	0	0	0	0	0
2013	2010	0	0	0	0	0	3,485
2014	2010	0	0	0	0	0	9,236
2015	2010	0	0	0	0	0	0
2016[5]	2010	0	0	0	0	0	12,110
EVERETT							
1990	1980	0	0	0	0	0	N/A
1992	1980	0	0	0	0	0	N/A
1993	1980	0	0	0	0	0	N/A
1994	1990	0	0	0	0	0	0
1995	1990	0	0	0	0	0	0
1996	1990	0	0	0	0	0	0
1997	1990	0	0	0	0	0	0
1998	1990	0	0	0	0	0	0
1999[3]	1990	0	0	0	0	0	0
2000[3]	1990	0	0	0	0	0	0
2000[3]	2000	0	0	0	0	0	0
2001[3]	2000	0	0	0	0	0	0
2002[3]	2000	0	0	0	0	0	0
2003[3]	2000	0	0	0	0	0	0
2004[3,4]	2000	0	0	0	0	0	0
2005[3,4]	2000	0	0	0	0	0	0
2006[4]	2000	0	0	0	0	0	0
2007	2000	0	0	0	0	0	0
2008	2000	0	0	0	0	0	0
2009	2000	0	0	0	0	0	0
2010	2000	0	0	0	0	0	0
2010	2010	0	0	0	0	0	0
2011	2010	0	0	0	0	0	0
2012	2010	0	0	0	0	0	0
2012	2010	0	0	0	0	0	0
2013	2010	0	0	0	0	0	0

Table H-10 Noise-Exposed Population by Community (Continued)

Year	Census Data	80+ dB DNL	75+ dB DNL	70-75 dB DNL	65-70 dB DNL[1]	Total (65+)	60-65 dB DNL
EVERETT							
2014	2010	0	0	0	0	0	0
2015	2010	0	0	0	0	0	0
2016[5]	2010	0	0	0	0	0	0
MEDFORD							
1990	1980	0	0	0	0	0	N/A
1992	1980	0	0	0	0	0	N/A
1993	1980	0	0	0	0	0	N/A
1994	1990	0	0	0	0	0	0
1995	1990	0	0	0	0	0	0
1996	1990	0	0	0	0	0	0
1997	1990	0	0	0	0	0	0
1998	1990	0	0	0	0	0	0
1999	1990	0	0	0	0	0	0
2000	1990	0	0	0	0	0	0
2000	2000	0	0	0	0	0	0
2001	2000	0	0	0	0	0	0
2002	2000	0	0	0	0	0	0
2003	2000	0	0	0	0	0	0
2004[4]	2000	0	0	0	0	0	0
2005[4]	2000	0	0	0	0	0	0
2006[4]	2000	0	0	0	0	0	0
2007	2000	0	0	0	0	0	0
2008	2000	0	0	0	0	0	0
2009	2000	0	0	0	0	0	0
2010	2000	0	0	0	0	0	0
2010	2010	0	0	0	0	0	0
2011	2010	0	0	0	0	0	0
2012	2010	0	0	0	0	0	0
2012	2010	0	0	0	0	0	0
2013	2010	0	0	0	0	0	0
2014	2010	0	0	0	0	0	0
2015	2010	0	0	0	0	0	0
2016[5]	2010	0	0	0	0	0	0
QUINCY							
1990	1980	0	0	0	0	0	N/A
1992	1980	0	0	0	0	0	N/A
1993	1980	0	0	0	0	0	N/A
1994	1990	0	0	0	0	0	0
1995	1990	0	0	0	0	0	0
1996	1990	0	0	0	0	0	0
1997	1990	0	0	0	0	0	0
1998	1990	0	0	0	0	0	0
1999	1990	0	0	0	0	0	0
2000	1990	0	0	0	0	0	0
2000	2000	0	0	0	0	0	636
2001	2000	0	0	0	0	0	610
2002	2000	0	0	0	0	0	610
2003	2000	0	0	0	0	0	610

Table H-10 Noise-Exposed Population by Community (Continued)

Year	Census Data	80+ dB DNL	75+ dB DNL	70-75 dB DNL	65-70 dB DNL[1]	Total (65+)	60-65 dB DNL
QUINCY							
2004[4]	2000	0	0	0	0	0	610
2005[4]	2000	0	0	0	0	0	610
2006[4]	2000	0	0	0	0	0	610
2007	2000	0	0	0	0	0	0
2008	2000	0	0	0	0	0	0
2009	2000	0	0	0	0	0	0
2010	2000	0	0	0	0	0	0
2010	2010	0	0	0	0	0	0
2011	2010	0	0	0	0	0	0
2012	2010	0	0	0	0	0	0
2012	2010	0	0	0	0	0	0
2013	2010	0	0	0	0	0	0
2014	2010	0	0	0	0	0	0
2015	2010	0	0	0	0	0	0
2016[5]	2010	0	0	0	0	0	0
REVERE							
1990	1980	0	0	0	4,274	4,274	N/A
1992	1980	0	0	0	3,848	3,848	N/A
1993	1980	0	0	0	4,617	4,617	N/A
1994	1990	0	0	0	3,569	3,569	2,099
1995	1990	0	0	0	3,364	3,364	2,304
1996	1990	0	0	172	3,292	3,464	2,505
1997	1990	0	0	0	3,293	3,293	2,047
1998	1990	0	0	0	3,168	3,168	2,132
1999	1990	0	0	128	3,165	3,293	2,047
2000	1990	0	0	0	2,552	2,552	2,386
2000	2000	0	0	0	2,496	2,496	3,100
2001	2000	0	0	0	2,496	2,496	3,100
2002	2000	0	0	0	2,822	2,822	2,399
2003	2000	0	0	0	2,994	2,994	2,227
2004[4]	2000	0	0	82	2,969	3,051	2,678
2005[4]	2000	0	0	82	2,540	2,622	2,731
2006[4]	2000	0	0	82	2,540	2,622	2,698
2007	2000	0	0	0	2,450	2,450	2,853
2008	2000	0	0	0	2,434	2,434	1,802
2009	2000	0	0	0	2,512	2,512	1,452
2010	2000	0	0	0	2,505	2,505	1,385
2010	2010	0	0	0	2,413	2,413	2,473
2011	2010	0	0	0	2,547	2,547	3,123
2012	2010	0	0	0	2,772	2,772	3,236
2012	2010	0	0	0	2,762	2,762	3,191
2013	2010	0	0	0	2,505	2,505	2,791
2014	2010	0	0	0	2,832	2,832	3,829
2015	2010	0	0	0	3,789	3,789	3,385
2016[5]	2010	0	0	0	2,376	2,376	3,508
WINTHROP							
1990	1980	0	676	1,211	2,420	4,307	N/A
1992	1980	0	626	1,146	2,488	4,262	N/A

Table H-10	Noise-Exposed Population by Community (Continued)						
Year	**Census Data**	**80+ dB DNL**	**75+ dB DNL**	**70-75 dB DNL**	**65-70 dB DNL[1]**	**Total (65+)**	**60-65 dB DNL**
WINTHROP							
1993	1980	0	648	1,211	1,773	3,632	N/A
1994	1990	0	417	1,343	5,154	6,914	7,512
1995	1990	0	482	1,611	5,757	7,850	7,077
1996	1990	0	417	1,376	5,930	7,723	7,333
1997	1990	0	417	1,659	6,386	8,462	6,839
1998	1990	0	519	1,522	6,572	8,613	6,507
1999	1990	0	353	1,408	5,946	7,707	7,135
2000	1990	0	277	991	5,240	6,508	7,296
2000	2000	0	247	1,070	4,684	6,001	7,776
2001	2000	0	244	683	4,123	5,050	8,104
2002	2000	0	2	481	2,247	2,730	7,921
2003	2000	0	0	339	1,956	2,295	7,386
2004[4]	2000	0	2	337	1,649	1,988	6,508
2005[4]	2000	0	39	347	1,280	1,666	6,353
2006[4]	2000	0	39	416	1,288	1,743	6,845
2007	2000	0	0	247	1,139	1,386	6,749
2008	2000	0	0	244	1,409	1,653	6,547
2009	2000	0	0	171	643	814	4,221
2010	2000	0	0	131	523	654	3,960
2010	2010	0	0	130	598	728	3,720
2011	2010	0	0	130	939	1069	4,303
2012	2010	0	0	200	1,325	1,525	5,564
2012	2010	0	0	200	1,186	1,386	5,305
2013	2010	0	0	130	1,060	1,190	5,466
2014	2010	0	0	130	1,775	1,905	6,456
2015	2010	0	0	320	2,623	2,943	6,375
2016[5]	2010	0	0	130	913	1,403	5,062
All Communities							
1990	1980	0	676	2,989	40,477	44,142	NA
1992	1980	0	628	2,352	14,604	17,584	NA
1993	1980	0	648	1,475	9,210	11,333	NA
1994	1990	0	523	1,608	16,421	18,552	49,016
1995	1990	0	588	2,462	18,031	21,081	52,896
1996	1990	0	523	1,922	17,997	20,442	59,574
1997	1990	0	523	2,378	23,536	26,437	73,691
1998	1990	0	577	2,102	20,617	23,296	70,062
1999	1990	0	411	1,900	20,838	23,149	64,379
2000	1990	0	335	1,174	15,672	17,181	47,778
2000	2000	0	247	1,304	16,194	17,745	54,190
2001	2000	0	244	998	13,004	14,246	43,616
2002	2000	0	2	613	7,694	8,309	38,150
2003	2000	0	0	503	6,680	7,183	35,577
2004[4]	2000	0	67	611	8,760	9,438	41,975
2005[4]	2000	0	104	533	5,840	6,477	33,127
2006[4]	2000	0	104	597	4,882	5,583	27,496
2007(7.01)[4, 5]	2000	0	0	416	7,683	8,099	40,822
2008(7.0b)[4, 5]	2000	0	5	244	7,330	7,579	35,122

Table H-10 Noise-Exposed Population by Community (Continued)

Year	Census Data	80+ dB DNL	75+ dB DNL	70-75 dB DNL	65-70 dB DNL[1]	Total (65+)	60-65 dB DNL
All Communities							
2009	2000	0	5	238	4,092	4,335	23,419
2010	2000	0	0	198	3,672	3,870	25,125
2010	2010	0	0	130	3,700	3,830	28,736
2011	2010	0	0	130	3,817	3,947	19,026
2012	2010	0	0	200	4,536	4,736	20,876
2012(7.0d)[4, 5]	2010	0	0	200	4,369	4,569	19,533
2013(7.0d)[4, 5]	2010	0	0	130	4,177	4,307	26,577
2014(7.0d)[4, 5]	2010	0	0	164	8,758	8,922	42,864
2015	2010	0	0	430	13,667	14,097	52,748
2016[6]	2010	0	0	130	7,320	7,450	41,486

Source: Data prepared for Massport by HMMH 2017.
Notes: South End is included in Boston totals.
N/A Not available.
1 65 dB DNL is the federally-defined noise criterion.
2 Portions of Dorchester, East Boston, Roxbury, South Boston
3 Boston population by community changed in 1999 due to employment of more accurate hill effects methodology and reporting change.
4 All results from 2004 to 2015 are from the RealContours™ modeling system.
5 7.01, 7.0b, 7.0c, and 7.0d refer to INMv7.01, INMv7.0b, INMv7.0c, and INMv7.0d respectively. AEDT version 2cSP2 was used for 2016.
6 All results from 2016 are from AEDT using the RC for AEDT™ pre-processor

Residential Sound Insulation Program (RSIP)

In 2016, no new dwelling units received sound insulation from Massport, leaving totals of 5,467 residential buildings and 11,515 dwelling units that have been sound insulated since 1986 when the program was first implemented. **Table H-11** lists the yearly progress of this mitigation effort.

Following FAA's approval of model adjustments based on the effects of terrain (discussed in the *1999 ESPR*), Massport submitted, and the New England Region of FAA approved, a new sound insulation program. The revised contour, approved for a two-year period beginning in 1999, included dwelling units in East Boston, South Boston, and Winthrop that previously had not been eligible for insulation. Massport received notice of FAA funding for $5 million. Subsequently, Massport updated its program contour, first with the *2001 EDR* contour and more recently with the Logan Airside Improvements Project approved contour. These updates have allowed Massport to continue the program with additional funds every year since 1999. This latest update takes into account runway use changes due to the new Runway 14-32 which opened in late November 2006. This update expands the focus of the sound insulation program into Chelsea to satisfy the mitigation commitments made in the Airside Improvements Program Record of Decision (ROD). Massport has also utilized a program where they have contacted properties that are still eligible within the RSIP boundaries that had previously declined to participate. They have been offered a second chance to participate in the program.

Table H-11 Residential Sound Insulation Program (RSIP) Status (1986-2016)

Construction Year	Residential Buildings[1]	Dwelling Units[2]
1986	4	8
1987	43	51
1988	102	159
1989	94	133
1990	121	200
1991	175	360
1992	197	354
1993	318	654
1994	310	542
1995	372	753
1996	323	577
1997	364	808
1998	328	806
1999	330	718
2000	195	601
2001	260	278
2002	205	354
2003	230	468
2004	320	791
2005	314	471
2006	286	827
2007	160	548
2008	94	388
2009	111	287
2010	56	83
2011	62	114
2012[3]	0	0
2013	45	76
2014	48	106
2015	0	0
2016	0	0
Total	**5,467**	**11,515**

Source: Massport, 2017.
Notes:
1 Includes multiple units.
2 Individual units.
3 Federal funding was delayed in 2012

Table H-12 provides a list of all schools that have been treated under Massport's sound insulation program. To date, Massport has provided sound insulation to 36 schools at a cost of over $8 million.

Table H-12 Schools Treated Under Massport Sound Insulation Program

Boston:	
East Boston	**Winthrop**
East Boston High	Winthrop Jr. High School
St. Mary's Star of the Sea	E. B. Newton
St. Dominic Savio High	A. T. Cummings (Ctr.) School
St. Lazarus	3 Total Winthrop Schools
James Otis	
Samuel Adams	
Curtis Guild	**Revere**
Dante Alighieri	Beachmont School
P.J. Kennedy	1 Total Revere School
Donald McKay	
Hugh Roe O'Donnell	
E Boston Central Catholic	**Chelsea**
Manassah Bradley	Shurtleff School
13 East Boston Schools	Williams School
	St. Rose Elementary
South Boston	St. Stanislaus
St. Augustine	Chelsea High School
Cardinal Cushing	5 Total Chelsea Schools
Patrick Gavin	
St. Bridgid's	**36 Total Schools**
Oliver Hazard Perry	
Condon School	
6 South Boston Schools	
Roxbury and Dorchester	
Samuel Mason	
Dearborn Middle	
Ralph Waldo Emerson	
Lewis Middle	
Nathan Hale Elem.	
Phillis Wheatley Elem.	
Davis Ellis Elem.	
Henry L. Higginson	
8 Roxbury and Dorchester Schools	
27 Total Boston Schools	

Source: Massport, 2015.

Noise Complaints

Table H-13 presents a detailed list by community of the total complaints made in 2015 and 2016, which can be filed either on Massport's Noise Complaint Line, through a form on Massport's website or through the PublicVue flight track portal. The Noise Complaint Line provides individuals the ability to express their concerns about aviation noise (activities) or to ask questions regarding noise at Logan Airport. Callers ask a range of questions such as "Why is this runway in use?"; "What times do the planes stop flying?" and "Was that aircraft off-course?"

The Noise Abatement Office (NAO) staff documents noise line complaints by obtaining information from the caller about the nature of the complaint, time of the occurrence, location of caller's residence, and the activity that was disturbed. The NAO uses the collected information to determine the probable activity responsible for the complaint and writes a letter report to the complainant. The letter includes the original complaint, a response that identifies the activity responsible for the call (arrivals, departures, run-up, etc.), meteorological information at the time of the call (a major factor in aviation activities), runways in use at the time of the call, and a notice that FAA will receive a copy of the report.

In 2016, Massport received 38,053 noise complaints from 82 communities (**Figure H-13)**, an increase from 17,369 in 2015. The number of individual complainants increased at a much smaller rate, by 1,903 individuals in 2015 to 2,255 individuals in 2016, indicating that noise annoyance is growing among a concentrated population rather than spreading to a larger population. This is consistent with a recent survey of U.S. airports that finds noise complaints concentrated among relatively small numbers of complainants.[16] This research, completed by George Mason University, shows that a small number of people account for a disproportionately high share of the total number of noise complaints (the full article is included at the end of this appendix). Massport's website, http://www.massport.com/logan-airport/about-logan/noise-abatement/complaints/), provides for additional general questions and answers regarding the Noise Complaint Line.

16 Dourado, E. and Russell, R. October 2016. *Airport Noise NIMBYism: An Empirical Investigation.* Mercatus Center at George Mason University. https://www.mercatus.org/system/files/dourado-airport-noise-mop-v1.pdf. Accessed September 27 ,2017.

Figure H-13 Complaint line calls and callers by year

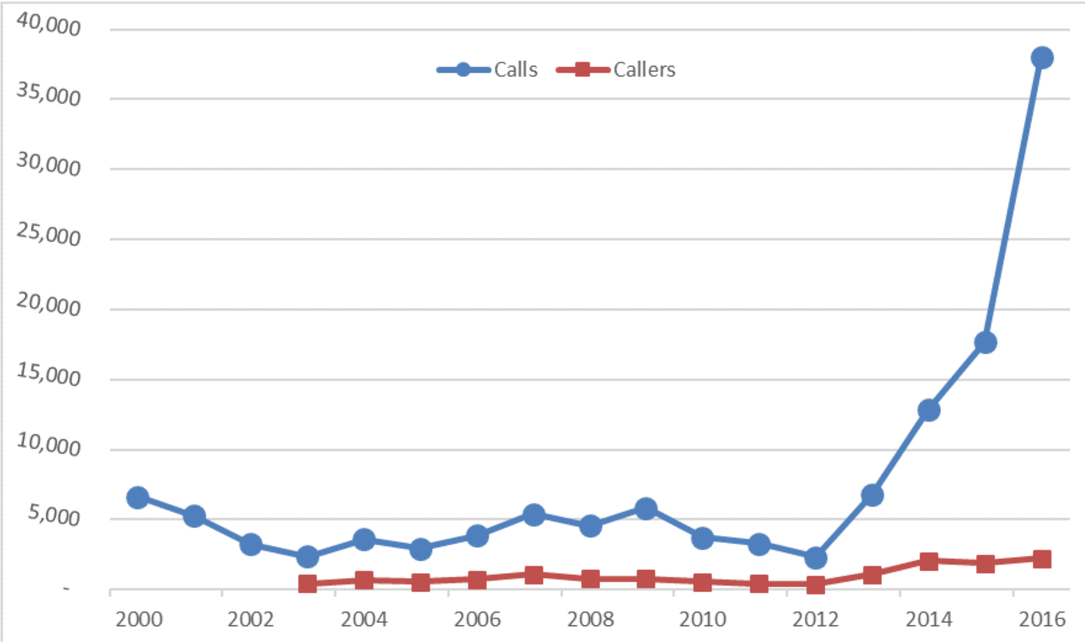


Table H-13 Noise Complaint Line Summary

	2015		2016		
Town Name	**Calls**	**Callers**	**Calls**	**Callers**	**Change (calls)**
Allston	0	0	1	1	1
Arlington	1,851	92	1,968	87	117
Belmont	715	95	501	63	(214)
Beverly	1	1	4	4	3
Billerica	0	0	1	1	1
Boston	120	10	78	24	(42)
Braintree	2	2	12	5	10
Brookline	5	3	5	4	0
Cambridge	1,697	136	2,154	128	457
Canton	10	2	20	6	10
Charlestown	6	3	25	13	19
Chelmsford	0	0	1	1	1
Chelsea	116	37	146	39	30
Cohasset	110	12	125	8	15
Danvers	8	2	9	4	1
Dedham	10	5	6	4	(4)
Dorchester	115	20	326	36	211
Duxbury	1	1	1	1	0
East Boston	250	69	203	61	(47)

Table H-13 Noise Complaint Line Summary (Continued)

	2015		2016		
Town Name	**Calls**	**Callers**	**Calls**	**Callers**	**Change (calls)**
Essex	0	0	1	1	1
Everett	114	30	84	25	(30)
Framingham	19	2	6	2	(13)
Groveland	0	0	1	1	1
Hamilton	2	1	42	15	40
Hingham	55	16	68	18	13
Holbrook	19	4	11	2	(8)
Hull	1,136	152	1,266	220	130
Hyde Park	28	7	190	8	162
Ipswich	0	0	10	5	10
Jamaica Plain	288	60	434	76	146
Littleton	6	1	11	1	5
Lynn	424	13	323	15	(101)
Lynnfield	4	3	2	2	(2)
Malden	36	6	10	7	(26)
Manchester	0	0	6	2	6
Marblehead	10	5	14	4	4
Marshfield	2	1	3	3	1
Mattapan	6	1	2	2	(4)
Medfield	0	0	1	1	1
Medford	508	116	1,784	177	1,276
Melrose	8	4	9	4	1
Middleton	1	1	3	2	2
Millis	1	1	113	2	112
Milton	4,991	343	21,796	466	16,805
Nahant	50	19	339	12	289
Natick	7	1	10	1	3
Needham	7	2	51	5	44
Newton	19	6	44	19	25
North End	0	0	1	1	1
Norwell	4	3	13	1	9
Peabody	64	12	72	6	8
Pembroke	1	1	4	2	3
Quincy	89	11	28	16	(61)
Randolph	1	1	7	3	6
Rehoboth	0	0	1	1	1
Revere	57	25	87	33	30
Roslindale	285	55	588	103	303

Table H-13 Noise Complaint Line Summary (Continued)

	2015		2016		
Town Name	**Calls**	**Callers**	**Calls**	**Callers**	**Change (calls)**
Rowley	0	0	1	1	1
Roxbury	129	11	286	40	157
Salem	7	6	26	8	19
Saugus	1	1	4	1	3
Scituate	3	3	37	10	34
Sharon	9	2	2	1	(7)
Shrewsbury	0	0	1	1	1
Somerville	1,910	191	1,804	153	(106)
South Boston	263	48	577	42	314
South End	216	38	294	40	78
Stoneham	7	2	24	6	17
Stoughton	2	2	21	2	19
Sudbury	0	0	116	1	116
Wakefield	0	0	25	2	25
Waltham	1	1	1	1	0
Watertown	298	34	265	38	(33)
Wellesley	0	0	1	1	1
Wenham	285	2	416	9	131
West Roxbury	205	28	170	21	(35)
Weston	0	0	1	1	1
Westwood	0	0	56	4	56
Weymouth	41	6	125	5	84
Wilmington	0	0	1	1	1
Winchester	733	24	489	16	(244)
Winthrop	0	0	271	96	271
Woburn	0	0	0	0	0
Grand Total	**17,369**	**1,792**	**38,035**	**2,255**	**20,666**

Source: Massport, HMMH 2017
Note: Negative numbers are shown in ( )

Cumulative Noise Index (CNI)

Massport reports total annual fleet noise at Logan Airport, defined in the Logan Airport Noise Rules by a metric referred to as the CNI. The CNI is a single number representing the sum of the entire set of single-event noise levels experienced at the Airport over a full year of operation, weighted similarly to DNL so that activity occurring at night is penalized by adding an extra 10 dB to each event. This penalty is mathematically equivalent to multiplying the number of nighttime events by each aircraft by a factor of 10. The Logan Airport Noise Rules define CNI in terms of Effective Perceived Noise Level (EPNL) and require that the index be computed for the fleet of commercial aircraft operating at Logan Airport throughout the year. In addition, in EDRs and ESPRs, Massport reports partial CNI values of noise at Logan Airport, so that various subsets of the fleet (cargo, night operations, passenger jets, etc.) are identified (see **Table H-14**). The Noise Rules, adopted by Massport following public hearings held in February 1986, established a CNI limit of 156.5 Effective Perceived Noise Decibels (EPNdB). The CNI generally has decreased since 1990, remaining below that cap, with changes from year to year on the order of a few tenths of a decibel. The 2016 CNI remains well below the cap of 156.5 EPNL.

Table H-14 Cumulative Noise Index (EPNL) – 1990 to 2015 (limit 156.5)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Full CNI (Entire Commercial Jet Fleet)	**156.4**	**155.8**	**155.5**	**155.3**	**155.4**	**155.3**	**155.1**	**154.8**	**154.7**	**154.9**
Total Passenger Jets	155.2	154.8	154.6	154.4	154.4	154.2	154.1	153.9	153.7	153.9
Total Cargo Jets	150.1	148.9	148.0	147.9	148.3	148.8	148.6	147.5	147.9	148.0
Total Daytime	152.5	152.1	152.4	152.1	152.1	151.6	151.2	150.8	150.4	150.4
Total Nighttime	154.4	153.4	152.6	152.4	152.6	152.9	152.9	152.5	152.7	153.1
Total Stage 2 Jets	N/A	N/A	N/A	N/A	151.0	150.2	149.4	149.2	147.7	147.1
Total Stage 3 Jets	N/A	N/A	N/A	N/A	153.4	153.8	153.8	153.4	153.8	154.2
Daytime Stage 2	N/A	N/A	N/A	N/A	149.0	148.5	147.6	146.5	145.2	144.1
Nighttime Stage 2	N/A	N/A	N/A	N/A	146.7	145.1	144.8	145.8	144.1	144.0
Daytime Stage 3	N/A	N/A	N/A	N/A	149.1	148.8	148.7	148.8	148.9	149.2
Nighttime Stage 3	N/A	N/A	N/A	N/A	151.4	152.1	152.2	151.5	152.1	152.5
Passenger Jet Stage 2	N/A	N/A	N/A	N/A	150.5	149.9	149.2	148.9	147.5	146.8
Passenger Jet Stage 3	N/A	N/A	N/A	N/A	152.2	152.3	152.3	152.2	152.6	153.0
Cargo Jet Stage 2	N/A	N/A	N/A	N/A	141.5	137.4	136.8	137.4	139.0	134.5
Cargo Jet Stage 3	N/A	N/A	N/A	N/A	147.3	148.5	148.3	147.0	147.3	147.9
Daytime Passenger	N/A	152.0	152.2	152.0	152.0	151.5	151.1	150.6	150.1	150.1
Nighttime Passenger	N/A	151.6	150.9	150.6	150.8	151.0	151.0	151.1	151.2	151.6
Daytime Cargo	137.1	137.1	137.6	135.2	136.1	138.0	136.7	136.2	138.0	138.2
Nighttime Cargo	149.9	148.6	147.6	147.6	148.0	148.4	148.3	147.1	147.5	147.6
Daytime Passenger Stage 2	N/A	N/A	N/A	N/A	148.9	148.4	147.6	146.5	145.0	143.9
Daytime Passenger Stage 3	N/A	N/A	N/A	N/A	149.0	148.5	148.4	148.5	148.6	149.0
Nighttime Passenger Stage 2	N/A	N/A	N/A	N/A	149.0	148.5	148.4	148.5	142.8	143.7
Nighttime Passenger Stage 3	N/A	N/A	N/A	N/A	149.4	149.9	150.1	149.8	150.5	150.8
Daytime Cargo Stage 2	N/A	N/A	N/A	N/A	128.3	126.7	124.6	126.4	131.6	131.5
Daytime Cargo Stage 3	N/A	N/A	N/A	N/A	135.3	137.7	136.4	135.7	136.9	137.1
Nighttime Cargo Stage 2	N/A	N/A	N/A	N/A	141.3	137.0	136.5	137.0	138.2	131.5
Nighttime Cargo Stage 3	N/A	N/A	N/A	N/A	147.0	148.1	148.0	146.6	146.9	147.5

Table H-14 Cumulative Noise Index (EPNL) – 1990 to 2015 (limit 156.5) (Continued)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Full CNI (Entire Commercial Jet	**155**	**154**	**153**	**153**	**153**	**153**	**152.6**	**153**	**153**	**152**
Total Passenger Jets	153.6	152.9	151.8	151.3	152.2	152.1	151.4	151.5	151.9	151.1
Total Cargo Jets	148.2	147.8	147.4	147.1	147	146.6	146.5	146.4	146.1	145.9
Total Daytime	149.5	149	148.5	148	148.5	148.2	147.5	147.2	147.6	147.1
Total Nighttime	153.1	152.4	151.3	150.9	151.7	151.6	151	151.2	151.4	150.7
Total Stage 2 Jets	124.7	121.5	114.3	114.1	118.1	N/A	N/A	N/A	N/A	N/A
Total Stage 3 Jets	154.7	154.1	153.2	152.7	153.4	153.2	152	152.7	152.9	152.3
Daytime Stage 2	122.6	119.3	111.2	113.7	109.4	N/A	N/A	N/A	N/A	N/A
Nighttime Stage 2	120.5	117.3	111.4	103.2	117.5	N/A	N/A	N/A	N/A	N/A
Daytime Stage 3	149.5	149	148.5	148	148.5	148.2	147.5	147.2	147.6	147.1
Nighttime Stage 3	153.1	152.4	151.3	150.9	151.7	151.6	151	151.2	151.4	150.7
Passenger Jet Stage 2	124.2	116.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Passenger Jet Stage 3	153.6	152.9	151.8	151.3	152.2	152.1	151.4	151.5	151.9	151.1
Cargo Jet Stage 2	114.8	119.9	114.3	114.1	118.1	NA	NA	NA	NA	NA
Cargo Jet Stage 3	148.2	147.8	147.4	147.1	147	146.6	146.5	146.4	146.1	145.9
Daytime Passenger	149.3	148.7	148.2	147.7	148.2	147.9	147.2	146.9	147.3	146.8
Nighttime Passenger	151.6	150.8	149.4	148.8	150	150.1	149.3	149.7	150	149.1
Daytime Cargo	137.5	137.1	137	136.2	135.7	135.8	135.5	135.8	135.8	135.2
Nighttime Cargo	147.8	147.4	147	146.8	146.7	146.2	146.1	146	145.6	145.5
Daytime Passenger Stage 2	122.3	115	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Daytime Passenger Stage 3	149.2	148.7	148.2	147.7	148.2	147.9	147.2	146.9	147.3	146.8
Nighttime Passenger Stage	119.8	110.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nighttime Passenger Stage	151.6	150.8	149.4	148.8	150	150.1	149.3	149.7	150	149.1
Daytime Cargo Stage 2	111.1	117.3	111.2	113.7	109.4	N/A	N/A	N/A	N/A	N/A
Daytime Cargo Stage 3	137.5	137	137	136.1	135.7	135.8	135.5	135.8	135.8	135.2
Nighttime Cargo Stage 2	112.3	116.4	111.4	103.2	117.5	N/A	N/A	N/A	N/A	N/A
Nighttime Cargo Stage 3	147.8	147.4	147	146.8	146.7	146.2	146.1	146	145.6	145.5

Table H-14 Cumulative Noise Index (EPNL) – 1990 to 2016 (limit 156.5) (Continued)								
	2010	**2011**	**2012**	**2013**	**2014[1]**	**2015**	**2016**	**Change 2015 to 2016**
Full CNI (Entire Commercial Jet Fleet)	**152**	**152**	**152**	**152**	**153**	**153**	**152.6**	**(0.1)**
Total Passenger Jets	150.9	150.6	151.3	151.4	151.7	152	152.0	0.0
Total Cargo Jets	145.1	146.7	144.9	145.1	144.5	144.2	143.8	(0.4)
Total Daytime	146.8	146.9	147	147	147.1	147.2	147.0	(0.2)
Total Nighttime	150.3	150.6	150.6	150.8	151.0	151.2	151.2	0.0
Total Stage 2 Jets	113.6	110.8	104.9	111.3	N/A	N/A	N/A	N/A
Total Stage 3 Jets	151.9	152.1	152.2	152.3	152.5	152.7	152.6	(0.1)
Daytime Stage 2	103.6	N/A	104.9	101.4	N/A	N/A	N/A	N/A
Nighttime Stage 2	113.1	110.8	N/A	110.8	N/A	N/A	N/A	N/A
Daytime Stage 3	146.8	146.9	147	147	147.1	147.2	147.0	(0.2)
Nighttime Stage 3	150.3	150.6	150.6	150.8	151.0	151.2	151.2	0.0
Passenger Jet Stage 2	N/A	N/A	104.9	101.4	N/A	N/A	N/A	N/A
Passenger Jet Stage 3	150.9	150.6	151.3	151.4	151.7	152	152.0	0.0
Cargo Jet Stage 2	113.6	110.8	N/A	110.8	N/A	N/A	N/A	N/A
Cargo Jet Stage 3	145.1	146.7	144.9	145.1	144.5	144.2	143.8	(0.4)
Daytime Passenger	146.6	146.5	146.8	146.8	146.9	147	146.8	(0.2)
Nighttime Passenger	149	148.5	149.4	149.6	150.0	150.3	150.4	0.1
Daytime Cargo	134.5	136.6	134	133.6	134.9	134.4	133.8	(0.6)
Nighttime Cargo	144.7	146.3	144.5	144.8	144.0	143.7	143.4	(0.3)
Daytime Passenger Stage	N/A	N/A	104.9	101.4	N/A	N/A	N/A	N/A
Daytime Passenger Stage	146.6	146.5	146.8	146.8	146.9	147	146.8	(0.2)
Nighttime Passenger	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nighttime Passenger	149	148.5	149.4	149.6	150.0	150.3	150.4	0.1
Daytime Cargo Stage 2	103.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Daytime Cargo Stage 3	134.4	136.6	134	133.6	134.9	134.4	133.8	(0.6)
Nighttime Cargo Stage 2	113.1	110.8	N/A	110.8	N/A	N/A	N/A	N/A
Nighttime Cargo Stage 3	144.7	146.3	144.5	144.8	144.0	143.7	143.4	(0.3)

Source: HMMH, 2017.
Notes: GA and non-jet aircraft are not included in the calculation.
N/A = Not available.
1 The 2014 CNI analysis contained errors which appeared in the *2014 EDR* and *2015 EDR*. The analysis has been corrected and the numbers presented in this table are correct.

Flight Track Monitoring Report

As part of its ongoing commitment to mitigate noise at Logan Airport, Massport has undertaken evaluating the flight tracks of turbojet aircraft engaged in the implementation of established FAA noise abatement procedures. As is true for any airport operator, however, Massport has no authority to control where individual aircraft fly. That remains the responsibility of FAA, while the individual pilots are responsible for safely executing FAA's instructions. The flight procedures, which are used by the Air Traffic Control (ATC) staff at Boston Tower to achieve desired noise abatement tracks, are contained in FAA's Tower Order (BOS TWR 7040.1).

This is the fifteenth annual report for flight track monitoring. Prior to 2002, Massport had issued semi-annual reports, an outgrowth of the Flight Track Monitoring Program study. That study was contained in the *Generic Environmental Impact Report* filed with Massachusetts Environmental Policy Act (MEPA) in July 1996, and was the subject of two Community Working Group workshops in September and October 1996. The fourteenth annual report was published in Appendix H, *Noise Abatement* in the *2015 EDR*. The information for 2015 is repeated in this report for reference. The period covered by this *2016 EDR* is January 1, 2016 through December 31, 2016.

The purpose of the ongoing monitoring program is to identify any systematic changes in flight tracks that may occur and to reduce flight track dispersion, where appropriate. The next report will cover the period January 1, 2017 through December 31, 2017, and will be included in the *2017 ESPR*.

FAA Air Traffic Control (ATC) Procedures

FAA Tower Order BOS TWR 7040.1 entitled "Noise Abatement" describes the series of noise abatement policies, rules, regulations, and the procedures to be followed by FAA air traffic controllers in meeting their designated responsibilities to be "a good neighbor, while meeting our operational objectives/ responsibilities to the National Airspace System." Section 7.a.3 of the Order, subtitled "Turbojet Departure Noise Abatement Procedures," states that all turbojet departures shall be issued the Standard Instrument Departure (SID) procedure appropriate for the departure runway. They are paraphrased from the LOGAN NINE SID[17] below.

Note in the descriptions that follow that terms such as "BOS 2 DME" are used frequently. Here, BOS refers to an aid to navigation known as the BOSTON VORTAC, a radio beacon physically located on Logan Airport near the eastern shoreline between the ends of Runways 27 and 33L (see **Figure H-14**). DME refers to "Distance Measuring Equipment," a co-located aid to navigation that provides pilots with a cockpit display of the number of nautical miles that the aircraft is from the designated radio beacon. Thus, BOS 2 DME means an aircraft should be two nautical miles away from the BOS. The term "vectored" means the pilot is assigned to fly a magnetic heading given by and at the discretion of FAA air traffic controller to maintain the safe separation of aircraft. "MSL" is defined as feet above mean sea level and is the indicator of aircraft altitude used both by the pilot in the cockpit and the air traffic controller on the ground.

During 2010, several of the conventional-only (or radar vector) and RNAV procedures from the Boston Logan Airport Noise Study Categorical Exclusion (CATEX)[18] were implemented. There are eight new RNAV procedures for departures from Logan Airport. These eight procedures are used by aircraft departing Runways 4R, 9, 15R, 22L, 22R, 27, and 33L (Runways 27 and 33L were added in 2014). These procedures primarily affected departures flying over the North and South shores and were designed to increase the amount of jet traffic crossing back over land above 6,000 feet to minimize noise impacts to communities.

17 Accessed 04/07/2016

18 Federal Aviation Administration (FAA) Boston Logan Airport Noise Study Categorical Exclusion Record of Decision (CATEX ROD), Issued October 16, 2007

A ninth RNAV procedure, which is used by Runway 27, has been in use at the Airport and has been modified several times. For departures, the conventional procedures (flown by non-RNAV equipped aircraft) from the LOGAN NINE SID are:

- For Runway 4R, climb heading 036 degrees to BOS 4 DME, then turn right to a heading of 090 degrees, and then expect radar vectors to assigned route/navaid/fix. Aircraft that are initially vectored over water can expect to cross the coastline above 6,000 MSL before proceeding on course.
- For Runway 9, climb heading 093 degrees, and then expect radar vectors to assigned route/navaid/fix. Aircraft that are initially vectored over water can expect to cross the coastline above 6,000 MSL before proceeding on course.
- For Runway 14, climb heading 142 degrees to BOS 1 DME, then turn left to heading 120 degrees, then expect radar vectors to assigned route/navaid/fix. Aircraft that are initially vectored over water can expect to cross the coastline above 6,000 MSL before proceeding on course.
- For Runway 15R, climb heading 151 degrees to BOS 1 DME then turn left to 120 degrees, then expect radar vectors to assigned route/navaid/fix. Aircraft that are initially vectored over water can expect to cross the coastline above 6,000 MSL before proceeding on course.
- For Runways 22R and 22L, climbing left turn to a heading of 140 degrees, then expect radar vectors to assigned route/navaid/fix. Aircraft that are initially vectored over water can expect to cross the coastline above 6,000 MSL before proceeding on course.
- For Runway 33L, climb heading 331 degrees to BOS 2 DME then turn left to 316 degrees, then expect radar vectors to assigned route/navaid/fix.
- For Runway 27, climb heading 273 to BOS 2.2 DME, then turn left heading 235 degrees, then expect radar vectors to assigned route/navaid/fix.

The RNAV procedures (used only by Turbojets)[19] and the runways they serve:

- BLZZR THREE – Runways 4L, 9, 15R, 22L, 22R, 27, and 33L: This procedure directs most jet traffic in a well-defined flight corridor over the ocean and crossing back over the South Shore near Cohasset and Scituate.
- BRUWN FOUR – Runways 4L, 9, 15R, 22L, 22R, 27, and 33L: This procedure directs most jet traffic in a well-defined flight corridor over the ocean towards Cape Cod.
- CELTK FOUR – Runways 4L, 9, 15R, 22L, 22R, 27, and 33L: This procedure directs most jet traffic in a well-defined flight corridor over the ocean.
- HYLND FOUR – 4L, 9, 15R, 22L, 22R, 27, and 33L: This procedure directs most jet traffic in a well-defined flight corridor over the ocean and crossing back over the North Shore near Beverly.
- LBSTA FOUR – 4L, 9, 15R, 22L, 22R, 27, 33L: This procedure directs most jet traffic in a well-defined flight corridor over the ocean and crossing back over the North Shore near Manchester and Gloucester.
- PATSS FOUR – 4L, 9, 15R, 22L, 22R, 27, 33L: This procedure directs most jet traffic in a well-defined flight corridor over the ocean and crossing back over the South Shore near Cohasset and Scituate.
- REVSS THREE – 4L, 9, 15R, 22L, 22R, 27, 33L: This procedure directs most jet traffic in a well-defined flight corridor over the ocean and crossing back over the South Shore near Cohasset and Scituate.

19 These are the procedures as defined on April 7, 2016. Procedures may be adjusted at points throughout the year.

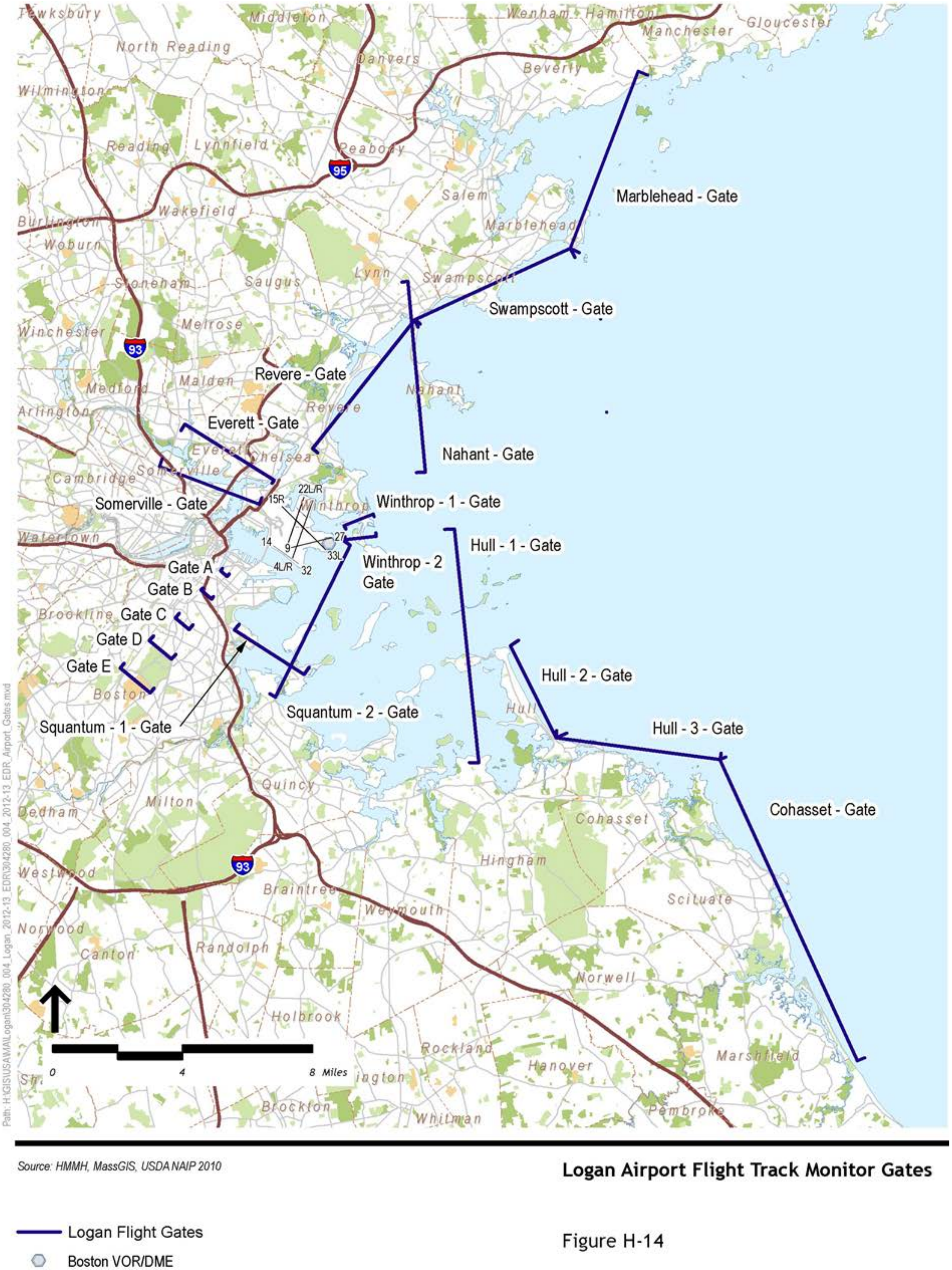
- SSOXS FOUR – 4L, 9, 15R, 22L, 22R, 27, 33L: This procedure directs most jet traffic in a well-defined flight corridor over the ocean and crossing back over the South Shore over Marshfield.
- WYLYY TWO – 27: This procedure directs most jet traffic in a well-defined flight corridor on a heading of 273 degrees then a turn to 235 degrees over South Boston.

These brief procedural statements form the basis of the verbal instructions and flight clearances that are passed from controller to pilot to achieve reduced noise in the communities surrounding Logan Airport while also maintaining the safe and efficient flow of aircraft in and out of the Airport. However, consistency with which these procedures are used varies due to air traffic demands, controller workloads, weather conditions, and other operational factors, as noted in the Flight Track Monitoring Program Study.

Figure H-14 presents the gates used in the analysis for the Flight Track Monitoring Report. These gates are virtual vertical planes, which are used in the analysis to capture the aircraft flight paths. The gates are defined using a geographic coordinate for each end of the gate along with a floor and a ceiling altitude. The gates also capture direction of flights (in or out). The edges of each gate in **Figure H-14** point in the direction that the aircraft is coming from. This information is used to evaluate the performance of the flight procedures off each runway end and is presented below. **Figure H-14** also displays the BOS location, which is used for the distance measurements for the conventional procedures.

The RNAV procedures are still captured by the original flight track monitoring gates. Traffic crossing over the North Shore passes through the Marblehead Gate and traffic passing over the South Shore passes through the Hull 2, Hull 3, and Cohasset Gates. Turbojets departing Runway 27 on the RNAV pass through the Runway 27 gates and the new Runway 33L RNAV flight tracks still pass between the Somerville and Everett gates as expected.

Figure H-14 Logan Airport Flight Track Monitor Gates



Statistical Analyses of Flight Tracks - Runway 4R

The Nahant Gate (**Figure H-14**) monitors aircraft after the first turn at 4 DME. The Swampscott and Marblehead Gates monitor northbound shoreline crossings, while the Hull 2, Hull 3, and Cohasset Gates monitor southbound shoreline crossings.

Tables H-15a and **H-15b** show that Runway 4R departures for 2016 were concentrated, with 99.5 percent "over the Causeway," and about 0.1 percent over the south end of the gate compared to 99.2 percent over the Causeway in 2015 and 0.3 percent over the south end of the gate. Departures through the north end of the gate remained the same at 0.5 percent in 2015 and 2016.

Table H-15a Runway 4R Nahant Gate Summary for 2015

	Number of Tracks Through Gate Segment	Total Number of Tracks Through Gate	Percentage of Tracks Through Gate Segment
North End of Gate	35	6,851	0.5%
Over Causeway	6,797	6,851	99.2%
South End of Gate	19	6,851	0.3%
Total	**6,851**	**6,851**	**100.0%**

Source: Massport, HMMH 2016.

Table H-15b Runway 4R Nahant Gate Summary for 2016

	Number of Tracks Through Gate Segment	Total Number of Tracks Through Gate	Percentage of Tracks Through Gate Segment
North End of Gate	31	6,850	0.5%
Over Causeway	6,814	6,850	99.5%
South End of Gate	5	6,850	0.1%
Total	**6,850**	**6,850**	**100.0%**

Source: Massport, HMMH 2017.

Table H-16a and **H-16b** show how many of the shoreline crossings from Runway 4R were above 6,000 feet. For 2016, 98.3 percent of the flights were above 6,000 feet compared to 97.2 percent in 2015. The Swampscott gate had 97.9 percent of flights above 6,000 feet in 2016 compared to 23.3 percent in 2015. The number of flights through the Swampscott gate increased in 2015 (116 in 2015, up to 234 in 2016). The crossing percentage for this gate is historically lower than most gates due to its proximity to the Nahant gate itself. As seen in **Figure H-14**, the Swampscott gate is adjacent to the Nahant gate and aircraft would have to climb very quickly to be above 6,000 feet when crossing the Swampscott gate.

Table H-16a Runway 4R Shoreline Crossings Above 6,000 Feet for 2015

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Swampscott Gate	116	27	23.3%
Marblehead Gate	2,770	2,735	98.7%
Hull 2 Gate	345	345	100.0%
Hull 3 Gate	1,034	1,033	99.9%
Cohasset Gate	196	196	100.0%
Total	**4,461**	**4,336**	**97.2%**

Source: Massport, HMMH 2016.

Table H-16b Runway 4R Shoreline Crossings Above 6,000 Feet for 2016

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Swampscott Gate	234	229	97.9%
Marblehead Gate	2,532	2,531	100.0%
Hull 2 Gate	82	18	22.0%
Hull 3 Gate	386	354	91.7%
Cohasset Gate	3032	3030	99.9%
Total	**6,266**	**6,162**	**98.3%**

Source: Massport, HMMH 2017.

Statistical Analyses of Flight Tracks - Runway 9

The Winthrop 1 and Winthrop 2 gates (**Figure H-14**) monitor early turns for departures off Runway 9. The Revere, Swampscott, or Marblehead gates monitor northbound shoreline crossings, while the Hull 2, Hull 3, or Cohasset gates monitor southbound shoreline crossings.

Tables H-17a and **H-17b** show how many tracks turned prior to the BOS 2 DME. Northbound turns before BOS 2 DME pass through the Winthrop 1 Gate. Southbound traffic would pass through the Winthrop 2 Gate. In 2016, between both gates there were a total of 52 such turns, 0.1 percent. In 2015, 44 tracks or 0.1 percent of the total also crossed these gates.

Table H-17a Runway 9 Gate Summary — Winthrop Gates 1 and 2 for 2015

	Number of Departure Tracks	Number of Tracks Through Gate	Percent Turning Before BOS 2 DME
Winthrop 1 Gate	45,371	20	<0.1%
Winthrop 2 Gate	45,371	24	0.1%
Total	**45,371**	**44**	**0.1%**

Source: Massport, HMMH 2016.

Table H-17b Runway 9 Gate Summary — Winthrop Gates 1 and 2 for 2016

	Number of Departure Tracks	Number of Tracks Through Gate	Percent Turning Before BOS 2 DME
Winthrop 1 Gate	55,882	18	<0.1%
Winthrop 2 Gate	55,882	34	0.1%
Total	**45,371**	**52**	**0.1%**

Source: Massport, HMMH 2017.

Table H-18a and **H-18b** indicate that 99.4 percent of Runway 9 departures were above 6,000 feet when crossing the shoreline in 2016, compared with 99.3 percent in 2015. The number of Runway 9 departures crossing back over the South Shore increased from 33,807 in 2015 to 36,811 in 2016.

A decrease in the percentage above 6,000 feet occurred at the Revere gate (60.6 percent in 2015 to 36.5 percent in 2016) and a slight increase at the Hull 2 gate (99.4 percent in 2015 to 99.5 percent in 2016).

The number of crossings decreased for the Revere gate (66 in 2015 to 63 in 2016) and increased at the Swampscott gate (435 in 2015 to 537 in 2016). The Marblehead gate had an increase in crossings (from 11,333 in 2015 to 12,489 in 2016), and an increase in the percent above 6,000 feet (from 99.7 percent in 2015 to 99.9 percent in 2016). Both the Hull 2 and Hull 3 gates had an increase in crossings compared to 2015. Hull 2 increased from 2,120 in 2015 to 2,379 in 2016, and Hull 3 increased from 4,834 in 2015 to 6,052 in 2016. The Hull 2 crossing percentage increased slightly from 99.4 percent in 2015 to 99.5 percent in 2016, and the Hull 3 gate crossings increased from 98.1 percent to 98.7 percent. The crossings through the Cohasset gate increased (from 15,019 in 2015 to 15,497 in 2016) and the percent above 6,000 feet increased slightly from 99.8 percent in 2015 to 99.9 percent in 2016.

Table H-18a Runway 9 Shoreline Crossings Above 6,000 Feet for 2015

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Revere Gate	66	40	60.6%
Swampscott Gate	435	398	91.5%
Marblehead Gate	11,333	11,298	99.7%
Hull 2 Gate	2,120	2,108	99.4%
Hull 3 Gate	4,834	4,742	98.1%
Cohasset Gate	15,019	14,993	99.8%
Total	**33,807**	**33,579**	**99.3%**

Source: Massport, HMMH 2016

Table H-18b Runway 9 Shoreline Crossings Above 6,000 Feet for 2016

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Revere Gate	63	23	36.5%
Swampscott Gate	537	495	92.2%
Marblehead Gate	12,489	12,471	99.9%
Hull 2 Gate	2,379	2,367	99.5%
Hull 3 Gate	6,052	5,971	98.7%
Cohasset Gate	15,497	15,484	99.9%
Total	**37,017**	**36,811**	**99.4%**

Source: Massport, HMMH 2017.

Statistical Analyses of Flight Tracks - Runway 15R

After takeoff, Runway 15R departures turn left approximately 30 degrees to avoid Hull, head out over Boston Harbor, and return over the shore through the Swampscott and Marblehead Gates (**Figure H-14**) to the north, or through the Hull 2, Hull 3, and Cohasset Gates to the south. **Tables H-19a** and **H-19b** indicate that 98.3 percent of Runway 15R departures were above 6,000 feet when crossing the shoreline in 2016, compared with 99.4 percent in 2015. While compliance at the Swampscott, Marblehead, and Cohassett gates remained at 98 percent or better for both 2015 and 2016, the proportion of flights over 6,000 feet at the Hull 2 gate fell from 94.3 percent in 2015 to 91.7 percent in 2016, and only 22 percent of flights crossed the Hull 1 gate over 6,000 feet in 26, compared to perfect compliance for 2015.

Table H-19a Runway 15R Shoreline Crossings Above 6,000 Feet for 2015

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Swampscott Gate	179	176	98.3%
Marblehead Gate	2,025	2,025	100.0%
Hull 2 Gate	14	14	100.0%
Hull 3 Gate	282	266	94.3%
Cohasset Gate	2,554	2,544	99.6%
Total	**5,054**	**5,025**	**99.4%**

Source: Massport, HMMH 2016.

Table H-19b Runway 15R Shoreline Crossings Above 6,000 Feet for 2016

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Swampscott Gate	234	229	97.9%
Marblehead Gate	2,532	2,531	100.0%
Hull 2 Gate	82	18	22.0%
Hull 3 Gate	386	354	91.7%
Cohasset Gate	3,032	3,030	99.9%
Total	**6,266**	**6,162**	**98.3%**

Source: Massport, HMMH 2017.

Statistical Analyses of Flight Tracks - Runways 22R and 22L

The Squantum 2 and Hull 1 Gates (**Figure H-14**) are used to monitor the turn to 140 degrees over Boston Harbor and north of Hull. The shoreline gates are used to monitor shoreline crossings, as for Runways 4R, 9, and 15R above. **Tables H-20a** and **H-20b** show the dispersion of the jet departures from Runways 22R and 22L as they pass through the Squantum 2 Gate. The first segment of the gate is the northernmost segment and is primarily over Boston Harbor. The other segments extend southward toward Quincy. The percentage of tracks passing through the first two segments of this gate decreased from 89.2 percent in 2015 to 88.8 percent in 2016.

Table H-20a Runways 22R and 22L Squantum 2 Gate Summary for 2015

	Number of Tracks Through Gate Segment	Total Number of Tracks Through All Gate Segments	Percentage of Tracks Through Gate Segment
0 - 12,000 ft	3,183	53,958	5.9%
12,000 - 14,000 ft	44,923	53,958	83.3%
14,000 - 21,000 ft	5,806	53,958	10.8%
21,000 - 27,000 ft	46	53,958	0.1%
Total	**53,958**	**53,958**	**100.0%**

Source: Massport, HMMH 2016.
Note: Percentages sum to more than 100 percent due to rounding.

Table H-20b Runways 22R and 22L Squantum 2 Gate Summary for 2016

	Number of Tracks Through Gate Segment	Total Number of Tracks Through All Gate Segments	Percentage of Tracks Through Gate Segment
0 - 12,000 ft	870	47,371	1.8%
12,000 - 14,000 ft	41,218	47,371	87.0%
14,000 - 21,000 ft	5,247	47,371	11.1%
21,000 - 27,000 ft	36	47,371	0.1%
Total	**47,371**	**47,371**	**100.0%**

Source: Massport, HMMH 2017.
Note: Percentages sum to more than 100 percent due to rounding.

Tables H-21a and **H-21b** show that the percent of tracks crossing north of the Hull peninsula as they passed through the Hull 1 Gate was 98.8 percent in 2015 and 98.7 percent in 2016.

Table H-21a Runways 15R, 22R, and 22L Hull 1 Gate Summary – North of Hull Peninsula for 2015

	Number of Tracks Through Gate Segment	Total Number of Tracks Through Gate	Percentage of Tracks Through Gate Segment
North of Hull Peninsula	61,537	62,259	98.8%
Over Hull	722	62,259	1.2%
Total	**62,259**	**62,259**	**100.0%**

Source: Massport, HMMH 2016

Table H-21b Runways 15R, 22R, and 22L Hull 1 Gate Summary – North of Hull Peninsula for 2016

	Number of Tracks Through Gate Segment	Total Number of Tracks Through Gate	Percentage of Tracks Through Gate Segment
North of Hull Peninsula	57,059	57,834	98.7%
Over Hull	775	57,834	1.3%
Total	**57,834**	**57,834**	**100.0%**

Source: Massport, HMMH 2017.

Tables H-22a and **H-22b** indicate that 99.0 percent of Runway 22R/22L departures were above 6,000 feet when crossing the shoreline in 2016, compared with 99.7 percent in 2015. Compliance was above 97.0 percent for the Swampscott, Marblehead, Hull 3, and Cohasset gates for both years. While 87.5 percent of flights through the Hull 2 gate were above the altitude threshold in 2015, this fell to 40.9 percent in 2016.

Table H-22a Runways 22R and 22L Shoreline Crossings Above 6,000 Feet for 2015

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Revere Gate	127	124	97.6%
Swampscott Gate	1114	1114	100.0%
Marblehead Gate	13,932	13,929	100.0%
Hull 2 Gate	32	28	87.5%
Hull 3 Gate	2,119	2057	97.1%
Cohasset Gate	20,704	20,651	99.7%
Total	**38,028**	**37,903**	**99.7%**

Source: Massport, HMMH 2016.

Table H-22b Runways 22R and 22L Shoreline Crossings Above 6,000 Feet for 2016

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Revere Gate	106	95	89.6%
Swampscott Gate	951	951	100.0%
Marblehead Gate	12,250	12,245	100.0%
Hull 2 Gate	452	185	40.9%
Hull 3 Gate	2,082	2035	97.7%
Cohasset Gate	18,017	18,006	99.9%
Total	**33,858**	**33,517**	**99.0%**

Source: Massport, HMMH 2017.

Runway 27

On September 15, 1996, FAA implemented a new departure procedure for Runway 27 called the WYLYY RNAV procedure. In accordance with the provisions of the ROD issued for the Runway 27 Environmental Impact Statement, Massport has been providing on-going radar flight track data and analysis to FAA with respect to the procedure.

In 2012, for the first time since 1997 when flight track monitoring began, each gate (Gates A through E) averaged over 68 percent for every month the Airport had all runways open and for the annual average. The percent of flight tracks through all gates (a number tracked but not required per the 1996 ROD) rounded up to 68 percent for the last two months of 2011 and continued for all of 2012. FAA had discussed these data internally and concluded that acceptable flight track dispersion had been achieved and that no subsequent action by FAA is required per the 1996 ROD requirements.[20]

Massport will continue to provide **Tables H-23a** and **H-23b** in the subsequent annual reports. **Table H-23a** presents the conformance results for the Runway 27 corridor for 2015 and **Table H-23b** for 2016. The average percentage of tracks through the corridor was 83.7 percent for 2015 and 80.6 percent for 2016.

Each gate is further from the runway and falls along the procedure. The gates also increase in width as the distance is increased along the flight path and they form a noise abatement corridor. A consistent percentage of traffic through each gate means that flights are not entering the corridor late or exiting the corridor too early. The average percent through each gate was 95.1 percent in 2015 and 95.0 percent for 2016.

Table H-23a Runway 27 Corridor Percent of Tracks Through Each Gate for 2015

Month	Total # of Tracks	Total # of Tracks Through All Gates	Percent of Tracks Through All Gates	Gate A	Gate B	Gate C	Gate D	Gate E	Average Percent Through Each Gate
				1,400[1]	2,200[1]	2,900[1]	4,700[1]	6,300[1]	
January	2,586	2,118	81.9%	2,212	2,435	2,524	2,560	2,538	94.9%
February	3,142	2604	82.9%	2,725	2,944	3,059	3,111	3,076	94.9%
March	2,706	2,207	81.6%	2,314	2,547	2,633	2,675	2,642	94.7%
April	1,245	1,059	85.1%	1,100	1,189	1,222	1,235	1,224	95.9%
May	685	539	78.7%	581	647	649	657	640	92.7%
June	772	642	83.2%	681	727	747	760	753	95.0%
July	1005	837	83.3%	868	954	975	995	989	95.1%
August	996	861	86.4%	891	940	968	984	980	95.6%
September	855	721	84.3%	742	809	834	846	840	95.2%
October	1,821	1569	86.2%	1,604	1,736	1,794	1,806	1,793	95.9%
November	1,868	1,612	86.3%	1,650	1,789	1,826	1,848	1,831	95.8%
December	1,634	1,379	84.4%	1,410	1,563	1,603	1,611	1,592	95.2%
Average	**1,610**	**1,346**	**83.7%**	**1,398**	**1,523**	**1,570**	**1,591**	**1,575**	**95.1%**

Source: Massport, HMMH 2016.
Notes: Gray shading indicates the percentage rounds up to 68 percent or greater.
1 Width of each gate in feet.

20 Logan Airport Runway 27 Advisory Committee Meeting - January 23, 2012 meeting minutes

Table H-23b Runway 27 Corridor Percent of Tracks Through Each Gate for 2016

Month	Total # of Tracks	Total # of Tracks Through All Gates	Percent of Tracks Through All Gates	Gate A	Gate B	Gate C	Gate D	Gate E	Average Percent Through Each Gate
				1,400[1]	2,200[1]	2,900[1]	4,700[1]	6,300[1]	
January	2,345	1,790	76.3%	1,849	2,256	2,297	2,313	2,299	93.9%
February	1,968	1560	79.3%	1,618	1,908	1,930	1,950	1,930	94.9%
March	1,895	1,509	79.6%	1,569	1,821	1,851	1,856	1,857	94.5%
April	1,148	936	81.5%	972	1,115	1,130	1,127	1,106	94.9%
May	988	809	81.9%	828	944	959	968	969	94.5%
June	1358	1048	77.2%	1,085	1,311	1,332	1,370	1,378	95.4%
July	1823	1510	82.8%	1,565	1,746	1,782	1,795	1,793	95.2%
August	837	703	84.0%	721	810	825	829	840	96.2%
September	737	614	83.3%	630	708	720	733	742	95.9%
October	2,285	1808	79.1%	1,860	2,204	2,239	2,246	2,252	94.5%
November	2,703	2,169	80.2%	2,226	2,609	2,645	2,674	2,670	94.9%
December	2,926	2,380	81.3%	2,448	2,808	2,862	2,897	2,886	95.0%
Average	**1,751**	**1,403**	**80.6%**	**1,448**	**1,687**	**1,714**	**1,730**	**1,727**	**95.0%**

Source: Massport, HMMH 2017.
Notes: Gray shading indicates the percentage rounds up to 68 percent or greater.
1 Width of each gate in feet.

Statistical Analyses of Flight Tracks — Runway 33L

The Somerville and Everett Gates (**Figure H-14**) extend from BOS 2 DME to BOS 5 DME and are used to monitor the departure procedure for Runway 33L. Turns to the left prior to the BOS 5 DME would pass through the Somerville Gate. Turns to the right prior to the BOS 5 DME would pass through the Everett Gate.

Tables H-24a and **H-24b** indicate the percentage of tracks turning before BOS 5 DME decreases from 1.7 percent in 2015 to 1.5 percent in 2016. The total number of tracks increased from 24,203 in 2015 to 29,854 in 2016.

Table H-24a Runway 33L Gates — Passages Below 3,000 Feet for 2015

	Number of Departure Tracks	Number of Tracks Turning Before BOS 5 DME	Percentage of Tracks Turning Before BOS 5 DME
Everett Gate	24,203	205	0.8%
Somerville Gate	24,203	197	0.8%
Total	**24,203**	**402**	**1.7%**

Source: Massport, HMMH 2016.

Table H-24b Runway 33L Gates — Passages Below 3,000 Feet for 2016

	Number of Departure Tracks	Number of Tracks Turning Before BOS 5 DME	Percentage of Tracks Turning Before BOS 5 DME
Everett Gate	29,854	222	0.7%
Somerville Gate	29,854	230	0.8%
Total	**29,854**	**452**	**1.5%**

Source: Massport, HMMH 2017.

Table H-25 provides the level of traffic off each runway end in 2015 and 2016. These percentages represent the amount of activity experienced off each runway end for a given year.

Table H-25 Runway Usage by Runway End

		2015		2016	
By Runway End	**Operations(s)**	**Total Flights**	**% of Total**	**Total Flights**	**% of Total**
04L	R4L A + R22R D	74,695	20.0%	64,921	16.6%
04R	R4R A + R22L D	52,664	14.1%	60,630	15.5%
09	R9 A + R27 D	20,892	5.6%	22,719	5.8%
14	N/A	0	0.0%	15	0.0%
15L	R15L A + R33R D	123	0.0%	78	0.0%
15R	R15R A + R33L D	31,388	8.4%	36,667	9.4%
22L	R22L A + R4R D	55,164	14.8%	56,495	14.5%
22R	R22R A + R4L D	6,312	1.7%	6,132	1.6%
27	R27 A + R9 D	88,683	23.8%	95,522	24.5%
32	R32 A + R14 D	4,066	1.1%	5,760	1.5%
33L	R33L A + R15R D	37,667	10.1%	39,619	10.1%
33R	R33R A + R15L D	1,275	0.3%	1,782	0.5%
All		**372,930**	**100.0%**	**390,339**	**100.0%**

Notes: A=Arrivals
1 D=Departures

2016 DNL Levels for Census Block Group Locations

Table H-26 reports the DNL value for each Census block group down to the DNL 50 dB computed with AEDT.

Table H-26 2016 DNL Levels for Census Block Group Locations within the DNL 50 dB

U.S. Census 2010 Block Group					
Block Group ID	**Name**	**Population**	**Housing units**	**Average Block DNL**	**DNL at centroid**
250250203021	Back Bay	1,181	721	50.5	50.5
250250202001	Back Bay	1,266	897	49.9	49.9
250250703001	Back Bay	1,065	804	51.4	51.5
250173521012	Cambridge	1,473	1,187	48.7	48.8
250250408012	Charlestown	828	263	55.4	55.6
250250408013	Charlestown	2,011	1,296	53.5	53.5
250250402001	Charlestown	775	304	53.4	53.3
250250408011	Charlestown	1,061	530	52.7	52.7
250250402002	Charlestown	831	423	52.1	52.1
250250403001	Charlestown	739	334	52.2	52.3
250250403004	Charlestown	617	320	51.8	51.8
250250403003	Charlestown	657	366	51.4	51.3
250250401001	Charlestown	958	555	51.0	51.2
250250403002	Charlestown	1,247	662	51.1	51.3
250250406001	Charlestown	863	491	51.5	50.9
250250406002	Charlestown	1,581	843	51.2	51.2
250250401002	Charlestown	1,210	684	50.6	50.6
250250403005	Charlestown	622	355	50.7	50.8
250250404011	Charlestown	1,689	766	50.1	50.2
250250404012	Charlestown	750	456	49.7	49.9
250251602003	Chelsea	1,497	494	64.0	63.8
250251601015	Chelsea	1,025	261	64.2	64.1
250251602002	Chelsea	1,210	374	62.9	62.9
250251601013	Chelsea	1,730	568	62.2	62.2
250251601011	Chelsea	1,332	353	61.9	62.0
250251603002	Chelsea	596	366	61.5	63.4
250251604002	Chelsea	1,783	683	61.2	61.3
250251602001	Chelsea	1,336	357	61.2	61.0
250251603001	Chelsea	1,469	913	60.5	61.0
250251604001	Chelsea	933	345	59.9	59.6
250251601012	Chelsea	1,372	438	59.5	59.4
250251605022	Chelsea	1,359	477	54.3	54.0

Table H-26 2016 DNL Levels for Census Block Group Locations within the DNL 50 dB (Continued)

U.S. Census 2010 Block Group					
Block Group ID	**Name**	**Population**	**Housing units**	**Average Block DNL**	**DNL at centroid**
250251601014	Chelsea	2,092	539	58.2	58.3
250251605021	Chelsea	1,703	624	55.2	54.1
250251605013	Chelsea	774	233	56.8	56.8
250251605023	Chelsea	1,398	488	54.8	54.9
250251605012	Chelsea	1,231	396	55.5	55.3
250251605014	Chelsea	754	392	55.6	55.7
250251605015	Chelsea	748	304	54.5	54.4
250251605011	Chelsea	2,097	646	54.7	54.9
250251606011	Chelsea	2,158	1,005	51.5	51.7
250251606012	Chelsea	1,905	565	53.0	52.9
250251606024	Chelsea	780	271	50.1	50.4
250251606025	Chelsea	985	409	50.8	50.9
250251606021	Chelsea	1,290	470	52.1	52.3
250251606022	Chelsea	795	304	49.9	50.0
250251606023	Chelsea	825	346	48.7	48.6
250251006032	Dorchester	598	284	59.3	58.2
250251007002	Dorchester	1,027	527	58.1	57.6
250251006031	Dorchester	1,306	556	56.2	55.9
250251007003	Dorchester	672	290	56.1	56.2
250250907004	Dorchester	651	302	55.2	55.3
250250909012	Dorchester	2,103	1,034	55.2	53.6
250250913002	Dorchester	1,131	388	54.4	54.3
250251007001	Dorchester	1,050	484	54.3	54.4
250250913001	Dorchester	1,368	480	53.3	53.2
250250907002	Dorchester	1,253	644	53.4	53.4
250250914001	Dorchester	1,672	584	52.6	52.4
250251008004	Dorchester	1,117	666	53.1	51.8
250251007004	Dorchester	856	371	53.0	52.9
250250907003	Dorchester	1,153	526	52.5	52.4
250250912003	Dorchester	742	296	52.1	52.2
250250921013	Dorchester	729	321	52.0	51.3
250251006011	Dorchester	1,094	488	52.2	52.2
250251007005	Dorchester	717	303	52.2	52.3
250250912001	Dorchester	1,081	451	52.2	52.2
250250907001	Dorchester	1,218	518	52.3	52.3
250250921011	Dorchester	1,113	467	51.1	50.9

Table H-26 2016 DNL Levels for Census Block Group Locations within the DNL 50 dB (Continued)

U.S. Census 2010 Block Group					
Block Group ID	**Name**	**Population**	**Housing units**	**Average Block DNL**	**DNL at centroid**
250250910013	Dorchester	682	335	51.0	50.6
250250912002	Dorchester	1,411	492	51.1	51.1
250250915002	Dorchester	1,494	547	50.8	50.7
250250911005	Dorchester	817	297	51.2	51.3
250250909011	Dorchester	1,627	606	51.6	51.9
250250915001	Dorchester	1,978	744	50.7	50.9
250251006012	Dorchester	898	382	50.5	50.7
250251008003	Dorchester	899	412	50.4	50.4
250250918003	Dorchester	933	357	50.5	50.4
250250918001	Dorchester	1,517	517	50.6	50.6
250250919001	Dorchester	1,042	329	50.2	50.2
250250918002	Dorchester	1,002	340	50.4	50.6
250250911001	Dorchester	1,395	625	51.0	51.1
250250203031	Downtown Boston	878	693	49.9	49.9
250250203033	Downtown Boston	1,179	789	49.6	49.6
250250701011	Downtown Boston	850	529	56.9	56.1
250250702002	Downtown Boston	1,133	444	54.9	54.8
250250303001	Downtown Boston	1,757	1,283	53.9	54.1
250250305001	Downtown Boston	704	442	52.8	52.8
250250305002	Downtown Boston	1,025	687	52.8	52.8
250250305003	Downtown Boston	809	527	52.5	52.5
250250701018	Downtown Boston	449	246	54.4	54.5
250250702001	Downtown Boston	1,460	599	54.4	54.4
250250304001	Downtown Boston	1,519	994	52.3	52.5
250250303002	Downtown Boston	1,262	709	53.0	53.1
250250301001	Downtown Boston	1,053	790	51.8	51.8
250250304002	Downtown Boston	932	665	52.2	52.2
250250701017	Downtown Boston	1,102	701	53.9	54.2
250250301002	Downtown Boston	901	587	51.4	51.4
250250302001	Downtown Boston	1,665	1,103	51.5	51.6
250250303004	Downtown Boston	548	465	52.8	52.9
250250701012	Downtown Boston	303	90	53.0	53.0
250250702003	Downtown Boston	2,625	647	53.0	53.3
250250303003	Downtown Boston	1,305	503	51.5	51.7
250250701016	Downtown Boston	366	325	52.9	52.8
250250701015	Downtown Boston	451	161	52.6	52.6

Table H-26 2016 DNL Levels for Census Block Group Locations within the DNL 50 dB (Continued)

U.S. Census 2010 Block Group					
Block Group ID	**Name**	**Population**	**Housing units**	**Average Block DNL**	**DNL at centroid**
250250701013	Downtown Boston	494	390	52.0	52.1
250250203032	Downtown Boston	1,343	365	50.1	50.3
250250701014	Downtown Boston	1,887	941	52.3	52.2
250250703002	Downtown Boston	733	449	52.4	52.4
250250203012	Downtown Boston	1,673	1,209	49.4	49.2
250250203011	Downtown Boston	350	205	49.2	49.2
250250509011	Eagle Hill East Boston	1,283	420	68.0	67.2
250250509013	Eagle Hill East Boston	918	309	65.9	65.1
250250509012	Eagle Hill East Boston	1,964	717	65.7	65.7
250250507003	Eagle Hill East Boston	1,476	505	62.9	63.4
250250502004	Eagle Hill East Boston	1,055	349	64.0	64.1
250250502003	Eagle Hill East Boston	836	283	63.9	63.9
250250507002	Eagle Hill East Boston	1,344	484	61.6	61.8
250250501011	Eagle Hill East Boston	1,713	534	63.1	62.6
250250507001	Eagle Hill East Boston	1,684	617	59.8	59.5
250250501013	Eagle Hill East Boston	1,930	684	62.0	61.9
250250502001	Eagle Hill East Boston	2,189	757	60.4	60.4
250250502002	Eagle Hill East Boston	1,151	445	59.5	58.9
250250501012	Eagle Hill East Boston	1,472	632	60.2	60.4
250173424004	Everett	1,348	517	58.7	57.5
250173424002	Everett	1,132	480	57.0	57.3
250173424003	Everett	905	346	55.9	57.3
250173424001	Everett	1,878	847	55.8	55.8
250173425003	Everett	2,200	970	55.4	55.6
250173423003	Everett	2,137	858	53.8	53.8
250173426002	Everett	904	347	54.1	54.1
250173423004	Everett	1,807	805	52.7	52.5
250173424005	Everett	792	363	53.0	53.1
250173426003	Everett	2,336	941	53.0	53.1
250173425002	Everett	2,169	870	52.8	53.0
250173426001	Everett	1,125	395	52.1	52.1
250173423002	Everett	1,555	596	52.1	52.2
250173421014	Everett	943	362	49.7	49.8
250173423001	Everett	1,327	495	51.1	51.3
250235001012	Hull	819	452	51.5	52.4
250235001011	Hull	1,502	836	50.6	54.7

Table H-26 2016 DNL Levels for Census Block Group Locations within the DNL 50 dB (Continued)

U.S. Census 2010 Block Group					
Block Group ID	**Name**	**Population**	**Housing units**	**Average Block DNL**	**DNL at centroid**
250251202013	Jamaica Plain	451	221	51.8	51.7
250251202012	Jamaica Plain	1,841	894	51.9	51.8
250251202011	Jamaica Plain	1,147	611	50.8	50.9
250251204002	Jamaica Plain	676	363	50.5	50.6
250251201041	Jamaica Plain	516	252	50.1	49.6
250250512002	Jefferies Point	1,548	692	59.4	59.6
250250512001	Jefferies Point	32	19	59.4	58.3
250250512003	Jefferies Point	799	449	58.7	58.5
250092072001	Lynn	1,212	391	58.2	56.0
250092070002	Lynn	1,235	456	56.7	56.4
250092072002	Lynn	1,727	789	56.7	56.5
250092071002	Lynn	992	307	56.7	56.5
250092061002	Lynn	2,051	665	56.4	56.3
250092055002	Lynn	2,552	961	55.9	55.8
250092060001	Lynn	1,443	478	55.8	55.7
250092071001	Lynn	1,446	444	55.7	55.3
250092062002	Lynn	2,267	786	55.5	55.0
250092061001	Lynn	1,793	797	55.3	54.8
250092052004	Lynn	1,435	511	55.1	55.0
250092060002	Lynn	1,916	642	54.8	54.5
250092052002	Lynn	714	277	54.6	54.4
250092052005	Lynn	854	385	54.7	52.5
250092051005	Lynn	637	264	54.3	54.1
250092071003	Lynn	1,075	342	54.4	54.3
250092052003	Lynn	1,510	564	53.9	54.0
250092051004	Lynn	1,527	556	53.7	53.2
250092052001	Lynn	806	410	53.6	52.7
250092062003	Lynn	1,859	573	53.3	53.6
250092062001	Lynn	1,128	327	53.3	53.2
250092051003	Lynn	919	361	53.1	53.0
250092070001	Lynn	963	585	52.7	53.6
250092058002	Lynn	1,089	342	52.4	52.3
250092063004	Lynn	1,040	367	52.4	52.3
250092058001	Lynn	1,044	362	52.1	52.0
250092059001	Lynn	1,743	598	52.2	52.1
250092068002	Lynn	1,792	915	51.7	51.7

Table H-26 2016 DNL Levels for Census Block Group Locations within the DNL 50 dB (Continued)

U.S. Census 2010 Block Group					
Block Group ID	**Name**	**Population**	**Housing units**	**Average Block DNL**	**DNL at centroid**
250092063001	Lynn	712	250	51.4	51.3
250092055001	Lynn	2,054	736	51.3	51.6
250092059002	Lynn	1,262	443	51.2	51.3
250092051002	Lynn	1,077	413	51.1	51.0
250092051001	Lynn	1,192	534	51.1	50.6
250092058003	Lynn	1,179	435	50.7	50.6
250092063003	Lynn	1,030	379	50.3	50.4
250173412003	Malden	1,070	451	53.1	52.8
250173412004	Malden	978	383	52.8	52.7
250173414005	Malden	769	389	52.1	52.1
250173412005	Malden	1,693	713	51.4	51.3
250173412006	Malden	976	362	50.4	50.7
250173412002	Malden	976	386	50.5	50.4
250259811004	Mattapan	400	128	50.9	50.6
250250924004	Mattapan	1,142	413	50.9	50.8
250251001001	Mattapan	167	61	50.4	50.2
250173398012	Medford	617	263	56.3	56.3
250173398011	Medford	2,101	1,369	56.3	56.6
250173398021	Medford	1,308	586	55.9	55.7
250173398013	Medford	808	375	56.2	56.2
250173397001	Medford	552	280	54.4	54.1
250173398022	Medford	2,498	1,096	54.5	54.9
250173398014	Medford	884	363	55.3	55.4
250173397003	Medford	785	357	53.8	53.8
250173397002	Medford	1,678	670	53.9	53.7
250173398023	Medford	751	294	53.8	53.7
250173396002	Medford	813	371	53.1	53.1
250173396003	Medford	757	369	53.0	52.9
250173399001	Medford	1,651	719	54.0	53.9
250173396004	Medford	827	363	53.1	53.0
250173396001	Medford	797	392	52.8	52.9
250173397004	Medford	863	377	53.3	53.3
250173399002	Medford	950	380	53.6	53.7
250173396005	Medford	885	377	52.8	52.8
250173399004	Medford	759	346	53.2	53.1
250173395002	Medford	1,312	547	52.5	52.4

Table H-26 2016 DNL Levels for Census Block Group Locations within the DNL 50 dB (Continued)

U.S. Census 2010 Block Group					
Block Group ID	**Name**	**Population**	**Housing units**	**Average Block DNL**	**DNL at centroid**
250173396006	Medford	945	443	52.7	52.6
250173395004	Medford	736	307	51.2	51.2
250173399003	Medford	939	425	52.5	52.5
250173399005	Medford	872	342	52.9	52.8
250173400003	Medford	713	303	52.7	52.6
250173391003	Medford	1,169	691	52.2	52.2
250173400001	Medford	1,033	435	52.0	52.0
250173401004	Medford	1,483	609	51.5	51.4
250173395001	Medford	2,710	553	51.8	51.6
250173400002	Medford	848	377	52.2	52.1
250173391002	Medford	1,460	603	51.7	51.7
250173391004	Medford	1,797	1,041	51.3	51.3
250173395003	Medford	641	283	50.9	51.1
250173401006	Medford	826	310	50.5	50.5
250173391001	Medford	617	243	50.3	49.2
250173391005	Medford	1,399	446	50.4	50.4
250214164007	Milton	1,002	386	56.6	53.7
250214164001	Milton	789	302	55.5	54.8
250214164005	Milton	1,028	348	55.6	54.9
250214164006	Milton	978	357	55.4	53.0
250214161012	Milton	1,969	732	54.7	53.9
250214164004	Milton	797	281	51.1	50.0
250214164002	Milton	664	267	50.6	49.4
250092011001	Nahant	629	319	50.0	47.7
250250511013	Orient Heights	1,537	621	63.3	62.6
250250511011	Orient Heights	1,602	598	58.5	59.2
250250511012	Orient Heights	1,949	741	57.0	57.1
250250511014	Orient Heights	1,005	385	57.7	60.9
250259813002	Other East Boston	389	245	79.3	66.0
250250510001	Other East Boston	2,039	855	63.9	64.1
250250510003	Other East Boston	1,088	467	62.7	63.8
250250510002	Other East Boston	962	462	57.5	58.6
250250505001	Other East Boston	1,857	702	59.2	59.4
250250506001	Other East Boston	1,248	494	58.5	58.7
250250506002	Other East Boston	815	312	57.9	57.7
250250504002	Other East Boston	1,735	797	57.5	57.4

Table H-26 2016 DNL Levels for Census Block Group Locations within the DNL 50 dB (Continued)

U.S. Census 2010 Block Group					
Block Group ID	**Name**	**Population**	**Housing units**	**Average Block DNL**	**DNL at centroid**
250250504001	Other East Boston	637	238	56.8	56.8
250250503001	Other East Boston	727	282	56.4	56.5
250250503002	Other East Boston	1,524	759	55.7	55.8
250251805002	Point Shirley Winthrop	572	271	67.1	65.1
250251805004	Point Shirley Winthrop	882	459	67.6	67.1
250251805003	Point Shirley Winthrop	1,156	671	58.6	60.0
250251805001	Point Shirley Winthrop	1,273	613	56.8	55.9
250214173001	Quincy	1,781	1,180	57.9	53.8
250214174001	Quincy	1,125	485	54.7	48.2
250214173002	Quincy	900	630	56.9	53.1
250214172001	Quincy	2,743	1,256	52.1	52.8
250214175023	Quincy	887	337	50.7	51.0
250214176021	Quincy	1,328	585	48.4	41.5
250251708002	Revere	1,359	577	64.3	62.6
250251708003	Revere	967	419	63.2	62.6
250251708001	Revere	1,815	797	62.6	62.9
250251707012	Revere	1,311	622	61.1	60.8
250251708004	Revere	977	424	60.6	62.9
250251705022	Revere	1,684	998	58.6	58.3
250251705021	Revere	1,134	550	58.3	58.0
250259815021	Revere	9	3	54.8	55.7
250251705012	Revere	1,501	814	56.5	54.9
250251705011	Revere	1,934	1,113	55.9	54.9
250251707025	Revere	1,391	553	55.4	55.8
250251707011	Revere	788	431	55.0	57.0
250251707022	Revere	1,474	509	55.2	55.3
250251706012	Revere	1,413	573	51.3	51.1
250251707021	Revere	1,146	352	53.5	53.9
250251707024	Revere	959	358	53.4	53.1
250251707023	Revere	1,658	547	52.3	52.1
250251706014	Revere	954	380	50.5	50.8
250251706013	Revere	1,387	497	49.4	49.5
250251701003	Revere	773	320	49.9	50.0
250251701007	Revere	1,335	498	48.5	48.5
250251701002	Revere	1,012	384	49.2	49.2
250251701001	Revere	1,671	769	48.7	48.4

Table H-26 2016 DNL Levels for Census Block Group Locations within the DNL 50 dB (Continued)

U.S. Census 2010 Block Group					
Block Group ID	**Name**	**Population**	**Housing units**	**Average Block DNL**	**DNL at centroid**
250251706011	Revere	1,351	557	48.9	48.9
250251704002	Revere	1,151	506	50.3	50.0
250251702002	Revere	1,395	499	47.6	47.6
250251702001	Revere	1,228	542	47.1	47.1
250251703007	Revere	729	300	46.4	46.4
250251701004	Revere	727	290	47.9	47.9
250251704003	Revere	1,101	431	48.2	48.4
250251701005	Revere	1,320	514	47.4	47.4
250251703006	Revere	1,209	517	46.7	46.9
250251704004	Revere	2,025	910	46.7	47.1
250251703005	Revere	1,692	659	45.2	45.2
250251704001	Revere	1,102	485	48.5	50.4
250251702004	Revere	1,335	533	46.1	46.1
250251703004	Revere	1,609	637	45.3	45.1
250251702003	Revere	606	240	46.5	46.5
250251703002	Revere	899	344	44.3	44.5
250251701006	Revere	722	289	47.2	47.3
250251703003	Revere	946	338	44.2	44.3
250259811003	Roslindale	6	6	52.1	51.9
250251101031	Roslindale	568	325	52.0	52.1
250251103012	Roslindale	1,271	552	51.3	51.2
250251101036	Roslindale	583	271	51.4	51.4
250251101035	Roslindale	1,440	666	51.5	51.5
250251103011	Roslindale	1,134	403	50.8	50.8
250251101034	Roslindale	620	289	51.2	51.2
250251101033	Roslindale	653	241	51.0	51.0
250251102011	Roslindale	2,051	874	50.2	50.1
250251104011	Roslindale	2,011	733	50.8	50.8
250250801001	Roxbury	2,612	450	56.4	56.1
250250906001	Roxbury	1,094	351	55.3	55.3
250250801002	Roxbury	738	294	55.6	55.6
250250906002	Roxbury	1,254	442	55.5	55.4
250250818002	Roxbury	921	442	55.1	55.1
250250904004	Roxbury	870	294	55.0	55.0
250250818003	Roxbury	820	369	54.7	54.7
250250818001	Roxbury	1,157	577	55.1	55.1

Table H-26	2016 DNL Levels for Census Block Group Locations within the DNL 50 dB (Continued)				
U.S. Census 2010 Block Group					
Block Group ID	**Name**	**Population**	**Housing units**	**Average Block DNL**	**DNL at centroid**
250250820003	Roxbury	841	414	54.5	54.4
250250904003	Roxbury	763	254	54.6	54.6
250250817002	Roxbury	893	430	54.7	54.7
250250820002	Roxbury	682	298	54.2	54.1
250250820001	Roxbury	1,292	566	54.1	54.1
250250803001	Roxbury	1,769	791	55.2	55.1
250250821003	Roxbury	2,244	1,012	54.0	54.0
250250819001	Roxbury	906	453	54.4	54.4
250250904001	Roxbury	871	311	54.2	54.2
250250817001	Roxbury	619	225	54.7	54.7
250250821001	Roxbury	1,228	526	53.7	53.7
250250904002	Roxbury	1,155	435	53.9	53.9
250250819002	Roxbury	617	259	54.1	54.0
250250819004	Roxbury	992	428	53.8	53.7
250250819003	Roxbury	600	257	53.9	53.9
250250821002	Roxbury	1,553	579	53.4	53.3
250250903003	Roxbury	978	422	53.6	53.5
250250817003	Roxbury	780	291	53.8	53.8
250250914002	Roxbury	1,069	355	53.3	53.4
250259803001	Roxbury	338	2	52.6	52.8
250250817004	Roxbury	887	355	53.9	54.0
250250804011	Roxbury	1,265	526	54.3	54.2
250250903002	Roxbury	1,310	513	52.8	52.4
250250901001	Roxbury	1,631	660	52.5	52.6
250250902003	Roxbury	934	308	52.6	52.7
250250817005	Roxbury	641	298	53.7	53.9
250250813001	Roxbury	1,661	806	52.9	52.9
250250815002	Roxbury	1,346	554	53.1	53.1
250250902002	Roxbury	626	278	52.3	52.1
250251203013	Roxbury	1,543	554	52.6	52.5
250250903001	Roxbury	891	333	52.5	52.5
250251203012	Roxbury	855	331	52.6	52.6
250250901003	Roxbury	693	303	51.7	51.8
250250901002	Roxbury	531	237	51.5	51.6
250250902001	Roxbury	673	244	51.4	51.5
250250815001	Roxbury	788	351	52.3	52.4

Table H-26 2016 DNL Levels for Census Block Group Locations within the DNL 50 dB (Continued)

U.S. Census 2010 Block Group					
Block Group ID	**Name**	**Population**	**Housing units**	**Average Block DNL**	**DNL at centroid**
250250806013	Roxbury	459	242	52.5	52.6
250250804012	Roxbury	1,445	723	52.5	52.4
250250814001	Roxbury	1,067	558	52.1	52.1
250250924005	Roxbury	721	276	50.7	50.7
250250901004	Roxbury	1,099	414	50.6	50.7
250251203014	Roxbury	1,231	567	51.3	51.4
250250924003	Roxbury	1,688	711	50.5	50.8
250251203011	Roxbury	1,166	443	51.3	51.5
250250813002	Roxbury	1,749	690	51.5	51.4
250250901005	Roxbury	617	249	50.2	50.1
250250813003	Roxbury	1,350	615	50.9	51.0
250092081021	Saugus	752	301	55.6	48.5
250173501032	Somerville	1,210	520	54.6	54.2
250173504001	Somerville	1,006	368	52.6	52.5
250173501042	Somerville	2,584	947	53.2	53.4
250173504005	Somerville	849	392	52.3	52.3
250173504002	Somerville	1,232	565	52.1	52.1
250173503003	Somerville	849	390	52.0	52.0
250173501041	Somerville	2,119	793	52.3	52.6
250173504003	Somerville	1,017	462	51.5	51.4
250173501044	Somerville	1,384	673	52.1	52.0
250173509001	Somerville	803	398	51.1	51.0
250173501043	Somerville	1,188	485	51.7	51.4
250173503002	Somerville	627	304	51.0	51.0
250173502001	Somerville	1,376	586	51.2	51.1
250173503001	Somerville	965	454	51.1	51.7
250173502006	Somerville	1,044	502	51.2	51.2
250173510005	Somerville	1,056	484	50.5	50.5
250173514031	Somerville	763	309	50.8	50.9
250173502005	Somerville	749	315	50.7	50.8
250173510001	Somerville	1,236	595	50.0	49.9
250173514033	Somerville	587	321	50.1	50.1
250173502004	Somerville	1,410	594	50.1	50.1
250173514035	Somerville	619	288	49.9	49.9
250173514032	Somerville	1,017	391	50.0	50.1
250173514034	Somerville	1,042	369	50.0	50.2

Table H-26 2016 DNL Levels for Census Block Group Locations within the DNL 50 dB (Continued)

U.S. Census 2010 Block Group					
Block Group ID	**Name**	**Population**	**Housing units**	**Average Block DNL**	**DNL at centroid**
250173502003	Somerville	1,385	533	50.0	49.9
250173511002	Somerville	912	465	49.8	49.7
250173502002	Somerville	603	233	49.8	49.8
250173514041	Somerville	1,147	448	49.0	49.0
250173504004	Somerville	1,464	721	51.7	51.7
250173506001	Somerville	1,656	2	52.2	52.2
250173506004	Somerville	1,164	487	52.1	52.0
250173510004	Somerville	1,813	870	49.2	49.2
250173510006	Somerville	1,018	523	49.2	49.3
250173506002	Somerville	939	371	51.7	51.6
250173511005	Somerville	1,146	540	49.0	49.0
250173505002	Somerville	811	382	51.8	51.8
250173505001	Somerville	818	390	51.9	51.9
250173511001	Somerville	1,601	747	49.0	49.0
250173506003	Somerville	813	231	51.3	51.2
250173514042	Somerville	1,335	527	49.0	49.0
250173514043	Somerville	1,026	396	48.8	48.8
250250606001	South Boston	2,357	1,530	62.7	61.0
250250612001	South Boston	1,702	1,188	59.0	59.0
250250601011	South Boston	881	441	60.5	60.5
250250607001	South Boston	741	253	58.8	58.9
250250601013	South Boston	981	496	59.7	59.8
250250601012	South Boston	633	350	59.3	59.5
250250607002	South Boston	1,152	383	58.3	58.3
250250601014	South Boston	721	397	58.7	59.3
250250612002	South Boston	627	383	57.1	56.8
250250608003	South Boston	886	470	57.9	57.9
250250608004	South Boston	1,666	943	57.4	57.1
250250605014	South Boston	631	295	58.1	58.4
250250608002	South Boston	757	396	56.8	56.9
250250605015	South Boston	656	333	57.2	57.3
250250602001	South Boston	821	419	57.3	57.3
250250608001	South Boston	655	333	56.6	56.6
250250605013	South Boston	717	431	56.8	56.8
250250605011	South Boston	699	375	57.0	57.0
250250605012	South Boston	868	508	56.5	56.5

Table H-26 2016 DNL Levels for Census Block Group Locations within the DNL 50 dB (Continued)

U.S. Census 2010 Block Group					
Block Group ID	**Name**	**Population**	**Housing units**	**Average Block DNL**	**DNL at centroid**
250250612003	South Boston	911	470	55.3	55.3
250250602002	South Boston	1,095	580	56.1	56.3
250250610001	South Boston	1,033	544	55.5	55.6
250250604005	South Boston	960	336	55.6	55.8
250250610002	South Boston	1,164	471	55.1	55.1
250250610003	South Boston	901	393	55.0	55.0
250250603013	South Boston	1,092	561	56.0	56.1
250250604001	South Boston	1,021	542	55.4	55.2
250250611011	South Boston	617	278	54.4	54.5
250250603011	South Boston	1,285	741	55.6	55.7
250250603012	South Boston	699	345	55.1	55.1
250250604002	South Boston	988	530	54.9	54.8
250250604004	South Boston	1,093	669	54.5	54.5
250250604003	South Boston	842	466	54.4	54.4
250250611012	South Boston	1,615	766	53.5	53.7
250250712011	South End	1,899	819	56.5	56.2
250250711012	South End	1,424	750	55.6	54.9
250250712012	South End	1,232	580	55.6	55.5
250250711011	South End	1,498	928	55.4	55.6
250250704021	South End	1,723	680	55.4	55.2
250250711013	South End	831	507	54.9	54.6
250250705001	South End	1,700	1,018	54.3	54.3
250250705003	South End	1,393	803	53.9	53.8
250250705002	South End	999	524	53.4	53.4
250250705004	South End	1,368	721	53.4	53.4
250250709001	South End	2,166	1,231	52.9	53.0
250250703004	South End	1,119	746	52.7	52.6
250250805002	South End	2,020	863	52.5	52.4
250250709002	South End	1,163	567	52.5	52.5
250250706001	South End	1,127	667	52.3	52.5
250250703003	South End	992	707	51.8	52.0
250250706002	South End	1,113	642	51.8	51.8
250251802004	Winthrop	1,343	549	62.1	61.1
250251802001	Winthrop	1,471	610	59.3	59.9
250251802003	Winthrop	648	336	58.8	58.9
250251804002	Winthrop	839	347	58.8	58.9

Table H-26 2016 DNL Levels for Census Block Group Locations within the DNL 50 dB (Continued)

U.S. Census 2010 Block Group					
Block Group ID	**Name**	**Population**	**Housing units**	**Average Block DNL**	**DNL at centroid**
250251802002	Winthrop	647	299	57.2	57.3
250251804001	Winthrop	876	435	58.1	58.1
250251801013	Winthrop	2,344	1,194	55.8	55.0
250251801011	Winthrop	1,207	584	53.9	53.7
250251801012	Winthrop	1,215	724	51.5	52.2
250251803014	Winthrop Court Rd	760	297	63.8	64.0
250251803012	Winthrop Court Rd	778	322	61.7	61.8
250251803011	Winthrop Court Rd	652	258	60.3	60.4
250251803013	Winthrop Court Rd	834	351	61.1	61.3

MERCATUS ON POLICY

Airport Noise NIMBYism: An Empirical Investigation

Eli Dourado and Raymond Russell

October 2016

MERCATUS CENTER
George Mason University

Eli Dourado is a research fellow at the Mercatus Center at George Mason University and director of its Technology Policy Program. He has researched and written on a wide array of technology topics, including drones, cryptocurrency, Internet security, and the economics of technology. His popular writing has appeared in the *New York Times*, the *Wall Street Journal*, the *Washington Post*, *Foreign Policy*, *Vox*, *Slate*, *Ars Technica*, and *Wired*, among other outlets. Dourado is a PhD candidate in economics at George Mason University and received his BA in economics and political science from Furman University.

Raymond Russell was a 2016 Google Policy Fellow at the Mercatus Center at George Mason University. His research interests include data science and the economics of technological change. He is an undergraduate at the University of Washington studying physics and economics.

Every growing city encounters criticism from residents who will settle for little else but the status quo. Local governments intent on building or expanding infrastructure must contend with citizens opposed to the inconvenience and nuisance of increased construction, more neighbors, and heavier traffic. This hostility to expansion, called "NIMBYism" (not in my backyard), can be a barrier to denser development, lower housing prices, and ultimately economic growth.

But NIMBYism extends beyond opposition to urban development, and its consequences can hinder economic growth in nonobvious ways. In this policy brief, we explore a particular category of NIMBY complaints surrounding airport noise. Airport noise can be a nuisance, but it is also necessary for economic activity in the modern world. We evaluate noise complaint data from a selection of US airports to quantify opposition to airport noise. We find that the source of airport noise complaints is highly concentrated in a few dedicated complainers.

Airport noise policy must strike a reasonable balance between noise abatement and the economic benefits associated with noisy airplane takeoffs and landings. However, because the majority of noise complaints come from a small number of loud objectors, there is a danger that this balance has been tilted too far in the direction of noise abatement.[1] We hope that increasing awareness of the lopsided distribution of noise complaints can help promote noise standards that strike an appropriate balance and facilitate the advancement of faster and cheaper commercial flight.

MANY COMPLAINTS COME FROM A SMALL NUMBER OF CALLERS

Most airports in the United States allow the public to submit noise complaints through dedicated hotlines and online portals. Nearly all of the country's largest airports publish data on the calls they receive, but this information varies in thoroughness. Some airport authorities, such as the Port of Seattle, allow public access to each complainant's name, their personal information, and a summary of the call. Others, like Boston's Massport, only publish the number of complaints received and the number of unique callers. But even this summary information is useful; data from Massport on Boston Logan International Airport still illustrate the distribution and origin of complaints.

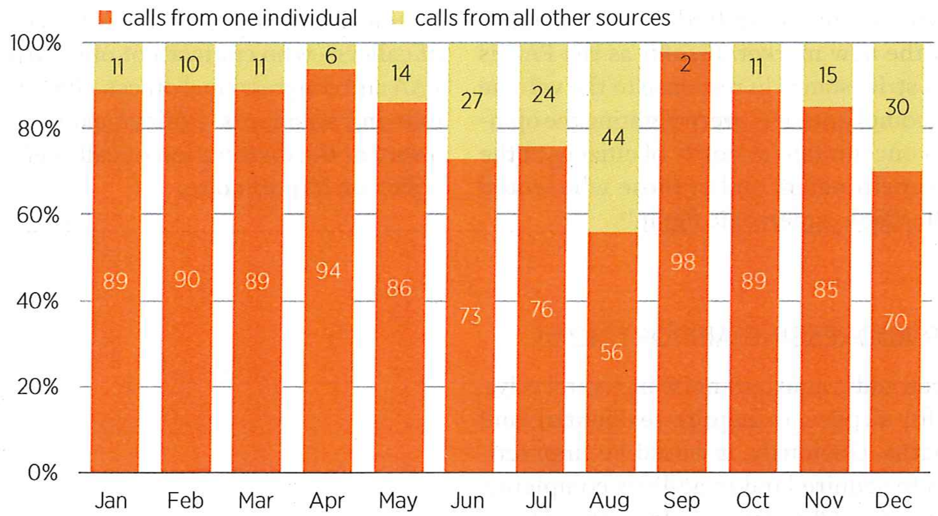
Generally, a very small number of people account for a disproportionately high share of the total number of noise complaints. In 2015, for example, 6,852 of the 8,760 complaints submitted to Ronald Reagan Washington National Airport originated from one residence in the affluent Foxhall neighborhood of northwest Washington, DC.[2] The residents of that particular house called Reagan National to express irritation about aircraft noise an average of almost 19 times per day during 2015. Other major airports report similar trends. In Seattle's detailed call-by-call lists, one individual complains so frequently that her grievances are not transcribed in full but simply tallied at the end of the month. While airport employees provide summaries of other calls, the description of this particular individual's calls is, "Same complaint over and over. Records a/c flying over."[3]

Relative to other large US airports, San Francisco International Airport receives an enormous number of complaints each year. In 2015, it registered 890,376 complaints. Predictably, we find that these complaints were not lodged by a correspondingly large number of people; rather, hundreds of thousands of calls came from just 9,561 callers. Even if calls were uniformly distributed among these callers, each would still have had to place 93 calls. But as with other US airports, San Francisco's complaint records show a high degree of concentration among a very small subset of total callers. In October 2015, 53 Portola Valley, CA, residents placed 25,259 calls to the airport—nearly 477 per person. Similarly, three residents of Daly City placed 1,034 calls in December 2015, and six Woodside callers complained 2,432 times in November.

TABLE 1. SUMMARY OF AIRPORT NOISE COMPLAINTS

Airport	Time period covered	Total number of complaints	Evidence of concentration
Ronald Reagan Washington National Airport (DCA)	2015	8,760	2 individuals at 1 residence in NW DC accounted for 6,852 complaints (78 percent).[4]
Denver International Airport (DEN)	2015	4,870	1 individual in Strasburg, CO, 30 miles from the airport, accounted for 3,555 complaints (73 percent). 4 callers accounted for 4,653 complaints (96 percent). A total of 42 households complained.[5]
Washington Dulles International Airport (IAD)	2015	1,223	1 individual in Poolesville, MD, 13 miles away from the airport, accounted for 1,024 complaints (84 percent).[6]
Las Vegas McCarran International Airport (LAS)	2015	3,963	1 individual accounted for 450 calls in September 2015 (98 percent of monthly total).[7]
Los Angeles International Airport (LAX)	2015	8,862	1 individual in Monterey Park, CA, accounted for 489 complaints during June 2015 (50 percent of monthly total). The top 3 callers accounted for 88 percent of June complaints.[8]
Portland International Airport (PDX)	2015	688	5 individuals accounted for 420 complaints (61 percent).[9]
Phoenix Sky Harbor International Airport (PHX)	2015	24,247	1,338 households in total lodged complaints. While data is not available by household, the airport received 3,814 complaints from 13 households in zip code 85258, for an average of 293 calls per household.[10]
Seattle-Tacoma International Airport (SEA)	2014	1,006	3 individuals accounted for 648 complaints (64 percent). Top caller accounted for 42 percent of total.[11]
San Francisco International Airport (SFO)	2015	890,376	53 Portola Valley, CA, individuals accounted for 25,259 complaints during the month of October 2015, for an average of 477 calls per person in that month.[12]

FIGURE 1. CONCENTRATION OF NOISE COMPLAINTS AT LAS VEGAS MCCARRAN INTERNATIONAL AIRPORT (LAS), 2015



Source: McCarran International Airport, "Noise Complaint Reports."

Table 1 summarizes the concentration of noise complaints registered at several large US airports. Figure 1 shows the monthly concentration of noise complaints over the course of 2015 at McCarran International Airport in Las Vegas.

SMALL NUMBER OF CALLERS HAVE DISPROPORTIONATE IMPACT

Airport noise complaint data paints a startling picture. A handful of individuals are responsible for most of the noise complaints at most airports we examine. Some of these individuals do not appear to live particularly close to the airports to which they are complaining. For example, one individual in Strasburg, CO, 30 miles from Denver International Airport, complained 3,555 times in 2015, an average of 9.7 times per day. One individual in La Selva Beach, CA, about *55 miles* from San Francisco International Airport, complained about airport noise 186 times during October 2015.

There are worrisome signs that this small, frustrated minority of citizens is affecting aviation policy. In recent decades, the Federal Aviation Administration (FAA) has imposed progressively more stringent noise standards on aircraft operating in US airspace.[13] While noise abatement is desirable, it can have significant costs—particularly on the fuel efficiency of aircraft—resulting not only in higher carbon emissions but also in higher ticket prices. It is troubling that a tiny but vocal group is potentially driving policy. While we do not have data on grievances lodged directly to the FAA or to members of Congress, it is probable that those airport noise complaints follow a similar pattern.

AIRPORT NOISE AND FUEL EFFICIENCY

Airport noise is entangled with fuel efficiency in at least two ways. First, the FAA's NextGen airspace modernization program will enable aircraft to travel along denser and more direct routes, particularly on approach for landing. NextGen will remove much of the need for circling above the airport in holding patterns, and it allows aircraft to descend more gradually, saving valuable fuel. However, denser and more gradual approaches also correspond to more noise on the ground under approach paths to the airport. Airports undergoing NextGen implementation have experienced a significant uptick in noise complaints.[14]

Second, airport noise standards are very important for fuel efficiency gains on potential new supersonic aircraft. Aircraft are more fuel efficient when they can take off at full throttle, and these gains in efficiency are of particular importance when aircraft are climbing to the high cruise speeds and altitudes of supersonic planes. Yet in the FAA's most recent policy statement on supersonics, the agency said it "would propose that any future supersonic airplane produce no greater noise impact on a community than a subsonic airplane."[15] Subsonic noise type certification requirements are quite strict, and they will become stricter still in 2018. Holding supersonic aircraft to subsonic noise standards would hamper the viability of the new market. Insofar as the FAA is adopting such a strict stance in response to the volume of airport noise complaints, it is overweighting the opinions of a small, concentrated minority of citizens at the expense of the environment and of those who would benefit from affordable supersonic flight.[16]

OPTIONS FOR ADDRESSING AIRPORT NOISE

Policymakers can address airport noise in several ways. One option is for airports to acquire residential land below flight paths. Obviously, it would be impractical for airports to acquire land to address complaints originating from up to 50 miles away from the airport. Nevertheless, numerous airports have bought up nearby land to reduce the effect of noise on people nearby. A second approach is to make noise standards more severe, creating mandatory retirement of the existing fleet of airplanes. This was done in the 1990s as the Stage 2 noise standard was replaced with Stage 3. Economist Stephen A. Morrison and his coauthors estimate that the benefits of the phaseout, in terms of property values for homeowners, were $5 billion less than the costs to airlines, in terms of the reduced life of their capital.[17]

A third approach is to subsidize and otherwise support the installation of more and better insulation in homes affected by airport noise. Aerospace engineer Philip J. Wolfe and his coauthors estimate that this is more cost-effective than land acquisition or mandatory retirement.[18] There are a number of insulation programs run by airports around the country.[19]

Finally, a noise tax could help to efficiently discourage the production of noise without outright banning it, and revenues could be used to fund insulation programs. This is a better strategy than existing FAA policy of continuing to increase noise standards, perhaps in response to a high volume of complaints.

CONCLUSION

It would be a mistake to allow the preferences of a vocal but minuscule minority of citizens, however sympathetic their circumstances, to impede much-needed improvements in aviation. Airport noise standards are already quite strict, and they create real economic and environmental costs associated with lower aircraft fuel efficiency. While our analysis cannot recommend a precise noise standard, we are concerned that a handful of callers—who contact not only airports but also the FAA and congressional offices—have unduly influenced existing standards. Policymakers should be acutely aware of the distribution of calls before taking further action on airport noise.

NOTES

1. In other words, airport noise complaints could be a classic case of concentrated benefits and diffused costs. Mancur Olson, *The Logic of Collective Action: Public Goods and the Theory of Groups*, 2nd ed. (Cambridge, MA: Harvard University Press, 1971).
2. Metropolitan Washington Airports Authority, "2015 Annual Aircraft Noise Report," accessed August 18, 2016.
3. Port of Seattle, "Public Records Request: Request #16-34," January 27, 2016.
4. Ibid.
5. Denver International Airport, "DEN Noise Report: January 1, 2015–December 31, 2015," accessed August 19, 2016.
6. Metropolitan Washington Airports Authority, "2015 Annual Aircraft Noise Report."
7. McCarran International Airport, "Noise Complaint Reports," July through September 2015 Noise Complaint Reports, October 22, 2015.
8. Los Angeles World Airports, "June 2015 ANCR Report," July 31, 2015.
9. Port of Portland, "2015 Year in Review," accessed August 19, 2016.
10. City of Phoenix Aviation Department, "Annual Noise Report 2015," accessed August 18, 2016.
11. Port of Seattle, "Public Records Request: Request #16-122," April 6, 2016.
12. San Francisco International Airport, "Noise Abatement Data," accessed August 19, 2016.
13. Federal Aviation Administration, "Details on FAA Noise Levels, Stages, and Phaseouts," June 10, 2016.
14. Pia Bergqvist, "NextGen Flight Paths Give Rise to Noise Complaints," *Flying Magazine*, June 23, 2016. Entire websites also exist to coordinate noise complaints against NextGen. See NextGenNoise, accessed September 26, 2016, http://nextgennoise.org/.
15. Federal Aviation Administration, Civil Supersonic Airplane Noise Type Certification Standards and Operating Rules, 73 Fed. Reg. 205 (October 22, 2008).
16. For subsonic aircraft, noise standards have in fact become stricter over time. In 2000, so-called Stage 3 noise requirements became mandatory. In 2006, the FAA stopped certifying aircraft under Stage 3 in favor of the more restrictive Stage 4 standards. In 2018, new Stage 5 standards will be required for certification. This continuous one-way ratchet in noise standards is at least circumstantial evidence that noise complaints are effective.
17. Steven A. Morrison, Clifford Winston, and Tara Watson, "Fundamental Flaws of Social Regulation: The Case of Airplane Noise," *Journal of Law and Economics* 42, no. 2 (1999): 723–44.
18. Philip J. Wolfe et al., "Costs and Benefits of US Aviation Noise Land-Use Policies," *Transportation Research Part D: Transport and Environment* 44 (2016): 147–56.
19. Jon Hilkevitch, "Midway-Area Homes to Get $10 Million More for Soundproofing," *Chicago Tribune*, August 5, 2015; Massachusetts Port Authority, "Sound Insulation Program," accessed August 19, 2016; Community Development Commission of the County of Los Angeles, "Residential Sound Insulation Program (RSIP)," accessed August 19, 2016.

This Page Intentionally Left Blank.

I

Air Quality/Emissions Reduction

This appendix provides the following detailed information and data tables in support of Chapter 7, *Air Quality/Emissions Reduction*:

- Fundamentals of Air Quality
  - Table I-1 National Ambient Air Quality Standards
  - Table I-2 Airport-Related Sources of Air Emissions
  - Table I-3 Attainment, Nonattainment, and Maintenance Areas
- Aircraft Fleet and Operational Data Used in AEDT 2c SP2
  - Table I-4 2016 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type
- Ground Service Equipment Time-in-Mode Survey
  - Table I-5 GSE Time-in-Mode (minutes)
- Ground Service Equipment/Alternative Fuels Conversion
  - Table I-6 Ground Service Equipment Alternative Fuel Conversion Summary (kg/day)
- Motor Vehicle Emissions
  - Table I-7 MOVES2014a Sample Input File for 2016
  - Table I-8 MOVES2014a Sample Output File for 2016
- Fuel Storage and Handling
  - Table I-9 Fuel Throughput by Fuel Category (gallons)
- Stationary Sources
  - Table I-10 Stationary Source Fuel Throughput by Fuel Category (gallons)
- 1993 – 2009 Emissions Inventories
  - Table I-11 Estimated VOC Emissions (in kg/day) at Logan Airport 1993-2001
  - Table I-12 Estimated VOC Emissions (in kg/day) at Logan Airport 2002-2009

Fundamentals of Air Quality

This section contains a general summary of air quality and air emissions with a particular emphasis on airport-related emissions where appropriate. This material is intended to supplement and provide background information for the materials contained in Chapter 7, *Air Quality/Emissions Reduction*.

Pollutant Types and Standards

The U.S. Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) for a select group of "criteria air pollutants" designed to protect public health, the environment, and the quality of life from the detrimental effects of air pollution. Listed alphabetically, these pollutants are briefly described below:

- **Carbon monoxide (CO)** is a colorless, odorless, tasteless gas. It may temporarily accumulate, especially in cool, calm weather conditions, when fuel use reaches a peak and CO is chemically most stable due to the low temperatures. CO from natural sources usually dissipates quickly, posing no threat to human health. Transportation sources (e.g., motor vehicles), energy generation, and open burning are among the predominant anthropogenic (i.e., man-made) sources of CO.

- **Lead (Pb)** in the atmosphere is generated from industrial sources including waste oil and solid waste incineration, iron and steel production, lead smelting, and battery and lead manufacturing. The lead content of motor vehicle emissions, which was the major source of lead in the past, has significantly declined with the widespread use of unleaded fuel. Low-lead fuel used in some general aviation (GA) aircraft is still a source of airport-related lead.

- **Nitrogen dioxide (NO_2)**, nitric oxide (NO), and the nitrate radical (NO_3) are collectively called oxides of nitrogen (NO_x). These three compounds are interrelated, often changing from one form to another in chemical reactions, and NO_2 is the compound commonly measured for comparison to the NAAQS. NO_x is generally emitted in the form of NO, which is oxidized to NO_2. The principal man-made source of NO_x is fuel combustion in motor vehicles and power plants – aircraft engines are also a source. Reactions of NO_x with other atmospheric chemicals can lead to formation of ozone (O_3) and acidic precipitation.

- **Ozone (O_3)** is a secondary pollutant, formed from daytime reactions of NO_x and volatile organic compounds (VOCs) in the presence of sunlight. VOCs, which are a subset of hydrocarbons (HC) and have no NAAQS, are released in industrial processes and from evaporation of gasoline and solvents. Sources of NO_x are discussed above.

- **Particulate matter (PM)** comprises very small particles of dirt, dust, soot, or liquid droplets called aerosols. The NAAQS for PM is segregated by sizes (i.e., less than 10 and less than 2.5 microns as PM_{10} and $PM_{2.5}$, respectively). PM is formed as an exhaust product in the internal combustion engine or can be generated from the breakdown and dispersion of other solid materials (e.g., fugitive dust).

- **Sulfur oxides (SO_x)** are primarily composed of sulfur dioxide (SO_2) which is emitted in natural processes and by man-made sources such as combustion of sulfur-containing fuels and sulfuric acid manufacturing.

The NAAQS for these criteria pollutants are subdivided into the Primary Standards (designed to protect human health) and the Secondary Standards (designed to protect the environment and human welfare) and are listed below in **Table I-1**. Exceedances of these values constitute violations of the NAAQS.

Table I-1 National Ambient Air Quality Standards

Pollutants	Averaging Time	Concentration	Condition of Violation
Ozone (O_3)	8-hour	0.070 ppm	3-year average of the fourth-highest daily maximum 8-hour average.
Carbon Monoxide (CO)	8-hour	9 ppm	No more than once per year.
	1-hour	35 ppm	
Nitrogen Dioxide (NO_2)	Annual Average	53 ppb	Annual mean.
	1-hour	100 ppb	3-year average of the 98th percentile of the daily maximum 1-hour average.
Sulfur Dioxide (SO_2)	3-hour	0.5 ppm	No more than once per year.
	1-hour	75 ppb	Three-year average of the 99th percentile of 1-hour daily maximum concentrations.
Particulate Matter (PM_{10})	24-hour	150 $\mu g/m^3$	Not to be exceeded more than once per year on average over 3 years.
Particulate Matter ($PM_{2.5}$)	Annual (primary)	12 $\mu g/m^3$	Annual mean, averaged over 3 years.
	Annual (secondary)	15 $\mu g/m^3$	Annual mean, averaged over 3 years.
	24-hour	35 $\mu g/m^3$	3-year average of the 98th percentile.
Lead (Pb)	Rolling 3-month average	0.15 $\mu g/m^3$	Not to be exceeded.

Source: EPA, 2017, https://www.epa.gov/criteria-air-pollutants.
Note: ppm - parts per million; ppb – parts per billion; µg/m3 - micrograms per cubic meter

Sources of Airport Air Emissions

Almost all large metropolitan airports generate air emissions from the following general source categories: aircraft, ground service equipment (GSE), and motor vehicles traveling to, from, and moving about the airport; fuel storage and transfer facilities; a variety of stationary sources (e.g., steam boilers, back-up generators, snow melters, etc.); an assortment of aircraft maintenance activities (e.g., painting, cleaning, repair, etc.); routine airfield, roadway, and building maintenance activities (e.g., painting, cleaning, repair, etc.); and periodic construction activities for new projects or improvements to existing facilities. **Table I-2** provides a summary listing of these sources of air emissions, the pollutants, and their characteristics.

Table I-2 Airport-related Sources of Air Emissions

Sources	Emissions	Characteristics
Aircraft	CO NO_2 PM SO_2 VOCs	Exhaust products of fuel combustion that vary depending on aircraft engine type, number of engines, power setting, and period of operation. Emissions are also emitted by an aircraft's auxiliary power unit (APU).
Motor vehicles	CO NO_2 PM SO_2 VOCs	Exhaust products of fuel combustion from patron and employee traffic approaching, departing, and moving about the airport site. Emissions vary depending on vehicle type, distance traveled, operating speed, and ambient conditions.
Ground service equipment	CO NO_2 PM SO_2 VOCs	Exhaust products of fuel combustion from service trucks, tow tugs, belt loaders, and other portable equipment.
Fuel storage and transfer	VOCs	Formed from the evaporation and vapor displacement of fuel from storage tanks and fuel transfer facilities. Emissions vary with fuel usage, type of storage tank, refueling method, fuel type, vapor recovery, climate, and ambient temperature.
Stationary sources	CO NO_2 PM SO_2 VOCs	Exhaust products of fossil fuel combustion from boilers dedicated to indoor heating requirements and emissions from incinerators used for waste reduction. Emissions are generally well controlled with operational techniques and post-burn collection methods. Sources include boilers and hot water generators, emergency generators, incinerators, paint booth and surface coating operations, welding operations, and firefighting facilities.
Construction Activities	CO NO_2 PM SO_2 VOCs	Construction projects may have associated emissions from dust generated during excavation and land clearing, exhaust emissions from construction equipment and motor vehicles, and evaporative emissions from asphalt paving and painting. The amount of particulate emissions varies with the material type, the amount of area exposed, and meteorology. The construction of airport and airfield improvement projects at airports represents temporary sources of emissions.

Source: KBE 2013.

Notes: CO - Carbon monoxide; VOC - Volatile organic compounds; PM - Particulate matter; NO_2 - Nitrogen dioxide; SO_2 - Sulfur dioxide.

EPA, state, and local air quality agencies maintain outdoor air monitoring networks to measure air quality conditions and gauge compliance with the NAAQS. Based upon the data collected by these agencies, all areas throughout the country are designated by EPA with respect to their compliance with the NAAQS. **Table I-3** provides the definitions of each of these designations.

Table I-3 Attainment, Nonattainment, and Maintenance Areas

Attainment/Nonattainment Designations			
Attainment	**Attainment/Maintenance**	**Nonattainment Area**	**Unclassifiable**
Any area that meets the NAAQS established for all of the criteria air pollutants.	Any area that is in transition from formerly being a nonattainment area to an attainment area (also called Maintenance).	Any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) one or more of the NAAQS.	Any area that cannot be classified on the basis of available information as meeting or not meeting the NAAQS.

Source: EPA

For O_3, CO, PM_{10}, and $PM_{2.5}$, the nonattainment designations are further classified by the severity, or degree, of the violation of the NAAQS. For example, in the case of O_3, these classifications range from highest to lowest as extreme, severe, serious, marginal, and moderate.

The nonattainment designation of an area has a bearing on the emission control measures required and the time periods allotted by which a State Implementation Plan (SIP) must demonstrate attainment of the NAAQS. It is also important to note that the degree of nonattainment determines the thresholds of emissions that are considered to be "*de minimis,*" or levels below (i.e., within) which a formal General Conformity determination is not required.

Finally, the boundaries of nonattainment areas are generally determined based on Core Based Statistical Areas (CBSA) as defined by U.S. census data (air monitoring station locations and contributing emission sources also play a role). However, nonattainment areas for localized pollutants such as lead and CO typically only comprise a partial CBSA or a local "hot-spot." By comparison, regional pollutants such as O_3 can encompass multiple CBSAs and can extend across state lines.

State Implementation Plans (SIP)

For the purposes of this summary explanation of SIPs, it is sufficient to characterize SIPs as the principal instrument by which a state formulates and implements its strategies for bringing nonattainment or maintenance areas into compliance with the NAAQS. In equally broad terms, the SIP contains the necessary emission limitations, control measures and timetables for achieving this objective. Therefore, the SIP development process is delegated to state air quality agencies that may in turn rely on regional, county, and local agencies to help prepare emission inventories that include airport-related emissions.

Aircraft Fleet and Operational Data used in AEDT 2c SP2

The Federal Aviation Administration (FAA) Aviation Environmental Design Tool (AEDT), Version 2c Service Pack 2 (AEDT 2c SP2) was used in support of the 2016 air quality analysis.

Table I-4 contains the data that were used in AEDT 2c SP2 to represent actual conditions at Logan Airport in 2016. These data include aircraft type, engine, landing takeoff cycles (LTOs), and taxi times. The aircraft are divided into four categories: air carrier (AC), cargo (CA), commuter (CO), and GA.

Table I-4 2016 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
Air Carrier Aircraft				
Boeing 767-300 Series	CF6-80C2B6 1862M39	2	AC (CHARTER)	25.34
Boeing 737-200 Series	JT8D-15A	1	AC (CHARTER) AJI	25.34
Boeing 737-400 Series	CFM56-3B-2	7	AC (CHARTER) BSK	25.34
Boeing 777-200 Series	GE90-90B DAC I	1	AC (CHARTER) CSN	25.34
Boeing 737-800 Series	CFM56-7B26 (8CM051)	9	AC (CHARTER) EAL	25.34
Boeing 767-300 Series	CF6-80C2B6 1862M39	1	AC (CHARTER) ISS	25.34
Boeing 737-200 Series	JT8D-15A	1	AC (CHARTER) KFS	25.34
Bombardier Learjet 35	TFE731-2-2B	35	AC (CHARTER) KFS	25.34
Bombardier CRJ-200	CF34-3B	1	AC (CHARTER) MNU	25.34
Boeing 787-8 Dreamliner	GEnx-1B64 TAPS (11GE136)	1	AC (CHARTER) RAM	25.34
Bombardier Learjet 35	TFE731-2-2B	8	AC (CHARTER) RAX	25.34
Boeing 777-200 Series	GE90-90B DAC II (6GE090)	3	AC (CHARTER) SVA	25.34
Boeing 737-800 Series	CFM56-7B26 (8CM051)	2	AC (CHARTER) SWG	25.34
Boeing 737-400 Series	CFM56-3B-2	11	AC (CHARTER) SWQ	25.34
Raytheon Beech Baron 58	TIO-540-J2B2	1	AC (CHARTER) USC	25.34
Bombardier Learjet 35	TFE731-2-2B	1	AC (CHARTER) USC	25.34
Bombardier Global Express	BR700-710A2-20	13	AC (CHARTER) VJT	25.34
Airbus A319-100 Series	CFM56-5B6/P	5,705	AC AAL	25.34
Airbus A320-200 Series	V2527-A5	1,574	AC AAL	25.34
Airbus A321-100 Series	V2533-A5	5,360	AC AAL	25.34
Airbus A330-200 Series	PW4168 Talon II	155	AC AAL	25.34
Boeing 737-800 Series	CFM56-7B26 (8CM051)	8,457	AC AAL	25.34
Boeing 757-200 Series	RB211-535E4B Phase 5	1,641	AC AAL	25.34

Table I-4 2016 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type (Continued)

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
Air Carrier Aircraft (Cont'd.)				
Embraer ERJ190	CF34-10E6 SAC	4,990	AC AAL	25.34
Boeing MD-88	JT8D-219 Environmental Kit (E_Kit)	8	AC AAL	25.34
Airbus A319-100 Series	CFM56-5A5	35	AC ACA	25.34
Boeing 787-8 Dreamliner	GEnx-1B64 TAPS (11GE136)	1	AC ACA	25.34
Embraer ERJ190	CF34-10E5A1 SAC	1,321	AC ACA	25.34
Airbus A330-200 Series	CF6-80E1A3	85	AC AFR	25.34
Airbus A340-300 Series	CFM56-5C2	8	AC AFR	25.34
Airbus A380-800 Series	Trent 9XX	1	AC AFR	25.34
Boeing 777-200 Series	GE90-90B DAC I	356	AC AFR	25.34
Boeing 737-700 Series	CFM56-7B22	136	AC AMX	25.34
Boeing 737-800 Series	CFM56-7B26 (8CM051)	154	AC AMX	25.34
Boeing 737-800 Series	CFM56-7B24	598	AC ASA	25.34
Boeing 737-900 Series	CFM56-7B27	1,030	AC ASA	25.34
Airbus A330-200 Series	CF6-80E1A4 Low emissions	279	AC AZA	25.34
Airbus A318-100 Series	CFM56-5B8/P	1	AC BAW	25.34
Airbus A380-800 Series	Trent 9XX	2	AC BAW	25.34
Boeing 747-400 Series	RB211-524H	657	AC BAW	25.34
Boeing 777-200 Series	GE90-90B DAC I	595	AC BAW	25.34
Boeing 787-9 Dreamliner	Trent 1000-J2	95	AC BAW	25.34
Airbus A330-200 Series	JT9D-70	96	AC BER	25.34
Boeing 787-8 Dreamliner	GEnx-1B64 TAPS (11GE136)	326	AC CHH	25.34
Boeing 787-9 Dreamliner	Trent 1000-J2	154	AC CHH	25.34
Boeing 737-300 Series	CFM56-3-B1	189	AC CMP	25.34
Boeing 737-800 Series	CFM56-7B26 (8CM051)	130	AC CMP	25.34
Boeing 777-300 ER	GE90-115B	227	AC CPA	25.34
Airbus A319-100 Series	CFM56-5A5	3,174	AC DAL	25.34
Airbus A320-200 Series	CFM56-5A3	2,146	AC DAL	25.34
Airbus A321-100 Series	V2533-A5	265	AC DAL	25.34
Airbus A330-300 Series	PW4168A Talon II	377	AC DAL	25.34

Table I-4 2016 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type (Continued)

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
Air Carrier Aircraft (Cont'd.)				
Boeing 717-200 Series	BR700-715A1-30	3,211	AC DAL	25.34
Boeing 737-800 Series	CFM56-7B26 (8CM051)	1,990	AC DAL	25.34
Boeing 737-900 Series	CFM56-7B26 (8CM051)	513	AC DAL	25.34
Boeing 757-200 Series	PW2037 (4PW072)	1,634	AC DAL	25.34
Boeing 767-300 Series	CF6-80A2	385	AC DAL	25.34
Boeing 767-400 ER	CF6-80C2B7F 1862M39	480	AC DAL	25.34
Boeing MD-88	JT8D-219 Environmental Kit (E_Kit)	960	AC DAL	25.34
Boeing MD-90	V2525-D5	1,835	AC DAL	25.34
Airbus A330-300 Series	PW4168A Talon II	72	AC DLH	25.34
Airbus A340-600 Series	Trent 556-61 Phase5 Tiled (6RR041)	282	AC DLH	25.34
Boeing 747-400 Series	CF6-80C2B1F 1862M39	235	AC DLH	25.34
Boeing 747-8	GEnx-2B67 TAPS (8GENX1)	275	AC DLH	25.34
Bombardier CRJ-900	CF34-8C5 LEC (8GE110)	688	AC EDV	25.34
Airbus A330-200 Series	CF6-80E1A2 1862M39	208	AC EIN	25.34
Airbus A330-300 Series	CF6-80E1A4 Standard	459	AC EIN	25.34
Boeing 757-200 Series	PW2040 (4PW073)	275	AC EIN	25.34
Boeing 767-200 Series	CF6-80A	92	AC EIN	25.34
Boeing 767-300 Series	PW4060 Reduced smoke	148	AC ELY	25.34
Airbus A330-200 Series	PW4168A Talon II	36	AC EWG	25.34
Bombardier CRJ-200	CF34-3B	159	AC FLG	25.34
Bombardier CRJ-900	CF34-8C5 LEC (8GE110)	2,971	AC FLG	25.34
Airbus A330-300 Series	CF6-80E1A4 Standard	206	AC IBE	25.34
Boeing 757-200 Series	RB211-535E4 (3RR028)	603	AC ICE	25.34
Boeing 767-300 Series	CF6-80C2B6 1862M39	76	AC ICE	25.34
Boeing 787-8 Dreamliner	GEnx-1B64 TAPS (11GE136)	164	AC JAL	25.34
Boeing 787-9 Dreamliner	Trent 1000-J2	204	AC JAL	25.34
Airbus A320-200 Series	V2527-A5	20,397	AC JBU	25.34
Airbus A321-100 Series	V2533-A5	811	AC JBU	25.34

Table I-4	**2016 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type (Continued)**

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
Air Carrier Aircraft (Cont'd.)				
Embraer ERJ190	CF34-10E6 SAC	24,659	AC JBU	25.34
Boeing 737-800 Series	CFM56-7B26 (8CM051)	80	AC NAX	25.34
Boeing 787-8 Dreamliner	GEnx-1B64 TAPS (11GE136)	179	AC NAX	25.34
Boeing 787-9 Dreamliner	Trent 1000-J2	69	AC NAX	25.34
Airbus A319-100 Series	V2522-A5	2,039	AC NKS	25.34
Airbus A320-200 Series	V2527-A5	1,584	AC NKS	25.34
Embraer ERJ145	AE3007A1E	2	AC PDT	25.34
Airbus A350-900 series	Trent XWB	275	AC QTR	25.34
Boeing 777-300 ER	GE90-115B	1	AC QTR	25.34
Airbus A310-200 Series	CF6-80C2A2 1862M39	145	AC RZO	25.34
Airbus A330-200 Series	PW4168A Talon II	169	AC RZO	25.34
Boeing 767-300 Series	CF6-80C2B6 1862M39	1	AC RZO	25.34
Boeing 737-300 Series	CFM56-3-B1	250	AC SAS	25.34
Boeing 737-700 Series	CFM56-7B22	274	AC SCX	25.34
Boeing 737-800 Series	CFM56-7B27	413	AC SCX	25.34
Bombardier CRJ-900	CF34-8C5 LEC (8GE110)	12	AC SKW	25.34
Boeing 737-300 Series	CFM56-3-B1	2,255	AC SWA	25.34
Boeing 737-700 Series	CFM56-7B24	7,937	AC SWA	25.34
Boeing 737-800 Series	CFM56-7B26 (8CM051)	2,026	AC SWA	25.34
Airbus A330-300 Series	Trent 772 Improved traverse	401	AC SWR	25.34
Airbus A340-300 Series	CFM56-5C4	109	AC SWR	25.34
Airbus A330-200 Series	PW4168A Talon II	189	AC TAP	25.34
Airbus A330-200 Series	PW4168A Talon II	31	AC TCX	25.34
Airbus A330-300 Series	Trent 772 Improved traverse	329	AC THY	25.34
Boeing 777-300 ER	GE90-115B	691	AC UAE	25.34
Airbus A319-100 Series	V2522-A5	545	AC UAL	25.34
Airbus A320-200 Series	V2527-A5	1,630	AC UAL	25.34
Boeing 737-700 Series	CFM56-7B24	747	AC UAL	25.34
Boeing 737-800 Series	CFM56-7B26 (8CM051)	2,808	AC UAL	25.34
Boeing 737-900 Series	CFM56-7B26 (8CM051)	5,406	AC UAL	25.34

Table I-4 2016 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type (Continued)

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
Air Carrier Aircraft (Cont'd.)				
Boeing 757-200 Series	PW2037 (4PW072)	173	AC UAL	25.34
Boeing 757-300 Series	RB211-535E4B Phase 5	1,122	AC UAL	25.34
Boeing 777-200 Series	PW4077	95	AC UAL	25.34
Airbus A330-200 Series	PW4168A Talon II	80	AC VIR	25.34
Airbus A340-600 Series	Trent 556-61 Phase5 Tiled (6RR041)	213	AC VIR	25.34
Boeing 787-9 Dreamliner	Trent 1000-A Phase5 Tiled (11RR049)	64	AC VIR	25.34
Airbus A320-200 Series	V2527-A5	1,862	AC VRD	25.34
Bombardier de Havilland Dash 8 Q400	PW150A	1,126	AC WEN	25.34
Airbus A321-100 Series	V2533-A5	339	AC WOW	25.34
Total Air Carrier Aircraft LTOs		**140,126**		
Cargo Aircraft				
Boeing 767-200 Series	CF6-80A	4	CA ABX	25.34
Boeing 757-200 Series	PW2040 (4PW073)	251	CA FDX	25.34
Airbus A300F4-600 Series	CF6-80C2A5F	308	CA FDX	25.34
Boeing 757-200 Series	RB211-535E4 (3RR028)	302	CA FDX	25.34
Boeing 767-300 Series	CF6-80C2B6 1862M39	683	CA FDX	25.34
Boeing DC-10-10 Series	CF6-6D	655	CA FDX	25.34
Boeing 767-200 Series	JT9D-7R4D, -7R4D1	8	CA GTI	25.34
Cessna 208 Caravan	PT6A-114	3	CA MTN	25.34
Airbus A300F4-600 Series	PW4158	438	CA UPS	25.34
Boeing 757-200 Series	PW2040 (4PW073)	162	CA UPS	25.34
Boeing 767-300 ER	CF6-80C2B6F	317	CA UPS	25.34
Raytheon Beech 99	PT6A-36	4	CA WIG	25.34
Cessna 208 Caravan	PT6A-114	195	CA WIG	25.34
Total Cargo Aircraft LTOs		**3,330**		

Table I-4 2016 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type (Continued)

Aircraft Type	Engine	LTOs	Description (Airlines)	Taxi Times
Commuter Aircraft				
Bombardier CRJ-700	CF34-8C1	223	CO ASH	25.34
Embraer ERJ170	CF34-8E5 LEC (8GE108)	20	CO ASH	25.34
Bombardier CRJ-700	CF34-8C1	946	CO ASQ	25.34
Embraer ERJ145	AE3007A1 Type 2	1,070	CO ASQ	25.34
Bombardier CRJ-200	CF34-3B	2,505	CO AWI	25.34
Bombardier CRJ-700	CF34-8C5 LEC (8GE110)	346	CO GJS	25.34
Bombardier CRJ-900	CF34-8C5 LEC (8GE110)	1,045	CO GJS	25.34
Bombardier CRJ-700	CF34-8C1	3	CO JIA	25.34
Bombardier CRJ-200	CF34-3B	2,916	CO JZA	25.34
Bombardier de Havilland Dash 8 Q100	PW120A	175	CO JZA	25.34
Bombardier de Havilland Dash 8 Q400	PW150A	65	CO JZA	25.34
Cessna 402	TIO-540-J2B2	17,997	CO KAP	25.34
Bombardier de Havilland Dash 8 Q100	PW120A	256	CO PDT	25.34
Saab 340-B-Plus	CT7-9B	1,831	CO PEN	25.34
Bombardier de Havilland Dash 8 Q400	PW150A	1,935	CO POE	25.34
Embraer ERJ170	CF34-8E5 LEC (8GE108)	729	CO RPA	25.34
Embraer ERJ170	CF34-8E5 LEC (8GE108)	1,369	CO SKV	25.34
Embraer ERJ170	CF34-8E5 LEC (8GE108)	42	CO SKW	25.34
Embraer ERJ145	AE3007A1E	541	CO TCF	25.34
Embraer ERJ170	CF34-8E5 LEC (8GE108)	1,948	CO TCF	25.34
Embraer ERJ175	CF34-8E5A1 LEC (8GE105)	784	CO TCF	25.34
Total Commuter LTO		**36,746**		
General Aviation Aircraft				
Pilatus PC-12	PT6A-67B	981	GA CNS	25.34
Raytheon Beechjet 400	JT15D-5, -5A, -5B	41	GA CNS	25.34
Cessna 560 Citation Excel	JT15D-5, -5A, -5B	944	GA EJA	25.34

Table I-4 2016 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type (Continued)

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
General Aviation Aircraft (Cont'd.)				
Cessna 680 Citation Sovereign	PW308C	407	GA EJA	25.34
Cessna 750 Citation X	AE3007C Type 2	392	GA EJA	25.34
Bombardier Learjet 45	TFE731-2-2B	380	GA EJA	25.34
Dassault Falcon 2000	PW308C	322	GA EJA	25.34
Gulfstream G400	TAY Mk611-8	77	GA EJM	25.34
Gulfstream G500	BR700-710A1-10 (4BR008)	71	GA EJM	25.34
Bombardier Challenger 300	AE3007A1 Type 2	53	GA EJM	25.34
Bombardier Learjet 45	TFE731-2-2B	41	GA EJM	25.34
Raytheon Hawker 800	TFE731-3	32	GA EJM	25.34
Raytheon Super King Air 300	PT6A-60A	358	GA GAJ	25.34
Raytheon Super King Air 300	PT6A-60A	121	GA GAJ	25.34
Cessna 560 Citation XLS	JT15D-5, -5A, -5B	96	GA GAJ	25.34
Cessna 560 Citation V	JT15D-5, -5A, -5B	5	GA GAJ	25.34
Bombardier Learjet 60	TFE731-2/2A	4	GA GAJ	25.34
Pilatus PC-12	PT6A-67B	891	GA GPD	25.34
Cessna 525 CitationJet	JT15D-1 series	5	GA GPD	25.34
Bombardier Challenger 300	AE3007A1 Type 2	271	GA LXJ	25.34
Bombardier Learjet 60	TFE731-2/2A	46	GA LXJ	25.34
Gulfstream G400	TAY Mk611-8	43	GA LXJ	25.34
Bombardier Challenger 600	CF34-3B	24	GA LXJ	25.34
Bombardier Learjet 45	TFE731-2-2B	22	GA LXJ	25.34
Cessna 172 Skyhawk	TSIO-360C	67	GA NGF	25.34
Raytheon Beech Bonanza 36	TIO-540-J2B2	57	GA NGF	25.34
Cessna 182	IO-360-B	56	GA NGF	25.34
Raytheon Beech Bonanza 36	TIO-540-J2B2	46	GA NGF	25.34
Raytheon Beech Baron 58	TIO-540-J2B2	42	GA NGF	25.34
Bombardier Learjet 45	TFE731-2-2B	97	GA OPT	25.34
Cessna 750 Citation X	AE3007C Type 2	29	GA OPT	25.34
Raytheon Beechjet 400	JT15D-5, -5A, -5B	29	GA OPT	25.34

Table I-4 2016 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type (Continued)

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
General Aviation Aircraft (Cont'd.)				
Embraer ERJ135	AE3007A1/3 Type 3 (reduced emissions)	18	GA OPT	25.34
Raytheon Beechjet 400	JT15D-5, -5A, -5B	349	GA TMC	25.34
Raytheon Hawker 800	TFE731-3	194	GA TMC	25.34
Bombardier Challenger 600	CF34-3B	17	GA TMC	25.34
Gulfstream G400	TAY Mk611-8	1,336	GA	25.34
Bombardier Challenger 600	CF34-3B	1,249	GA	25.34
Gulfstream G500	BR700-710A1-10 (4BR008)	1,161	GA	25.34
Dassault Falcon 2000	PW308C	953	GA	25.34
Raytheon Hawker 800	TFE731-3	908	GA	25.34
Raytheon Super King Air 200	PT6A-42	736	GA	25.34
Bombardier Challenger 300	AE3007A1 Type 2	643	GA	25.34
Raytheon Hawker 800	TFE731-3	194	GA TMC	25.34
Bombardier Challenger 600	CF34-3B	17	GA TMC	25.34
Gulfstream G400	TAY Mk611-8	1,336	GA	25.34
Bombardier Challenger 600	CF34-3B	1,249	GA	25.34
Gulfstream G500	BR700-710A1-10 (4BR008)	1,161	GA	25.34
Dassault Falcon 2000	PW308C	953	GA	25.34
Raytheon Hawker 800	TFE731-3	908	GA	25.34
Raytheon Super King Air 200	PT6A-42	736	GA	25.34
Bombardier Challenger 300	AE3007A1 Type 2	643	GA	25.34
Dassault Falcon 900	TFE731-3	552	GA	25.34
Cessna 525 CitationJet	JT15D-1 series	544	GA	25.34
Bombardier Global Express	BR700-710A2-20	483	GA	25.34
Cessna 750 Citation X	AE3007C Type 2	123	GA XOJ	25.34
Bombardier Challenger 300	AE3007A1 Type 2	95	GA XOJ	25.34
Total General Aviation Aircraft LTOs		**15,411**		
Total Fleet LTOs		**195,613**		

Source: KBE, HMMH, and FAA ASPM 2017.

Ground Service Equipment Time-in-Mode Survey

A GSE time-in-mode (TIM) survey was conducted at Logan Airport on June 27-28, 2017. The purpose of the GSE TIM survey was to provide up-to-date GSE operating times, which directly affects GSE emissions. The last GSE TIM survey was conducted in 2012 in support of the *2011 ESPR*. The TIM is the average time that GSE and aircraft auxiliary power units (APUs) operate during a single aircraft LTO cycle. The surveyed TIM is used in place of the default TIM values in AEDT, thus yielding GSE emissions that best reflect the conditions at Logan Airport. The TIM survey focused on the most prevalent airlines (e.g., Southwest, JetBlue, American, Delta, and United) and the most common aircraft types, such as narrow body air carriers (e.g., A320, A321, B737, B757, etc.) and large commuter aircraft (e.g., ERJ170, ERJ190, CRJ700, CRJ900, etc.). The TIMs are provided in **Table I-5**.

Table I-5 GSE Time-in-Mode (minutes)

GSE Type	Narrow-Body Air Carriers	Large Commuter Aircraft
Aircraft Tractor	6.37	7.13
Baggage Tractor	27.23	17.43
Belt Loader	26.85	14.88
Cabin Service Truck	2.07	0.53
Catering Truck	11.30	13.28
Hydrant Truck	3.73	2.53
Lavatory Truck	4.82	2.45
Service Truck	0.12	0.57
Water Service Truck	1.65	0.75
Auxiliary Power Unit (APU)	16.63	14.70

Source: KBE 2017.
Notes: GSE TIM survey conducted by KBE with assistance from Massport (security escorts) on June 27-28, 2017.

Ground Service Equipment/Alternative Fuels Conversion

For the 2016 analyses, GSE emissions were calculated using AEDT emission factors which are based on EPA NONROAD2005 model in combination with the recently updated GSE time-in-mode survey and the GSE fuel types obtained from the Logan Airport Vehicle Aerodrome Permit Application. In this way, the most up-to-date GSE fleet operational, conversion, and emissions characteristics are used (**Table I-6**).

Table I-6 Ground Service Equipment Alternative Fuel Conversion Summary (kg/day)

Year	Pollutant	Percent Reduction	Calculated Emissions without Reduction	Reduction from AFVs	Calculated Emissions with Reduction
2000	Volatile Organic Compounds (VOCs)	13.72%	178	24	154
	Oxides of Nitrogen (NO_x)	9.87%	369	36	333
	Carbon Monoxide (CO)	12.88%	6,124	789	5,335
2001	VOCs	13.72%	166	23	143
	NO_x	9.87%	338	33	305
	CO	12.88%	5,960	768	5,193
2002	VOCs	13.6%	286	39	247
	NO_x	8.0%	350	28	322
	CO	16.3%	6,174	1,004	5,170
2003	VOCs	13.8%	263	36	227
	NO_x	8.0%	316	25	291
	CO	16.4%	5,692	934	4,758
2004	VOCs	11.9%	212	25	187
	NO_x	6.6%	357	24	333
	CO	15.4%	4,236	650	3,586
2005	VOCs	12.2%	203	25	178
	NO_x	6.9%	335	23	312
	CO	15.4%	4,175	643	3,531
	$PM_{10}/PM_{2.5}$	9.9%	11	1	10
2006	VOCs	10.7%	86	9	77

Table I-6 Ground Service Equipment Alternative Fuel Conversion Summary (kg/day) (Continued)

Year	Pollutant	Percent Reduction	Calculated Emissions without Reduction	Reduction from AVFs	Calculated Emission with Reduction
	NO_x	7.5%	324	24	300
	CO	13.8%	1,841	255	1,586
	$PM_{10}/PM_{2.5}$	10.8%	10	1	9
2007	VOCs	8.2%	85	7	78
	NO_x	5.1%	315	16	299
	CO	10.4%	2,124	220	1,904
	$PM_{10}/PM_{2.5}$	5.9%	10	<1	10
2008	VOCs	8.3%	72	6	66
	NO_x	4.8%	270	13	257
	CO	10.2%	1,792	183	1,609
	$PM_{10}/PM_{2.5}$	5.6%	16	<1	15
2009	VOCs	8.2%	61	5	56
	NO_x	4.8%	230	11	219
	CO	10.0%	1,516	152	1,364
	$PM_{10}/PM_{2.5}$	3.5%	14	<1	14
2010	VOCs	7.5%	53	4	49
	NO_x	3.9%	206	8	198
	CO	8.5%	1,335	113	1,222
	$PM_{10}/PM_{2.5}$	2.5%	13	<1	13
2011	VOCs	13.2%	38	5	33
	NO_x	7.5%	188	14	173
	CO	16.7%	834	139	694
	$PM_{10}/PM_{2.5}$	5.5%	14	1	13
2012	VOCs	11.8%	34	4	30
	NO_x	6.8%	176	12	164

Table I-6 Ground Service Equipment Alternative Fuel Conversion Summary (kg/day) (Continued)

Year	Pollutant	Percent Reduction	Calculated Emissions without Reduction	Reduction from AVFs	Calculated Emission with Reduction
	CO	16.3%	738	120	618
	$PM_{10}/PM_{2.5}$	4.9%	13	<1	13
2013	VOCs	10.3%	29	3	26
	NO_x	6.5%	155	10	145
	CO	15.9%	634	101	533
	$PM_{10}/PM_{2.5}$	5.0%	12	<1	12
2014	VOCs	11.5%	26	3	23
	NO_x	5.6%	142	8	134
	CO	15.4%	572	88	484
	$PM_{10}/PM_{2.5}$	4.8%	12	<1	12
2015	VOCs	4.5%	22	1	21
	NO_x	5.2%	135	7	128
	CO	15.2%	521	79	442
	$PM_{10}/PM_{2.5}$	14.3%	14	2	12
2016	VOCs	9.0%	26	2	24
	NO_x	3.8%	173	6	167
	CO	13.5%	560	67	493
	$PM_{10}/PM_{2.5}$	2.6%	15	<1	15

Source: KBE and Massport.

Notes: 2000 and 2001 analyses used EDMS v4.03. 2002 and 2003 analyses used EDMS v4.11, which used updated emission factors from the NONROAD2002 Model. 2004 analyses used EDMS v4.21, which again used emission factors from EPA NONROAD2002 Model. 2005 analysis used EDMS v4.5, which used emission factors from EPA NONROAD2002 Model. 2006 analysis used EDMS v5.0.1, which used emission factors from EPA NONROAD2005 Model. 2007 analysis used EDMS v5.0.2, which used emission factors from EPA NONROAD2005 Model. 2008 analysis used EDMS v5.1, which used emission factors from EPA NONROAD2005 Model. 2009 analysis used EDMS v5.1.2, which used emission factors from EPA NONROAD2005 Model. 2010, 2011, and 2012 analysis used EDMS v5.1.3, which used emission factors from EPA NONROAD2005 Model. 2013, 2014, 2015, and 2016 used AEDT2c SP2, which used emission factors from EPA NONROAD2005 Model.

Motor Vehicle Emissions

For the 2016 analysis, the motor vehicle emission factor model MOVES2014a was used. The resultant emission factors were multiplied by average daily vehicle miles to calculate daily emissions. The on-Airport traffic data are summarized in the vehicle miles traveled (VMT) analyses of Appendix G, *Ground Access*. Due to the new roadway configuration of the Ted Williams Tunnel, through-traffic no longer traverses Airport property. Therefore, as of 2003, emissions from these vehicles are no longer included as part of the Logan Airport emissions inventory. Further, MOVES2014a was used to obtain vehicle emissions at idle to estimate parking and curbside motor vehicle emissions. Idling emissions are determined for a unit of time and multiplied by total idling time to reach the associated emissions. The input and output files of MOVES2014a are included as **Tables I-7** and **I-8.**

Table I-7 MOVES2014a Sample Input File for 2016


```
<runspec version="MOVES2014a-20151201">
    <description><![CDATA[2016 ESPR Summer Passenger Car/Truck
Gas/Diesel/Ethanol
at 0-50 mph]]></description>
    <models>
        <model value="ONROAD"/>
    </models>
    <modelscale value="Inv"/>
    <modeldomain value="PROJECT"/>
    <geographicselections>
        <geographicselection type="COUNTY" key="25025" description="MASSACHUSETTS - Suffolk County"/>
    </geographicselections>
    <timespan>
        <year key="2016"/>
        <month id="7"/>
        <day id="5"/>
        <beginhour id="15"/>
        <endhour id="15"/>
        <aggregateBy key="Hour"/>
    </timespan>
    <onroadvehicleselections>
        <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="21" sourcetypename="Passenger Car"/>
        <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="31" sourcetypename="Passenger Truck"/>
        <onroadvehicleselection fueltypeid="5" fueltypedesc="Ethanol (E-85)" sourcetypeid="21" sourcetypename="Passenger Car"/>
        <onroadvehicleselection fueltypeid="5" fueltypedesc="Ethanol (E-85)" sourcetypeid="31" sourcetypename="Passenger Truck"/>
        <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="21" sourcetypename="Passenger Car"/>
        <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="31" sourcetypename="Passenger Truck"/>
    </onroadvehicleselections>
    <offroadvehicleselections>
    </offroadvehicleselections>
    <offroadvehiclesccs>
    </offroadvehiclesccs>
    <roadtypes separateramps="false">
        <roadtype roadtypeid="1" roadtypename="Off-Network" modelCombination="M1"/>
        <roadtype roadtypeid="5" roadtypename="Urban Unrestricted Access" modelCombination="M1"/>
    </roadtypes>
    <pollutantprocessassociations>
        <pollutantprocessassociation pollutantkey="58" pollutantname="Aluminum" processkey="1" processname="Running Exhaust"/>
        <pollutantprocessassociation pollutantkey="58" pollutantname="Aluminum" processkey="2" processname="Start Exhaust"/>
        <pollutantprocessassociation pollutantkey="58" pollutantname="Aluminum" processkey="15" processname="Crankcase Running
Exhaust"/>
        <pollutantprocessassociation pollutantkey="58" pollutantname="Aluminum" processkey="16" processname="Crankcase Start
Exhaust"/>
        <pollutantprocessassociation pollutantkey="58" pollutantname="Aluminum" processkey="17" processname="Crankcase Extended
Idle Exhaust"/>
```

<pollutantprocessassociation pollutantkey="58" pollutantname="Aluminum" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="58" pollutantname="Aluminum" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="36" pollutantname="Ammonium (NH4)" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="36" pollutantname="Ammonium (NH4)" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="36" pollutantname="Ammonium (NH4)" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="36" pollutantname="Ammonium (NH4)" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="36" pollutantname="Ammonium (NH4)" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="36" pollutantname="Ammonium (NH4)" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="36" pollutantname="Ammonium (NH4)" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="90" pollutantname="Atmospheric CO2" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="90" pollutantname="Atmospheric CO2" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="90" pollutantname="Atmospheric CO2" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="90" pollutantname="Atmospheric CO2" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="121" pollutantname="CMAQ5.0 Unspeciated (PMOTHR)" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="121" pollutantname="CMAQ5.0 Unspeciated (PMOTHR)" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="121" pollutantname="CMAQ5.0 Unspeciated (PMOTHR)" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="121" pollutantname="CMAQ5.0 Unspeciated (PMOTHR)" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="121" pollutantname="CMAQ5.0 Unspeciated (PMOTHR)" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="121" pollutantname="CMAQ5.0 Unspeciated (PMOTHR)" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="121" pollutantname="CMAQ5.0 Unspeciated (PMOTHR)" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="98" pollutantname="CO2 Equivalent" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="98" pollutantname="CO2 Equivalent" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="98" pollutantname="CO2 Equivalent" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="98" pollutantname="CO2 Equivalent" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="55" pollutantname="Calcium" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="55" pollutantname="Calcium" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="55" pollutantname="Calcium" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="55" pollutantname="Calcium" processkey="16" processname="Crankcase Start Exhaust"/>

<pollutantprocessassociation pollutantkey="55" pollutantname="Calcium" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="55" pollutantname="Calcium" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="55" pollutantname="Calcium" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="2" pollutantname="Carbon Monoxide (CO)" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="2" pollutantname="Carbon Monoxide (CO)" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="2" pollutantname="Carbon Monoxide (CO)" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="2" pollutantname="Carbon Monoxide (CO)" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="2" pollutantname="Carbon Monoxide (CO)" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="2" pollutantname="Carbon Monoxide (CO)" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="2" pollutantname="Carbon Monoxide (CO)" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="51" pollutantname="Chloride" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="51" pollutantname="Chloride" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="51" pollutantname="Chloride" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="51" pollutantname="Chloride" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="51" pollutantname="Chloride" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="51" pollutantname="Chloride" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="51" pollutantname="Chloride" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="118" pollutantname="Composite - NonECPM" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="118" pollutantname="Composite - NonECPM" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="118" pollutantname="Composite - NonECPM" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="118" pollutantname="Composite - NonECPM" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="118" pollutantname="Composite - NonECPM" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="118" pollutantname="Composite - NonECPM" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="118" pollutantname="Composite - NonECPM" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="112" pollutantname="Elemental Carbon" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="112" pollutantname="Elemental Carbon" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="112" pollutantname="Elemental Carbon" processkey="15" processname="Crankcase Running Exhaust"/>

<pollutantprocessassociation pollutantkey="112" pollutantname="Elemental Carbon" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="112" pollutantname="Elemental Carbon" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="112" pollutantname="Elemental Carbon" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="112" pollutantname="Elemental Carbon" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="119" pollutantname="H2O (aerosol)" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="119" pollutantname="H2O (aerosol)" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="119" pollutantname="H2O (aerosol)" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="119" pollutantname="H2O (aerosol)" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="119" pollutantname="H2O (aerosol)" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="119" pollutantname="H2O (aerosol)" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="119" pollutantname="H2O (aerosol)" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="59" pollutantname="Iron" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="59" pollutantname="Iron" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="59" pollutantname="Iron" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="59" pollutantname="Iron" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="59" pollutantname="Iron" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="59" pollutantname="Iron" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="59" pollutantname="Iron" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="54" pollutantname="Magnesium" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="54" pollutantname="Magnesium" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="54" pollutantname="Magnesium" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="54" pollutantname="Magnesium" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="54" pollutantname="Magnesium" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="54" pollutantname="Magnesium" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="54" pollutantname="Magnesium" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="66" pollutantname="Manganese Compounds" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="17" processname="Crankcase Extended Idle Exhaust"/>

<pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="35" pollutantname="Nitrate (NO3)" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="35" pollutantname="Nitrate (NO3)" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="35" pollutantname="Nitrate (NO3)" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="35" pollutantname="Nitrate (NO3)" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="35" pollutantname="Nitrate (NO3)" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="35" pollutantname="Nitrate (NO3)" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="35" pollutantname="Nitrate (NO3)" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="6" pollutantname="Nitrous Oxide (N2O)" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="6" pollutantname="Nitrous Oxide (N2O)" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="6" pollutantname="Nitrous Oxide (N2O)" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="6" pollutantname="Nitrous Oxide (N2O)" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="11" processname="Evap Permeation"/>
<pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="13" processname="Evap Fuel Leaks"/>
<pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="122" pollutantname="Non-carbon Organic Matter (NCOM)" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="122" pollutantname="Non-carbon Organic Matter (NCOM)" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="122" pollutantname="Non-carbon Organic Matter (NCOM)" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="122" pollutantname="Non-carbon Organic Matter (NCOM)" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="122" pollutantname="Non-carbon Organic Matter (NCOM)" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="122" pollutantname="Non-carbon Organic Matter (NCOM)" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="122" pollutantname="Non-carbon Organic Matter (NCOM)" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="111" pollutantname="Organic Carbon" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="111" pollutantname="Organic Carbon" processkey="2" processname="Start Exhaust"/>

<pollutantprocessassociation pollutantkey="111" pollutantname="Organic Carbon" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="111" pollutantname="Organic Carbon" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="111" pollutantname="Organic Carbon" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="111" pollutantname="Organic Carbon" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="111" pollutantname="Organic Carbon" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="53" pollutantname="Potassium" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="53" pollutantname="Potassium" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="53" pollutantname="Potassium" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="53" pollutantname="Potassium" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="53" pollutantname="Potassium" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="53" pollutantname="Potassium" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="53" pollutantname="Potassium" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="100" pollutantname="Primary Exhaust PM10 - Total" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="100" pollutantname="Primary Exhaust PM10 - Total" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="100" pollutantname="Primary Exhaust PM10 - Total" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="100" pollutantname="Primary Exhaust PM10 - Total" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="100" pollutantname="Primary Exhaust PM10 - Total" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="100" pollutantname="Primary Exhaust PM10 - Total" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="100" pollutantname="Primary Exhaust PM10 - Total" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="1" processname="Running Exhaust"/>

<pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="106" pollutantname="Primary PM10 - Brakewear Particulate" processkey="9" processname="Brakewear"/>
<pollutantprocessassociation pollutantkey="107" pollutantname="Primary PM10 - Tirewear Particulate" processkey="10" processname="Tirewear"/>
<pollutantprocessassociation pollutantkey="116" pollutantname="Primary PM2.5 - Brakewear Particulate" processkey="9" processname="Brakewear"/>
<pollutantprocessassociation pollutantkey="117" pollutantname="Primary PM2.5 - Tirewear Particulate" processkey="10" processname="Tirewear"/>
<pollutantprocessassociation pollutantkey="57" pollutantname="Silicon" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="57" pollutantname="Silicon" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="57" pollutantname="Silicon" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="57" pollutantname="Silicon" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="57" pollutantname="Silicon" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="57" pollutantname="Silicon" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="57" pollutantname="Silicon" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="52" pollutantname="Sodium" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="52" pollutantname="Sodium" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="52" pollutantname="Sodium" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="52" pollutantname="Sodium" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="52" pollutantname="Sodium" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="52" pollutantname="Sodium" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="52" pollutantname="Sodium" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="115" pollutantname="Sulfate Particulate" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="115" pollutantname="Sulfate Particulate" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="115" pollutantname="Sulfate Particulate" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="115" pollutantname="Sulfate Particulate" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="115" pollutantname="Sulfate Particulate" processkey="17" processname="Crankcase Extended Idle Exhaust"/>

<pollutantprocessassociation pollutantkey="115" pollutantname="Sulfate Particulate" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="115" pollutantname="Sulfate Particulate" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="31" pollutantname="Sulfur Dioxide (SO2)" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="31" pollutantname="Sulfur Dioxide (SO2)" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="31" pollutantname="Sulfur Dioxide (SO2)" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="31" pollutantname="Sulfur Dioxide (SO2)" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="31" pollutantname="Sulfur Dioxide (SO2)" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="31" pollutantname="Sulfur Dioxide (SO2)" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="31" pollutantname="Sulfur Dioxide (SO2)" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="56" pollutantname="Titanium" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="56" pollutantname="Titanium" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="56" pollutantname="Titanium" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="56" pollutantname="Titanium" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="56" pollutantname="Titanium" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="56" pollutantname="Titanium" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="56" pollutantname="Titanium" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="91" pollutantname="Total Energy Consumption" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="91" pollutantname="Total Energy Consumption" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="91" pollutantname="Total Energy Consumption" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="91" pollutantname="Total Energy Consumption" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="11" processname="Evap Permeation"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="13" processname="Evap Fuel Leaks"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="1" processname="Running Exhaust"/>

```
            <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="2" processname="Start Exhaust"/>
            <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="11" processname="Evap Permeation"/>
            <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="13" processname="Evap Fuel Leaks"/>
            <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="15" processname="Crankcase Running Exhaust"/>
            <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="16" processname="Crankcase Start Exhaust"/>
            <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
            <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="90" processname="Extended Idle Exhaust"/>
            <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="91" processname="Auxiliary Power Exhaust"/>
      </pollutantprocessassociations>
      <databaseselections>
            <databaseselection servername="" databasename="mylevs" description=""/>
      </databaseselections>
      <internalcontrolstrategies>
<internalcontrolstrategy classname="gov.epa.otaq.moves.master.implementation.ghg.internalcontrolstrategies.rateofprogress.RateOfProgressStrategy"><![CDATA[
useParameters	No

]]></internalcontrolstrategy>
      </internalcontrolstrategies>
      <inputdatabase servername="" databasename="" description=""/>
      <uncertaintyparameters uncertaintymodeenabled="false" numberofrunspersimulation="0" numberofsimulations="0"/>
      <geographicoutputdetail description="LINK"/>
      <outputemissionsbreakdownselection>
            <modelyear selected="false"/>
            <fueltype selected="false"/>
            <fuelsubtype selected="false"/>
            <emissionprocess selected="false"/>
            <onroadoffroad selected="true"/>
            <roadtype selected="false"/>
            <sourceusetype selected="true"/>
            <movesvehicletype selected="false"/>
            <onroadscc selected="false"/>
            <estimateuncertainty selected="false" numberOfIterations="2" keepSampledData="false" keepIterations="false"/>
            <sector selected="false"/>
            <engtechid selected="false"/>
            <hpclass selected="false"/>
            <regclassid selected="false"/>
      </outputemissionsbreakdownselection>
      <outputdatabase servername="" databasename="BOS2016s_pcpt_out" description=""/>
      <outputtimestep value="Hour"/>
      <outputvmtdata value="true"/>
```

```
    <outputsho value="true"/>
    <outputsh value="true"/>
    <outputshp value="true"/>
    <outputshidling value="true"/>
    <outputstarts value="true"/>
    <outputpopulation value="true"/>
    <scaleinputdatabase servername="localhost" databasename="bos2016s_pcpt_in" description=""/>
    <pmsize value="0"/>
    <outputfactors>
        <timefactors selected="true" units="Hours"/>
        <distancefactors selected="true" units="Miles"/>
        <massfactors selected="true" units="Grams" energyunits="Million BTU"/>
    </outputfactors>
    <savedata>

    </savedata>

    <donotexecute>

    </donotexecute>

    <generatordatabase shouldsave="false" servername="" databasename="" description=""/>
        <donotperformfinalaggregation selected="false"/>
    <lookuptableflags scenarioid="" truncateoutput="true" truncateactivity="true" truncatebaserates="true"/>
</runspec>
```


Source: KBE and Massport.

Table I-8 MOVES2014a Sample Output File for 2016

```
MasterKey MOVESRunID iterationID yearID monthID dayID hourID stateID countyID zoneID linkID pollutantID processID
sourceTypeID regClassId fuelTypeID modelYearID roadTypeID SCC emissionQuant activityTypeID activity emissionRate
massUnits distanceUnits
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 122 NULL 31 0 0 0 0 0
0.00437768 1 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 121 NULL 31 0 0 0 0 0
0.00170605 1 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 119 NULL 31 0 0 0 0 0 0
1 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 118 NULL 31 0 0 0 0 0
0.0336086 1 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 117 NULL 31 0 0 0 0 0 0
1 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 116 NULL 31 0 0 0 0 0 0
1 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 115 NULL 31 0 0 0 0 0
0.00303332 1 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 112 NULL 31 0 0 0 0 0
0.0135009 1 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 111 NULL 31 0 0 0 0 0
0.021888399 1 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 110 NULL 31 0 0 0 0 0
0.0471095 1 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 107 NULL 31 0 0 0 0 0 0
1 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 106 NULL 31 0 0 0 0 0 0
1 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 100 NULL 31 0 0 0 0 0
0.052074101 1 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 98 NULL 31 0 0 0 0 0
4689.25 1 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 91 NULL 31 0 0 0 0 0
0.061799474 1 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 90 NULL 31 0 0 0 0 0
4688.810059 1 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 87 NULL 31 0 0 0 0 0
0.752602875 1 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 79 NULL 31 0 0 0 0 0
0.70127213 1 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 66 NULL 31 0 0 0 0 0
0.000818762 1 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 59 NULL 31 0 0 0 0 0
0.000481374 1 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 58 NULL 31 0 0 0 0 0
0.000109358 1 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 57 NULL 31 0 0 0 0 0
0.000216864 1 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 56 NULL 31 0 0 0 0 0
1.33E-051 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 55 NULL 31 0 0 0 0 0
0.000545211 1 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 54 NULL 31 0 0 0 0 0
4.09E-051 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 53 NULL 31 0 0 0 0 0
3.19E-051 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 52 NULL 31 0 0 0 0 0
5.29E-051 0 NULL g mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 22 51 NULL 31 0 0 0 0 0
0.000108801 1 0 NULL g mi
```

1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	22	36	NULL	31	0	0	0	0	0	0.000821018	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	22	35	NULL	31	0	0	0	0	0	0.000181631	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	22	31	NULL	31	0	0	0	0	0	0.0918229	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	22	5	NULL	31	0	0	0	0	0	0.017741052	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	22	3	NULL	31	0	0	0	0	0	1.661653042	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	22	2	NULL	31	0	0	0	0	0	13.891914437	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,22,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	22	1	NULL	31	0	0	0	0	0	0.718864202	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	122	NULL	21	0	0	0	0	0	0.0045505	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	121	NULL	21	0	0	0	0	0	0.00186946	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	119	NULL	21	0	0	0	0	0	0	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	118	NULL	21	0	0	0	0	0	0.033500101	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	117	NULL	21	0	0	0	0	0	0	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	116	NULL	21	0	0	0	0	0	0	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	115	NULL	21	0	0	0	0	0	0.00130928	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	112	NULL	21	0	0	0	0	0	0.00571219	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	111	NULL	21	0	0	0	0	0	0.022752499	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	110	NULL	21	0	0	0	0	0	0.039212301	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	107	NULL	21	0	0	0	0	0	0	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	106	NULL	21	0	0	0	0	0	0	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	100	NULL	21	0	0	0	0	0	0.044315699	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	98	NULL	21	0	0	0	0	0	3604.77002	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	91	NULL	21	0	0	0	0	0	0.047527436	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	90	NULL	21	0	0	0	0	0	3604.280029	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	87	NULL	21	0	0	0	0	0	0.955521941	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	79	NULL	21	0	0	0	0	0	0.89418292	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	66	NULL	21	0	0	0	0	0	0.000803656	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	59	NULL	21	0	0	0	0	0	0.000745486	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	58	NULL	21	0	0	0	0	0	0.000132223	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	57	NULL	21	0	0	0	0	0	0.000132695	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	56	NULL	21	0	0	0	0	0	1.39E-05	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	55	NULL	21	0	0	0	0	0	0.000589248	1	0	NULL	g	mi

```
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	54	NULL	21	0	0	0	0	0
	5.91E-051	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	53	NULL	21	0	0	0	0	0
	3.48E-051	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	52	NULL	21	0	0	0	0	0
	1.72E-051	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	51	NULL	21	0	0	0	0	0
	4.30E-051	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	36	NULL	21	0	0	0	0	0
	0.00113269	1	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	35	NULL	21	0	0	0	0	0
	0.0001181131	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	31	NULL	21	0	0	0	0	0
	0.0715200011	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	5	NULL	21	0	0	0	0	0
	0.0200134571	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	3	NULL	21	0	0	0	0	0
	1.2766045331	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	2	NULL	21	0	0	0	0	0
	5.0523424151	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,21,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	21	1	NULL	21	0	0	0	0	0
	0.9139379261	0	NULL	g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	122	NULL	31	0	0	0	0	0
	0.0004391671	1	0.000439167g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	121	NULL	31	0	0	0	0	0
	0.0001791871	1	0.000179187g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	119	NULL	31	0	0	0	0	0	0
	1	1	0	g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	118	NULL	31	0	0	0	0	0
	0.00327079	1	1	0.00327079	g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	117	NULL	31	0	0	0	0	0
	0.0012442	1	1	0.0012442	g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	116	NULL	31	0	0	0	0	0
	0.0014	1	1	0.0014	g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	115	NULL	31	0	0	0	0	0
	0.0001686011	1	0.000168601g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	112	NULL	31	0	0	0	0	0
	0.00121482	1	1	0.00121482	g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	111	NULL	31	0	0	0	0	0
	0.00219583	1	1	0.00219583	g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	110	NULL	31	0	0	0	0	0
	0.00448561	1	1	0.00448561	g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	107	NULL	31	0	0	0	0	0
	0.00829473	1	1	0.00829473	g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	106	NULL	31	0	0	0	0	0
	0.0112	1	1	0.0112	g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	100	NULL	31	0	0	0	0	0
	0.00503061	1	1	0.00503061	g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	98	NULL	31	0	0	0	0	0
	418.36700441	1	418.3670044g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	91	NULL	31	0	0	0	0	0
	0.0055128741	1	0.005512874g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	90	NULL	31	0	0	0	0	0
	418.27801511	1	418.2780151g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	87	NULL	31	0	0	0	0	0
	0.1064201971	1	0.106420197g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	79	NULL	31	0	0	0	0	0
	0.0990578981	1	0.099057898g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	66	NULL	31	0	0	0	0	0
	1.64E-051	1	1.64E-05g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	59	NULL	31	0	0	0	0	0
	6.94E-051	1	6.94E-05g	mi
```

1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	58	NULL	31	0	0	0	0	0	1.26E-05	1	1	1.26E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	57	NULL	31	0	0	0	0	0	1.37E-05	1	1	1.37E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	56	NULL	31	0	0	0	0	0	1.34E-06	1	1	1.34E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	55	NULL	31	0	0	0	0	0	5.66E-05	1	1	5.66E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	54	NULL	31	0	0	0	0	0	5.55E-06	1	1	5.55E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	53	NULL	31	0	0	0	0	0	3.34E-06	1	1	3.34E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	52	NULL	31	0	0	0	0	0	2.28E-06	1	1	2.28E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	51	NULL	31	0	0	0	0	0	4.86E-06	1	1	4.86E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	36	NULL	31	0	0	0	0	0	0.000106192	1	1	0.000106192	g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	35	NULL	31	0	0	0	0	0	1.21E-05	1	1	1.21E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	31	NULL	31	0	0	0	0	0	0.00818743	1	1	0.00818743	g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	5	NULL	31	0	0	0	0	0	0.003596358	1	1	0.003596358	g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	3	NULL	31	0	0	0	0	0	0.260831296	1	1	0.260831296	g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	2	NULL	31	0	0	0	0	0	2.533923388	1	1	2.533923388	g	mi
1,1,2016,7,5,15,25,25025,250250,20,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	20	1	NULL	31	0	0	0	0	0	0.102611698	1	1	0.102611698	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	122	NULL	31	0	0	0	0	0	0.000445066	1	1	0.000445066	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	121	NULL	31	0	0	0	0	0	0.000181432	1	1	0.000181432	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	119	NULL	31	0	0	0	0	0	0	1	1	0	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	118	NULL	31	0	0	0	0	0	0.00331308	1	1	0.00331308	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	117	NULL	31	0	0	0	0	0	0.0013404	1	1	0.0013404	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	116	NULL	31	0	0	0	0	0	0.00219603	1	1	0.00219603	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	115	NULL	31	0	0	0	0	0	0.000170062	1	1	0.000170062	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	112	NULL	31	0	0	0	0	0	0.00119351	1	1	0.00119351	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	111	NULL	31	0	0	0	0	0	0.00222533	1	1	0.00222533	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	110	NULL	31	0	0	0	0	0	0.00450659	1	1	0.00450659	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	107	NULL	31	0	0	0	0	0	0.00893608	1	1	0.00893608	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	106	NULL	31	0	0	0	0	0	0.017568201	1	1	0.017568201	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	100	NULL	31	0	0	0	0	0	0.00505381	1	1	0.00505381	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	98	NULL	31	0	0	0	0	0	427.2330017	1	1	427.2330017	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	91	NULL	31	0	0	0	0	0	0.005629692	1	1	0.005629692	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	90	NULL	31	0	0	0	0	0	427.1409912	1	1	427.1409912	g	mi

1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	87	NULL	31	0	0	0	0	0	0.108525284	1	1	0.108525284	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	79	NULL	31	0	0	0	0	0	0.101111598	1	1	0.101111598	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	66	NULL	31	0	0	0	0	0	1.82E-05	1	1	1.82E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	59	NULL	31	0	0	0	0	0	6.98E-05	1	1	6.98E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	58	NULL	31	0	0	0	0	0	1.27E-05	1	1	1.27E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	57	NULL	31	0	0	0	0	0	1.41E-05	1	1	1.41E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	56	NULL	31	0	0	0	0	0	1.36E-06	1	1	1.36E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	55	NULL	31	0	0	0	0	0	5.73E-05	1	1	5.73E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	54	NULL	31	0	0	0	0	0	5.58E-06	1	1	5.58E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	53	NULL	31	0	0	0	0	0	3.38E-06	1	1	3.38E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	52	NULL	31	0	0	0	0	0	2.35E-06	1	1	2.35E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	51	NULL	31	0	0	0	0	0	5.09E-06	1	1	5.09E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	36	NULL	31	0	0	0	0	0	0.00010705	1	1	0.00010705	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	35	NULL	31	0	0	0	0	0	1.24E-05	1	1	1.24E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	31	NULL	31	0	0	0	0	0	0.00836078	1	1	0.00836078	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	5	NULL	31	0	0	0	0	0	0.003693645	1	1	0.003693645	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	3	NULL	31	0	0	0	0	0	0.25458011	1	1	0.25458011	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	2	NULL	31	0	0	0	0	0	2.517087221	1	1	2.517087221	g	mi
1,1,2016,7,5,15,25,25025,250250,19,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	19	1	NULL	31	0	0	0	0	0	0.1047616	1	1	0.1047616	g	mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	18	122	NULL	31	0	0	0	0	0	0.00046558	1	1	0.00046558	g	mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	18	121	NULL	31	0	0	0	0	0	0.000189645	1	1	0.000189645	g	mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	18	119	NULL	31	0	0	0	0	0	0	1	1	0	g	mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	18	118	NULL	31	0	0	0	0	0	0.00346393	1	1	0.00346393	g	mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	18	117	NULL	31	0	0	0	0	0	0.00144464	1	1	0.00144464	g	mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	18	116	NULL	31	0	0	0	0	0	0.00307423	1	1	0.00307423	g	mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	18	115	NULL	31	0	0	0	0	0	0.000176824	1	1	0.000176824	g	mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	18	112	NULL	31	0	0	0	0	0	0.00119599	1	1	0.00119599	g	mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	18	111	NULL	31	0	0	0	0	0	0.0023279	1	1	0.0023279	g	mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	18	110	NULL	31	0	0	0	0	0	0.00465992	1	1	0.00465992	g	mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	18	107	NULL	31	0	0	0	0	0	0.00963098	1	1	0.00963098	g	mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	18	106	NULL	31	0	0	0	0	0	0.0245938	1	1	0.0245938	g	mi

1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 18 100 NULL 31 0 0 0 0 0
0.00522606 1 1 0.00522606 g mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 18 98 NULL 31 0 0 0 0 0
438.7279968 1 1 438.7279968 g mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 18 91 NULL 31 0 0 0 0 0
0.005781106 1 1 0.005781106 g mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 18 90 NULL 31 0 0 0 0 0
438.631012 1 1 438.631012 g mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 18 87 NULL 31 0 0 0 0 0
0.11164511 1 1 0.11164511 g mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 18 79 NULL 31 0 0 0 0 0
0.104209997 1 1 0.104209997 g mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 18 66 NULL 31 0 0 0 0 0
2.05E-051 1 2.05E-05g mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 18 59 NULL 31 0 0 0 0 0
7.25E-051 1 7.25E-05g mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 18 58 NULL 31 0 0 0 0 0
1.32E-051 1 1.32E-05g mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 18 57 NULL 31 0 0 0 0 0
1.50E-051 1 1.50E-05g mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 18 56 NULL 31 0 0 0 0 0
1.42E-061 1 1.42E-06g mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 18 55 NULL 31 0 0 0 0 0
5.99E-051 1 5.99E-05g mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 18 54 NULL 31 0 0 0 0 0
5.80E-061 1 5.80E-06g mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 18 53 NULL 31 0 0 0 0 0
3.54E-061 1 3.54E-06g mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 18 52 NULL 31 0 0 0 0 0
2.48E-061 1 2.48E-06g mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 18 51 NULL 31 0 0 0 0 0
5.47E-061 1 5.47E-06g mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 18 36 NULL 31 0 0 0 0 0
0.000111454 1 1 0.000111454 g mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 18 35 NULL 31 0 0 0 0 0
1.31E-051 1 1.31E-05g mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 18 31 NULL 31 0 0 0 0 0
0.00858492 1 1 0.00858492 g mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 18 5 NULL 31 0 0 0 0 0
0.003913358 1 1 0.003913358 g mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 18 3 NULL 31 0 0 0 0 0
0.249039963 1 1 0.249039963 g mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 18 2 NULL 31 0 0 0 0 0
2.586617231 1 1 2.586617231 g mi
1,1,2016,7,5,15,25,25025,250250,18,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 18 1 NULL 31 0 0 0 0 0
0.108077303 1 1 0.108077303 g mi
1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 122 NULL 31 0 0 0 0 0
0.000499927 1 1 0.000499927 g mi
1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 121 NULL 31 0 0 0 0 0
0.000203487 1 1 0.000203487 g mi
1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 119 NULL 31 0 0 0 0 0 0
1 1 0 g mi
1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 118 NULL 31 0 0 0 0 0
0.00371732 1 1 0.00371732 g mi
1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 117 NULL 31 0 0 0 0 0
0.001556 1 1 0.001556 g mi
1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 116 NULL 31 0 0 0 0 0
0.00413246 1 1 0.00413246 g mi
1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 115 NULL 31 0 0 0 0 0
0.000188512 1 1 0.000188512 g mi
1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 112 NULL 31 0 0 0 0 0
0.00121684 1 1 0.00121684 g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 111 NULL 31 0 0 0 0 0
0.00249963 1 1 0.00249963 g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 110 NULL 31 0 0 0 0 0
0.00493416 1 1 0.00493416 g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 107 NULL 31 0 0 0 0 0
0.0103734 1 1 0.0103734 g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 106 NULL 31 0 0 0 0 0
0.033059601 1 1 0.033059601 g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 100 NULL 31 0 0 0 0 0
0.00553441 1 1 0.00553441 g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 98 NULL 31 0 0 0 0 0
453.7569885 1 1 453.7569885 g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 91 NULL 31 0 0 0 0 0
0.005979039 1 1 0.005979039 g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 90 NULL 31 0 0 0 0 0
453.651001 1 1 453.651001 g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 87 NULL 31 0 0 0 0 0
0.115952313 1 1 0.115952313 g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 79 NULL 31 0 0 0 0 0
0.108516097 1 1 0.108516097 g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 66 NULL 31 0 0 0 0 0
2.34E-051 1 2.34E-05g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 59 NULL 31 0 0 0 0 0
7.73E-051 1 7.73E-05g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 58 NULL 31 0 0 0 0 0
1.42E-051 1 1.42E-05g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 57 NULL 31 0 0 0 0 0
1.63E-051 1 1.63E-05g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 56 NULL 31 0 0 0 0 0
1.53E-061 1 1.53E-06g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 55 NULL 31 0 0 0 0 0
6.43E-051 1 6.43E-05g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 54 NULL 31 0 0 0 0 0
6.19E-061 1 6.19E-06g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 53 NULL 31 0 0 0 0 0
3.79E-061 1 3.79E-06g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 52 NULL 31 0 0 0 0 0
2.70E-061 1 2.70E-06g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 51 NULL 31 0 0 0 0 0
6.02E-061 1 6.02E-06g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 36 NULL 31 0 0 0 0 0
0.000119138 1 1 0.000119138 g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 35 NULL 31 0 0 0 0 0
1.43E-051 1 1.43E-05g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 31 NULL 31 0 0 0 0 0
0.00887758 1 1 0.00887758 g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 5 NULL 31 0 0 0 0 0
0.004255366 1 1 0.004255366 g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 3 NULL 31 0 0 0 0 0
0.243295908 1 1 0.243295908 g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 2 NULL 31 0 0 0 0 0
2.730957508 1 1 2.730957508 g mi

1,1,2016,7,5,15,25,25025,250250,17,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 17 1 NULL 31 0 0 0 0 0
0.1127211 1 1 0.1127211 g mi

1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 16 122 NULL 31 0 0 0 0 0
0.000545325 1 1 0.000545325 g mi

1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 16 121 NULL 31 0 0 0 0 0
0.000221774 1 1 0.000221774 g mi

1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 16 119 NULL 31 0 0 0 0 0 0
1 1 0 g mi

1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 16 118 NULL 31 0 0 0 0 0
0.0040537 1 1 0.0040537 g mi

1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	117	NULL	31	0	0	0	0	0	0.0016765	1	1	0.0016765	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	116	NULL	31	0	0	0	0	0	0.00553236	1	1	0.00553236	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	115	NULL	31	0	0	0	0	0	0.0002054	1	1	0.0002054	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	112	NULL	31	0	0	0	0	0	0.00126867	1	1	0.00126867	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	111	NULL	31	0	0	0	0	0	0.00272662	1	1	0.00272662	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	110	NULL	31	0	0	0	0	0	0.00532236	1	1	0.00532236	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	107	NULL	31	0	0	0	0	0	0.0111767	1	1	0.0111767	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	106	NULL	31	0	0	0	0	0	0.0442589	1	1	0.0442589	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	100	NULL	31	0	0	0	0	0	0.00597	1	1	0.00597	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	98	NULL	31	0	0	0	0	0	479.0830078	1	1	479.0830078	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	91	NULL	31	0	0	0	0	0	0.006312671	1	1	0.006312671	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	90	NULL	31	0	0	0	0	0	478.9689941	1	1	478.9689941	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	87	NULL	31	0	0	0	0	0	0.121400006	1	1	0.121400006	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	79	NULL	31	0	0	0	0	0	0.113921002	1	1	0.113921002	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	66	NULL	31	0	0	0	0	0	2.73E-05	1	1	2.73E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	59	NULL	31	0	0	0	0	0	8.37E-05	1	1	8.37E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	58	NULL	31	0	0	0	0	0	1.54E-05	1	1	1.54E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	57	NULL	31	0	0	0	0	0	1.80E-05	1	1	1.80E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	56	NULL	31	0	0	0	0	0	1.67E-06	1	1	1.67E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	55	NULL	31	0	0	0	0	0	7.01E-05	1	1	7.01E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	54	NULL	31	0	0	0	0	0	6.71E-06	1	1	6.71E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	53	NULL	31	0	0	0	0	0	4.13E-06	1	1	4.13E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	52	NULL	31	0	0	0	0	0	2.99E-06	1	1	2.99E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	51	NULL	31	0	0	0	0	0	6.75E-06	1	1	6.75E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	36	NULL	31	0	0	0	0	0	0.000129304	1	1	0.000129304	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	35	NULL	31	0	0	0	0	0	1.58E-05	1	1	1.58E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	31	NULL	31	0	0	0	0	0	0.00937161	1	1	0.00937161	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	5	NULL	31	0	0	0	0	0	0.004640481	1	1	0.004640481	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	3	NULL	31	0	0	0	0	0	0.240565047	1	1	0.240565047	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	2	NULL	31	0	0	0	0	0	2.887135744	1	1	2.887135744	g	mi
1,1,2016,7,5,15,25,25025,250250,16,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	16	1	NULL	31	0	0	0	0	0	0.118506595	1	1	0.118506595	g	mi

1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 0.000610181 1 1 0.000610181 g mi	1	2016	7	5	15	25	25025	250250	15	122	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 0.00024788 1 1 0.00024788 g mi	1	2016	7	5	15	25	25025	250250	15	121	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 1 1 0 g mi	1	2016	7	5	15	25	25025	250250	15	119	NULL	31	0	0	0	0	0 0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 0.00454062 1 1 0.00454062 g mi	1	2016	7	5	15	25	25025	250250	15	118	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 0.00180606 1 1 0.00180606 g mi	1	2016	7	5	15	25	25025	250250	15	117	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 0.00732576 1 1 0.00732576 g mi	1	2016	7	5	15	25	25025	250250	15	116	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 0.00023576 1 1 0.00023576 g mi	1	2016	7	5	15	25	25025	250250	15	115	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 0.00145322 1 1 0.00145322 g mi	1	2016	7	5	15	25	25025	250250	15	112	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 0.0030509 1 1 0.0030509 g mi	1	2016	7	5	15	25	25025	250250	15	111	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 0.00599383 1 1 0.00599383 g mi	1	2016	7	5	15	25	25025	250250	15	110	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 0.0120404 1 1 0.0120404 g mi	1	2016	7	5	15	25	25025	250250	15	107	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 0.058606099 1 1 0.058606099 g mi	1	2016	7	5	15	25	25025	250250	15	106	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 0.00671969 1 1 0.00671969 g mi	1	2016	7	5	15	25	25025	250250	15	100	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 537.6270142 1 1 537.6270142 g mi	1	2016	7	5	15	25	25025	250250	15	98	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 0.007084184 1 1 0.007084184 g mi	1	2016	7	5	15	25	25025	250250	15	91	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 537.507019 1 1 537.507019 g mi	1	2016	7	5	15	25	25025	250250	15	90	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 0.127673104 1 1 0.127673104 g mi	1	2016	7	5	15	25	25025	250250	15	87	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 0.119943202 1 1 0.119943202 g mi	1	2016	7	5	15	25	25025	250250	15	79	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 3.28E-051 1 3.28E-05g mi	1	2016	7	5	15	25	25025	250250	15	66	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 9.30E-051 1 9.30E-05g mi	1	2016	7	5	15	25	25025	250250	15	59	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 1.72E-051 1 1.72E-05g mi	1	2016	7	5	15	25	25025	250250	15	58	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 2.04E-051 1 2.04E-05g mi	1	2016	7	5	15	25	25025	250250	15	57	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 1.86E-061 1 1.86E-06g mi	1	2016	7	5	15	25	25025	250250	15	56	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 7.84E-051 1 7.84E-05g mi	1	2016	7	5	15	25	25025	250250	15	55	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 7.46E-061 1 7.46E-06g mi	1	2016	7	5	15	25	25025	250250	15	54	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 4.62E-061 1 4.62E-06g mi	1	2016	7	5	15	25	25025	250250	15	53	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 3.46E-061 1 3.46E-06g mi	1	2016	7	5	15	25	25025	250250	15	52	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 7.74E-061 1 7.74E-06g mi	1	2016	7	5	15	25	25025	250250	15	51	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 0.000143917 1 1 0.000143917 g mi	1	2016	7	5	15	25	25025	250250	15	36	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 1.78E-051 1 1.78E-05g mi	1	2016	7	5	15	25	25025	250250	15	35	NULL	31	0	0	0	0	0
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001 0.0105167 1 1 0.0105167 g mi	1	2016	7	5	15	25	25025	250250	15	31	NULL	31	0	0	0	0	0

1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	15	5	NULL	31	0	0	0	0	0	0.00485863	1	1	0.00485863	g	mi
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	15	3	NULL	31	0	0	0	0	0	0.258709222	1	1	0.258709222	g	mi
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	15	2	NULL	31	0	0	0	0	0	2.965916395	1	1	2.965916395	g	mi
1,1,2016,7,5,15,25,25025,250250,15,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	15	1	NULL	31	0	0	0	0	0	0.124744698	1	1	0.124744698	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	122	NULL	31	0	0	0	0	0	0.000755474	1	1	0.000755474	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	121	NULL	31	0	0	0	0	0	0.000306653	1	1	0.000306653	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	119	NULL	31	0	0	0	0	0	0	1	1	0	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	118	NULL	31	0	0	0	0	0	0.00561965	1	1	0.00561965	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	117	NULL	31	0	0	0	0	0	0.00194578	1	1	0.00194578	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	116	NULL	31	0	0	0	0	0	0.00826578	1	1	0.00826578	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	115	NULL	31	0	0	0	0	0	0.000291024	1	1	0.000291024	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	112	NULL	31	0	0	0	0	0	0.00172933	1	1	0.00172933	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	111	NULL	31	0	0	0	0	0	0.00377736	1	1	0.00377736	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	110	NULL	31	0	0	0	0	0	0.00734897	1	1	0.00734897	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	107	NULL	31	0	0	0	0	0	0.0129719	1	1	0.0129719	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	106	NULL	31	0	0	0	0	0	0.066126198	1	1	0.066126198	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	100	NULL	31	0	0	0	0	0	0.00823882	1	1	0.00823882	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	98	NULL	31	0	0	0	0	0	601.4290161	1	1	601.4290161	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	91	NULL	31	0	0	0	0	0	0.007924982	1	1	0.007924982	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	90	NULL	31	0	0	0	0	0	601.2979736	1	1	601.2979736	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	87	NULL	31	0	0	0	0	0	0.137463138	1	1	0.137463138	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	79	NULL	31	0	0	0	0	0	0.129362106	1	1	0.129362106	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	66	NULL	31	0	0	0	0	0	4.09E-05	1	1	4.09E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	59	NULL	31	0	0	0	0	0	0.00011437	1	1	0.00011437	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	58	NULL	31	0	0	0	0	0	2.12E-05	1	1	2.12E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	57	NULL	31	0	0	0	0	0	2.56E-05	1	1	2.56E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	56	NULL	31	0	0	0	0	0	2.31E-06	1	1	2.31E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	55	NULL	31	0	0	0	0	0	9.70E-05	1	1	9.70E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	54	NULL	31	0	0	0	0	0	9.17E-06	1	1	9.17E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	53	NULL	31	0	0	0	0	0	5.71E-06	1	1	5.71E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	14	52	NULL	31	0	0	0	0	0	4.34E-06	1	1	4.34E-06	g	mi

1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 14 51 NULL 31 0 0 0 0 0
9.82E-061 1 9.82E-06g mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 14 36 NULL 31 0 0 0 0 0
0.0001773141 1 0.000177314 g mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 14 35 NULL 31 0 0 0 0 0
2.23E-051 1 2.23E-05g mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 14 31 NULL 31 0 0 0 0 0
0.0117668 1 1 0.0117668 g mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 14 5 NULL 31 0 0 0 0 0
0.00533265 1 1 0.00533265 g mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 14 3 NULL 31 0 0 0 0 0
0.27053839 1 1 0.27053839 g mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 14 2 NULL 31 0 0 0 0 0
3.5305728911 1 3.530572891 g mi
1,1,2016,7,5,15,25,25025,250250,14,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 14 1 NULL 31 0 0 0 0 0
0.1346327071 1 0.134632707 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 122 NULL 31 0 0 0 0 0
0.0008525881 1 0.000852588 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 121 NULL 31 0 0 0 0 0
0.0003451021 1 0.000345102 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 119 NULL 31 0 0 0 0 0 0
1 1 0 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 118 NULL 31 0 0 0 0 0
0.00634918 1 1 0.00634918 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 117 NULL 31 0 0 0 0 0
0.0020966 1 1 0.0020966 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 116 NULL 31 0 0 0 0 0
0.00985681 1 1 0.00985681 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 115 NULL 31 0 0 0 0 0
0.0003399741 1 0.000339974 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 112 NULL 31 0 0 0 0 0
0.0019461 1 1 0.0019461 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 111 NULL 31 0 0 0 0 0
0.00426293 1 1 0.00426293 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 110 NULL 31 0 0 0 0 0
0.00829528 1 1 0.00829528 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 107 NULL 31 0 0 0 0 0
0.0139774 1 1 0.0139774 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 106 NULL 31 0 0 0 0 0
0.0788545011 1 0.078854501 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 100 NULL 31 0 0 0 0 0
0.00929102 1 1 0.00929102 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 98 NULL 31 0 0 0 0 0
699.65802 1 1 699.65802 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 91 NULL 31 0 0 0 0 0
0.0092195781 1 0.009219578 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 90 NULL 31 0 0 0 0 0
699.51599121 1 699.5159912 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 87 NULL 31 0 0 0 0 0
0.1508546171 1 0.150854617 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 79 NULL 31 0 0 0 0 0
0.1420160981 1 0.142016098 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 66 NULL 31 0 0 0 0 0
5.46E-051 1 5.46E-05g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 59 NULL 31 0 0 0 0 0
0.0001263621 1 0.000126362 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 58 NULL 31 0 0 0 0 0
2.38E-051 1 2.38E-05g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 57 NULL 31 0 0 0 0 0
2.99E-051 1 2.99E-05g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 56 NULL 31 0 0 0 0 0
2.60E-061 1 2.60E-06g mi

1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 55 NULL 31 0 0 0 0 0
0.0001091851 1 0.000109185 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 54 NULL 31 0 0 0 0 0
1.02E-051 1 1.02E-05g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 53 NULL 31 0 0 0 0 0
6.43E-061 1 6.43E-06g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 52 NULL 31 0 0 0 0 0
5.22E-061 1 5.22E-06g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 51 NULL 31 0 0 0 0 0
1.19E-051 1 1.19E-05g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 36 NULL 31 0 0 0 0 0
0.00019711 1 1 0.00019711 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 35 NULL 31 0 0 0 0 0
2.60E-051 1 2.60E-05g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 31 NULL 31 0 0 0 0 0
0.0136925 1 1 0.0136925 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 5 NULL 31 0 0 0 0 0
0.0057717431 1 0.005771743 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 3 NULL 31 0 0 0 0 0
0.2905873361 1 0.290587336 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 2 NULL 31 0 0 0 0 0
3.8864324091 1 3.886432409 g mi
1,1,2016,7,5,15,25,25025,250250,13,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 13 1 NULL 31 0 0 0 0 0
0.1477219021 1 0.147721902 g mi
1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 122 NULL 31 0 0 0 0 0
0.0009603621 1 0.000960362 g mi
1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 121 NULL 31 0 0 0 0 0
0.00038653 1 1 0.00038653 g mi
1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 119 NULL 31 0 0 0 0 0 0
1 1 0 g mi
1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 118 NULL 31 0 0 0 0 0
0.00717113 1 1 0.00717113 g mi
1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 117 NULL 31 0 0 0 0 0
0.00225858 1 1 0.00225858 g mi
1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 116 NULL 31 0 0 0 0 0
0.0130533 1 1 0.0130533 g mi
1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 115 NULL 31 0 0 0 0 0
0.0004121491 1 0.000412149 g mi
1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 112 NULL 31 0 0 0 0 0
0.00223454 1 1 0.00223454 g mi
1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 111 NULL 31 0 0 0 0 0
0.0048018 1 1 0.0048018 g mi
1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 110 NULL 31 0 0 0 0 0
0.00940568 1 1 0.00940568 g mi
1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 107 NULL 31 0 0 0 0 0
0.0150573 1 1 0.0150573 g mi
1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 106 NULL 31 0 0 0 0 0
0.1044270021 1 0.104427002 g mi
1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 100 NULL 31 0 0 0 0 0
0.0105134 1 1 0.0105134 g mi
1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 98 NULL 31 0 0 0 0 0
891.28100591 1 891.2810059 g mi
1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 91 NULL 31 0 0 0 0 0
0.01174516 1 1 0.01174516 g mi
1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 90 NULL 31 0 0 0 0 0
891.12200931 1 891.1220093 g mi
1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 87 NULL 31 0 0 0 0 0
0.1758937091 1 0.175893709 g mi
1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 79 NULL 31 0 0 0 0 0
0.1655096111 1 0.165509611 g mi
1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 66 NULL 31 0 0 0 0 0
8.19E-051 1 8.19E-05g mi

1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 59 NULL 31 0 0 0 0 0 0.000136307 1 1 0.000136307 g mi

1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 58 NULL 31 0 0 0 0 0 2.63E-05 1 1 2.63E-05 g mi

1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 57 NULL 31 0 0 0 0 0 3.60E-05 1 1 3.60E-05 g mi

1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 56 NULL 31 0 0 0 0 0 2.93E-06 1 1 2.93E-06 g mi

1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 55 NULL 31 0 0 0 0 0 0.00012245 1 1 0.00012245 g mi

1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 54 NULL 31 0 0 0 0 0 1.10E-05 1 1 1.10E-05 g mi

1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 53 NULL 31 0 0 0 0 0 7.20E-06 1 1 7.20E-06 g mi

1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 52 NULL 31 0 0 0 0 0 6.66E-06 1 1 6.66E-06 g mi

1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 51 NULL 31 0 0 0 0 0 1.51E-05 1 1 1.51E-05 g mi

1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 36 NULL 31 0 0 0 0 0 0.000215323 1 1 0.000215323 g mi

1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 35 NULL 31 0 0 0 0 0 3.10E-05 1 1 3.10E-05 g mi

1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 31 NULL 31 0 0 0 0 0 0.017449699 1 1 0.017449699 g mi

1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 5 NULL 31 0 0 0 0 0 0.006440759 1 1 0.006440759 g mi

1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 3 NULL 31 0 0 0 0 0 0.330884218 1 1 0.330884218 g mi

1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 2 NULL 31 0 0 0 0 0 4.24930191 1 1 4.24930191 g mi

1,1,2016,7,5,15,25,25025,250250,12,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 12 1 NULL 31 0 0 0 0 0 0.171878904 1 1 0.171878904 g mi

1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 11 122 NULL 31 0 0 0 0 0 0.00128368 1 1 0.00128368 g mi

1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 11 121 NULL 31 0 0 0 0 0 0.000510813 1 1 0.000510813 g mi

1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 11 119 NULL 31 0 0 0 0 0 0 1 1 0 g mi

1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 11 118 NULL 31 0 0 0 0 0 0.00963698 1 1 0.00963698 g mi

1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 11 117 NULL 31 0 0 0 0 0 0.00243372 1 1 0.00243372 g mi

1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 11 116 NULL 31 0 0 0 0 0 0.022643 1 1 0.022643 g mi

1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 11 115 NULL 31 0 0 0 0 0 0.000628671 1 1 0.000628671 g mi

1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 11 112 NULL 31 0 0 0 0 0 0.00309987 1 1 0.00309987 g mi

1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 11 111 NULL 31 0 0 0 0 0 0.00641839 1 1 0.00641839 g mi

1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 11 110 NULL 31 0 0 0 0 0 0.0127369 1 1 0.0127369 g mi

1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 11 107 NULL 31 0 0 0 0 0 0.0162249 1 1 0.0162249 g mi

1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 11 106 NULL 31 0 0 0 0 0 0.181143999 1 1 0.181143999 g mi

1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 11 100 NULL 31 0 0 0 0 0 0.0141806 1 1 0.0141806 g mi

1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 11 98 NULL 31 0 0 0 0 0 1466.150024 1 1 1466.150024 g mi

1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001 1 2016 7 5 15 25 25025 250250 11 91 NULL 31 0 0 0 0 0 0.01932182 1 1 0.01932182 g mi

1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	11	90	NULL	31	0	0	0	0	0	1465.939941	1	1	1465.939941	g	mi
1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	11	87	NULL	31	0	0	0	0	0	0.251010656	1	1	0.251010656	g	mi
1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	11	79	NULL	31	0	0	0	0	0	0.235990405	1	1	0.235990405	g	mi
1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	11	66	NULL	31	0	0	0	0	0	0.000163752	1	1	0.000163752	g	mi
1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	11	59	NULL	31	0	0	0	0	0	0.000166143	1	1	0.000166143	g	mi
1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	11	58	NULL	31	0	0	0	0	0	3.40E-05	1	1	3.40E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	11	57	NULL	31	0	0	0	0	0	5.42E-05	1	1	5.42E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	11	56	NULL	31	0	0	0	0	0	3.91E-06	1	1	3.91E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	11	55	NULL	31	0	0	0	0	0	0.000162243	1	1	0.000162243	g	mi
1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	11	54	NULL	31	0	0	0	0	0	1.36E-05	1	1	1.36E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	11	53	NULL	31	0	0	0	0	0	9.51E-06	1	1	9.51E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	11	52	NULL	31	0	0	0	0	0	1.10E-05	1	1	1.10E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	11	51	NULL	31	0	0	0	0	0	2.48E-05	1	1	2.48E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	11	36	NULL	31	0	0	0	0	0	0.000269963	1	1	0.000269963	g	mi
1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	11	35	NULL	31	0	0	0	0	0	4.62E-05	1	1	4.62E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	11	31	NULL	31	0	0	0	0	0	0.028721301	1	1	0.028721301	g	mi
1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	11	5	NULL	31	0	0	0	0	0	0.008447787	1	1	0.008447787	g	mi
1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	11	3	NULL	31	0	0	0	0	0	0.451777756	1	1	0.451777756	g	mi
1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	11	2	NULL	31	0	0	0	0	0	5.337890148	1	1	5.337890148	g	mi
1,1,2016,7,5,15,25,25025,250250,11,31,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	11	1	NULL	31	0	0	0	0	0	0.244350404	1	1	0.244350404	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	122	NULL	21	0	0	0	0	0	0.000385359	1	1	0.000385359	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	121	NULL	21	0	0	0	0	0	0.000158324	1	1	0.000158324	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	119	NULL	21	0	0	0	0	0	0	1	1	0	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	118	NULL	21	0	0	0	0	0	0.00283591	1	1	0.00283591	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	117	NULL	21	0	0	0	0	0	0.001229	1	1	0.001229	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	116	NULL	21	0	0	0	0	0	0.00128294	1	1	0.00128294	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	115	NULL	21	0	0	0	0	0	0.000109844	1	1	0.000109844	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	112	NULL	21	0	0	0	0	0	0.000483508	1	1	0.000483508	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	111	NULL	21	0	0	0	0	0	0.00192679	1	1	0.00192679	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	110	NULL	21	0	0	0	0	0	0.00331942	1	1	0.00331942	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	107	NULL	21	0	0	0	0	0	0.00819337	1	1	0.00819337	g	mi

1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	106	NULL	21	0	0	0	0	0	0.0102635	1	1	0.0102635	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	100	NULL	21	0	0	0	0	0	0.00375146	1	1	0.00375146	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	98	NULL	21	0	0	0	0	0	309.4840088	1	1	309.4840088	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	91	NULL	21	0	0	0	0	0	0.004079897	1	1	0.004079897	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	90	NULL	21	0	0	0	0	0	309.4060059	1	1	309.4060059	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	87	NULL	21	0	0	0	0	0	0.125556514	1	1	0.125556514	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	79	NULL	21	0	0	0	0	0	0.115660302	1	1	0.115660302	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	66	NULL	21	0	0	0	0	0	1.61E-05	1	1	1.61E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	59	NULL	21	0	0	0	0	0	6.31E-05	1	1	6.31E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	58	NULL	21	0	0	0	0	0	1.12E-05	1	1	1.12E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	57	NULL	21	0	0	0	0	0	1.12E-05	1	1	1.12E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	56	NULL	21	0	0	0	0	0	1.18E-06	1	1	1.18E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	55	NULL	21	0	0	0	0	0	4.99E-05	1	1	4.99E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	54	NULL	21	0	0	0	0	0	5.00E-06	1	1	5.00E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	53	NULL	21	0	0	0	0	0	2.95E-06	1	1	2.95E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	52	NULL	21	0	0	0	0	0	1.45E-06	1	1	1.45E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	51	NULL	21	0	0	0	0	0	3.65E-06	1	1	3.65E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	36	NULL	21	0	0	0	0	0	9.59E-05	1	1	9.59E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	35	NULL	21	0	0	0	0	0	1.00E-05	1	1	1.00E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	31	NULL	21	0	0	0	0	0	0.00613782	1	1	0.00613782	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	5	NULL	21	0	0	0	0	0	0.00319101	1	1	0.00319101	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	3	NULL	21	0	0	0	0	0	0.197913229	1	1	0.197913229	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	2	NULL	21	0	0	0	0	0	2.003333807	1	1	2.003333807	g	mi
1,1,2016,7,5,15,25,25025,250250,10,21,0,0,0,0,001	1	2016	7	5	15	25	25025	250250	10	1	NULL	21	0	0	0	0	0	0.118810304	1	1	0.118810304	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00 1	1	2016	7	5	15	25	25025	250250	9	122	NULL	21	0	0	0	0	0	0.000383303	1	1	0.000383303	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00 1	1	2016	7	5	15	25	25025	250250	9	121	NULL	21	0	0	0	0	0	0.000157479	1	1	0.000157479	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00 1	1	2016	7	5	15	25	25025	250250	9	119	NULL	21	0	0	0	0	0	0	1	1	0	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00 1	1	2016	7	5	15	25	25025	250250	9	118	NULL	21	0	0	0	0	0	0.0028208	1	1	0.0028208	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00 1	1	2016	7	5	15	25	25025	250250	9	117	NULL	21	0	0	0	0	0	0.001324	1	1	0.001324	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00 1	1	2016	7	5	15	25	25025	250250	9	116	NULL	21	0	0	0	0	0	0.00198081	1	1	0.00198081	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00 1	1	2016	7	5	15	25	25025	250250	9	115	NULL	21	0	0	0	0	0	0.000109279	1	1	0.000109279	g	mi

1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	112	NULL	21	0	0	0	0	0	0.000480934	1	1	0.000480934	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	111	NULL	21	0	0	0	0	0	0.00191651	1	1	0.00191651	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	110	NULL	21	0	0	0	0	0	0.00330173	1	1	0.00330173	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	107	NULL	21	0	0	0	0	0	0.00882671	1	1	0.00882671	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	106	NULL	21	0	0	0	0	0	0.0158465	1	1	0.0158465	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	100	NULL	21	0	0	0	0	0	0.00373148	1	1	0.00373148	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	98	NULL	21	0	0	0	0	0	317.0320129	1	1	317.0320129	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	91	NULL	21	0	0	0	0	0	0.004179437	1	1	0.004179437	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	90	NULL	21	0	0	0	0	0	316.9549866	1	1	316.9549866	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	87	NULL	21	0	0	0	0	0	0.12703304	1	1	0.12703304	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	79	NULL	21	0	0	0	0	0	0.117001198	1	1	0.117001198	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	66	NULL	21	0	0	0	0	0	1.79E-05	1	1	1.79E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	59	NULL	21	0	0	0	0	0	6.28E-05	1	1	6.28E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	58	NULL	21	0	0	0	0	0	1.11E-05	1	1	1.11E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	57	NULL	21	0	0	0	0	0	1.12E-05	1	1	1.12E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	56	NULL	21	0	0	0	0	0	1.17E-06	1	1	1.17E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	55	NULL	21	0	0	0	0	0	4.96E-05	1	1	4.96E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	54	NULL	21	0	0	0	0	0	4.97E-06	1	1	4.97E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	53	NULL	21	0	0	0	0	0	2.93E-06	1	1	2.93E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	52	NULL	21	0	0	0	0	0	1.44E-06	1	1	1.44E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	51	NULL	21	0	0	0	0	0	3.63E-06	1	1	3.63E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	36	NULL	21	0	0	0	0	0	9.54E-05	1	1	9.54E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	35	NULL	21	0	0	0	0	0	9.96E-06	1	1	9.96E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	31	NULL	21	0	0	0	0	0	0.00628758	1	1	0.00628758	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	5	NULL	21	0	0	0	0	0	0.003139933	1	1	0.003139933	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	3	NULL	21	0	0	0	0	0	0.192997023	1	1	0.192997023	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	2	NULL	21	0	0	0	0	0	2.018112183	1	1	2.018112183	g	mi
1,1,2016,7,5,15,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	9	1	NULL	21	0	0	0	0	0	0.120100796	1	1	0.120100796	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	122	NULL	21	0	0	0	0	0	0.000394183	1	1	0.000394183	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	121	NULL	21	0	0	0	0	0	0.00016195	1	1	0.00016195	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	119	NULL	21	0	0	0	0	0	0	1	1	0	g	mi

1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	118	NULL	21	0	0	0	0	0	0.00290085	1	1	0.00290085	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	117	NULL	21	0	0	0	0	0	0.001427	1	1	0.001427	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	116	NULL	21	0	0	0	0	0	0.00275537	1	1	0.00275537	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	115	NULL	21	0	0	0	0	0	0.00011236	1	1	0.00011236	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	112	NULL	21	0	0	0	0	0	0.000494587	1	1	0.000494587	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	111	NULL	21	0	0	0	0	0	0.00197091	1	1	0.00197091	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	110	NULL	21	0	0	0	0	0	0.00339544	1	1	0.00339544	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	107	NULL	21	0	0	0	0	0	0.00951338	1	1	0.00951338	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	106	NULL	21	0	0	0	0	0	0.022043001	1	1	0.022043001	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	100	NULL	21	0	0	0	0	0	0.00383739	1	1	0.00383739	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	98	NULL	21	0	0	0	0	0	327.5499878	1	1	327.5499878	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	91	NULL	21	0	0	0	0	0	0.004318093	1	1	0.004318093	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	90	NULL	21	0	0	0	0	0	327.4700012	1	1	327.4700012	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	87	NULL	21	0	0	0	0	0	0.129978836	1	1	0.129978836	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	79	NULL	21	0	0	0	0	0	0.119802296	1	1	0.119802296	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	66	NULL	21	0	0	0	0	0	2.01E-05	1	1	2.01E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	59	NULL	21	0	0	0	0	0	6.46E-05	1	1	6.46E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	58	NULL	21	0	0	0	0	0	1.15E-05	1	1	1.15E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	57	NULL	21	0	0	0	0	0	1.15E-05	1	1	1.15E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	56	NULL	21	0	0	0	0	0	1.21E-06	1	1	1.21E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	55	NULL	21	0	0	0	0	0	5.10E-05	1	1	5.10E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	54	NULL	21	0	0	0	0	0	5.11E-06	1	1	5.11E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	53	NULL	21	0	0	0	0	0	3.01E-06	1	1	3.01E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	52	NULL	21	0	0	0	0	0	1.48E-06	1	1	1.48E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	51	NULL	21	0	0	0	0	0	3.73E-06	1	1	3.73E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	36	NULL	21	0	0	0	0	0	9.81E-05	1	1	9.81E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	35	NULL	21	0	0	0	0	0	1.02E-05	1	1	1.02E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	31	NULL	21	0	0	0	0	0	0.00649621	1	1	0.00649621	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	5	NULL	21	0	0	0	0	0	0.003245141	1	1	0.003245141	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	3	NULL	21	0	0	0	0	0	0.192626998	1	1	0.192626998	g	mi
1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	2	NULL	21	0	0	0	0	0	2.134444714	1	1	2.134444714	g	mi

1,1,2016,7,5,15,25,25025,250250,8,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	8	1	NULL	21	0	0	0	0	0	0.123005599	1	1	0.123005599	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	122	NULL	21	0	0	0	0	0	0.000416333	1	1	0.000416333	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	121	NULL	21	0	0	0	0	0	0.000171052	1	1	0.000171052	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	119	NULL	21	0	0	0	0	0	0	1	1	0	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	118	NULL	21	0	0	0	0	0	0.00306381	1	1	0.00306381	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	117	NULL	21	0	0	0	0	0	0.001537	1	1	0.001537	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	116	NULL	21	0	0	0	0	0	0.00369191	1	1	0.00369191	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	115	NULL	21	0	0	0	0	0	0.00011862	1	1	0.00011862	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	112	NULL	21	0	0	0	0	0	0.000522374	1	1	0.000522374	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	111	NULL	21	0	0	0	0	0	0.00208166	1	1	0.00208166	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	110	NULL	21	0	0	0	0	0	0.00358618	1	1	0.00358618	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	107	NULL	21	0	0	0	0	0	0.0102467	1	1	0.0102467	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	106	NULL	21	0	0	0	0	0	0.029535299	1	1	0.029535299	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	100	NULL	21	0	0	0	0	0	0.00405297	1	1	0.00405297	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	98	NULL	21	0	0	0	0	0	341.7309875	1	1	341.7309875	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	91	NULL	21	0	0	0	0	0	0.004505022	1	1	0.004505022	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	90	NULL	21	0	0	0	0	0	341.644989	1	1	341.644989	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	87	NULL	21	0	0	0	0	0	0.134433419	1	1	0.134433419	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	79	NULL	21	0	0	0	0	0	0.124085799	1	1	0.124085799	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	66	NULL	21	0	0	0	0	0	2.30E-05	1	1	2.30E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	59	NULL	21	0	0	0	0	0	6.82E-05	1	1	6.82E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	58	NULL	21	0	0	0	0	0	1.21E-05	1	1	1.21E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	57	NULL	21	0	0	0	0	0	1.21E-05	1	1	1.21E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	56	NULL	21	0	0	0	0	0	1.27E-06	1	1	1.27E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	55	NULL	21	0	0	0	0	0	5.39E-05	1	1	5.39E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	54	NULL	21	0	0	0	0	0	5.40E-06	1	1	5.40E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	53	NULL	21	0	0	0	0	0	3.18E-06	1	1	3.18E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	52	NULL	21	0	0	0	0	0	1.56E-06	1	1	1.56E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	51	NULL	21	0	0	0	0	0	3.94E-06	1	1	3.94E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	36	NULL	21	0	0	0	0	0	0.00010363	1	1	0.00010363	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	35	NULL	21	0	0	0	0	0	1.08E-05	1	1	1.08E-05	g	mi

1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	31	NULL	21	0	0	0	0	0	0.00677748	1	1	0.00677748	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	5	NULL	21	0	0	0	0	0	0.003482968	1	1	0.003482968	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	3	NULL	21	0	0	0	0	0	0.195656136	1	1	0.195656136	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	2	NULL	21	0	0	0	0	0	2.343386173	1	1	2.343386173	g	mi
1,1,2016,7,5,15,25,25025,250250,7,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	7	1	NULL	21	0	0	0	0	0	0.127523899	1	1	0.127523899	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	122	NULL	21	0	0	0	0	0	0.00044439	1	1	0.00044439	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	121	NULL	21	0	0	0	0	0	0.000182581	1	1	0.000182581	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	119	NULL	21	0	0	0	0	0	0	1	1	0	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	118	NULL	21	0	0	0	0	0	0.00327026	1	1	0.00327026	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	117	NULL	21	0	0	0	0	0	0.001656	1	1	0.001656	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	116	NULL	21	0	0	0	0	0	0.00493551	1	1	0.00493551	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	115	NULL	21	0	0	0	0	0	0.000126585	1	1	0.000126585	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	112	NULL	21	0	0	0	0	0	0.000557579	1	1	0.000557579	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	111	NULL	21	0	0	0	0	0	0.00222195	1	1	0.00222195	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	110	NULL	21	0	0	0	0	0	0.00382784	1	1	0.00382784	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	107	NULL	21	0	0	0	0	0	0.0110401	1	1	0.0110401	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	106	NULL	21	0	0	0	0	0	0.039484099	1	1	0.039484099	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	100	NULL	21	0	0	0	0	0	0.0043261	1	1	0.0043261	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	98	NULL	21	0	0	0	0	0	363.631012	1	1	363.631012	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	91	NULL	21	0	0	0	0	0	0.004793718	1	1	0.004793718	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	90	NULL	21	0	0	0	0	0	363.5390015	1	1	363.5390015	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	87	NULL	21	0	0	0	0	0	0.140103295	1	1	0.140103295	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	79	NULL	21	0	0	0	0	0	0.129515499	1	1	0.129515499	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	66	NULL	21	0	0	0	0	0	2.68E-05	1	1	2.68E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	59	NULL	21	0	0	0	0	0	7.28E-05	1	1	7.28E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	58	NULL	21	0	0	0	0	0	1.29E-05	1	1	1.29E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	57	NULL	21	0	0	0	0	0	1.30E-05	1	1	1.30E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	56	NULL	21	0	0	0	0	0	1.36E-06	1	1	1.36E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	55	NULL	21	0	0	0	0	0	5.75E-05	1	1	5.75E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	54	NULL	21	0	0	0	0	0	5.77E-06	1	1	5.77E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	53	NULL	21	0	0	0	0	0	3.40E-06	1	1	3.40E-06	g	mi

1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	52	NULL	21	0	0	0	0	0	1.67E-06	1	1	1.67E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	51	NULL	21	0	0	0	0	0	4.20E-06	1	1	4.20E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	36	NULL	21	0	0	0	0	0	0.000110619	1	1	0.000110619	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	35	NULL	21	0	0	0	0	0	1.15E-05	1	1	1.15E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	31	NULL	21	0	0	0	0	0	0.00721187	1	1	0.00721187	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	5	NULL	21	0	0	0	0	0	0.003747167	1	1	0.003747167	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	3	NULL	21	0	0	0	0	0	0.202133402	1	1	0.202133402	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	2	NULL	21	0	0	0	0	0	2.564254761	1	1	2.564254761	g	mi
1,1,2016,7,5,15,25,25025,250250,6,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	6	1	NULL	21	0	0	0	0	0	0.133214399	1	1	0.133214399	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	122	NULL	21	0	0	0	0	0	0.000481429	1	1	0.000481429	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	121	NULL	21	0	0	0	0	0	0.000197798	1	1	0.000197798	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	119	NULL	21	0	0	0	0	0	0	1	1	0	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	118	NULL	21	0	0	0	0	0	0.00354292	1	1	0.00354292	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	117	NULL	21	0	0	0	0	0	0.001784	1	1	0.001784	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	116	NULL	21	0	0	0	0	0	0.00655266	1	1	0.00655266	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	115	NULL	21	0	0	0	0	0	0.000137223	1	1	0.000137223	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	112	NULL	21	0	0	0	0	0	0.000604072	1	1	0.000604072	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	111	NULL	21	0	0	0	0	0	0.00240714	1	1	0.00240714	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	110	NULL	21	0	0	0	0	0	0.00414699	1	1	0.00414699	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	107	NULL	21	0	0	0	0	0	0.0118934	1	1	0.0118934	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	106	NULL	21	0	0	0	0	0	0.052421201	1	1	0.052421201	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	100	NULL	21	0	0	0	0	0	0.0046868	1	1	0.0046868	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	98	NULL	21	0	0	0	0	0	407.3989868	1	1	407.3989868	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	91	NULL	21	0	0	0	0	0	0.005370806	1	1	0.005370806	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	90	NULL	21	0	0	0	0	0	407.303009	1	1	407.303009	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	87	NULL	21	0	0	0	0	0	0.146872103	1	1	0.146872103	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	79	NULL	21	0	0	0	0	0	0.135898501	1	1	0.135898501	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	66	NULL	21	0	0	0	0	0	3.21E-05	1	1	3.21E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	59	NULL	21	0	0	0	0	0	7.89E-05	1	1	7.89E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	58	NULL	21	0	0	0	0	0	1.40E-05	1	1	1.40E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	57	NULL	21	0	0	0	0	0	1.40E-05	1	1	1.40E-05	g	mi

1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	56	NULL	21	0	0	0	0	0	1.47E-06	1	1	1.47E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	55	NULL	21	0	0	0	0	0	6.23E-05	1	1	6.23E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	54	NULL	21	0	0	0	0	0	6.25E-06	1	1	6.25E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	53	NULL	21	0	0	0	0	0	3.68E-06	1	1	3.68E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	52	NULL	21	0	0	0	0	0	1.81E-06	1	1	1.81E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	51	NULL	21	0	0	0	0	0	4.55E-06	1	1	4.55E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	36	NULL	21	0	0	0	0	0	0.000119841	1	1	0.000119841	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	35	NULL	21	0	0	0	0	0	1.25E-05	1	1	1.25E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	31	NULL	21	0	0	0	0	0	0.00808013	1	1	0.00808013	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	5	NULL	21	0	0	0	0	0	0.003894251	1	1	0.003894251	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	3	NULL	21	0	0	0	0	0	0.221521229	1	1	0.221521229	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	2	NULL	21	0	0	0	0	0	2.637727022	1	1	2.637727022	g	mi
1,1,2016,7,5,15,25,25025,250250,5,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	5	1	NULL	21	0	0	0	0	0	0.139742494	1	1	0.139742494	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	122	NULL	21	0	0	0	0	0	0.000607645	1	1	0.000607645	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	121	NULL	21	0	0	0	0	0	0.000249663	1	1	0.000249663	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	119	NULL	21	0	0	0	0	0	0	1	1	0	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	118	NULL	21	0	0	0	0	0	0.0044711	1	1	0.0044711	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	117	NULL	21	0	0	0	0	0	0.001922	1	1	0.001922	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	116	NULL	21	0	0	0	0	0	0.00745541	1	1	0.00745541	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	115	NULL	21	0	0	0	0	0	0.000172525	1	1	0.000172525	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	112	NULL	21	0	0	0	0	0	0.000762326	1	1	0.000762326	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	111	NULL	21	0	0	0	0	0	0.00303822	1	1	0.00303822	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	110	NULL	21	0	0	0	0	0	0.00523342	1	1	0.00523342	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	107	NULL	21	0	0	0	0	0	0.0128134	1	1	0.0128134	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	106	NULL	21	0	0	0	0	0	0.059643298	1	1	0.059643298	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	100	NULL	21	0	0	0	0	0	0.00591469	1	1	0.00591469	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	98	NULL	21	0	0	0	0	0	460.1749878	1	1	460.1749878	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	91	NULL	21	0	0	0	0	0	0.006066531	1	1	0.006066531	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	90	NULL	21	0	0	0	0	0	460.0639954	1	1	460.0639954	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	87	NULL	21	0	0	0	0	0	0.158370227	1	1	0.158370227	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	79	NULL	21	0	0	0	0	0	0.146915898	1	1	0.146915898	g	mi

1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	66	NULL	21	0	0	0	0	0	4.02E-05	1	1	4.02E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	59	NULL	21	0	0	0	0	0	9.95E-05	1	1	9.95E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	58	NULL	21	0	0	0	0	0	1.77E-05	1	1	1.77E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	57	NULL	21	0	0	0	0	0	1.77E-05	1	1	1.77E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	56	NULL	21	0	0	0	0	0	1.86E-06	1	1	1.86E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	55	NULL	21	0	0	0	0	0	7.87E-05	1	1	7.87E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	54	NULL	21	0	0	0	0	0	7.88E-06	1	1	7.88E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	53	NULL	21	0	0	0	0	0	4.64E-06	1	1	4.64E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	52	NULL	21	0	0	0	0	0	2.27E-06	1	1	2.27E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	51	NULL	21	0	0	0	0	0	5.74E-06	1	1	5.74E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	36	NULL	21	0	0	0	0	0	0.000151264	1	1	0.000151264	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	35	NULL	21	0	0	0	0	0	1.58E-05	1	1	1.58E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	31	NULL	21	0	0	0	0	0	0.00912692	1	1	0.00912692	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	5	NULL	21	0	0	0	0	0	0.004480024	1	1	0.004480024	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	3	NULL	21	0	0	0	0	0	0.234676778	1	1	0.234676778	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	2	NULL	21	0	0	0	0	0	3.257755756	1	1	3.257755756	g	mi
1,1,2016,7,5,15,25,25025,250250,4,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	4	1	NULL	21	0	0	0	0	0	0.151338309	1	1	0.151338309	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	122	NULL	21	0	0	0	0	0	0.000702602	1	1	0.000702602	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	121	NULL	21	0	0	0	0	0	0.000288677	1	1	0.000288677	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	119	NULL	21	0	0	0	0	0	0	1	1	0	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	118	NULL	21	0	0	0	0	0	0.00516983	1	1	0.00516983	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	117	NULL	21	0	0	0	0	0	0.002071	1	1	0.002071	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	116	NULL	21	0	0	0	0	0	0.00888722	1	1	0.00888722	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	115	NULL	21	0	0	0	0	0	0.000199518	1	1	0.000199518	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	112	NULL	21	0	0	0	0	0	0.000881464	1	1	0.000881464	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	111	NULL	21	0	0	0	0	0	0.003513	1	1	0.003513	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	110	NULL	21	0	0	0	0	0	0.00605129	1	1	0.00605129	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	107	NULL	21	0	0	0	0	0	0.0138067	1	1	0.0138067	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	106	NULL	21	0	0	0	0	0	0.071097799	1	1	0.071097799	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	100	NULL	21	0	0	0	0	0	0.00683902	1	1	0.00683902	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	98	NULL	21	0	0	0	0	0	539.059021	1	1	539.059021	g	mi

1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	91	NULL	21	0	0	0	0	0	0.007106571	1	1	0.007106571	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	90	NULL	21	0	0	0	0	0	538.9370117	1	1	538.9370117	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	87	NULL	21	0	0	0	0	0	0.174041167	1	1	0.174041167	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	79	NULL	21	0	0	0	0	0	0.161721706	1	1	0.161721706	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	66	NULL	21	0	0	0	0	0	5.36E-05	1	1	5.36E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	59	NULL	21	0	0	0	0	0	0.000115081	1	1	0.000115081	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	58	NULL	21	0	0	0	0	0	2.04E-05	1	1	2.04E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	57	NULL	21	0	0	0	0	0	2.05E-05	1	1	2.05E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	56	NULL	21	0	0	0	0	0	2.15E-06	1	1	2.15E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	55	NULL	21	0	0	0	0	0	9.10E-05	1	1	9.10E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	54	NULL	21	0	0	0	0	0	9.12E-06	1	1	9.12E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	53	NULL	21	0	0	0	0	0	5.37E-06	1	1	5.37E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	52	NULL	21	0	0	0	0	0	2.63E-06	1	1	2.63E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	51	NULL	21	0	0	0	0	0	6.64E-06	1	1	6.64E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	36	NULL	21	0	0	0	0	0	0.000174903	1	1	0.000174903	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	35	NULL	21	0	0	0	0	0	1.82E-05	1	1	1.82E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	31	NULL	21	0	0	0	0	0	0.0106918	1	1	0.0106918	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	5	NULL	21	0	0	0	0	0	0.004948465	1	1	0.004948465	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	3	NULL	21	0	0	0	0	0	0.249984428	1	1	0.249984428	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	2	NULL	21	0	0	0	0	0	3.673358202	1	1	3.673358202	g	mi
1,1,2016,7,5,15,25,25025,250250,3,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	3	1	NULL	21	0	0	0	0	0	0.166606307	1	1	0.166606307	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	122	NULL	21	0	0	0	0	0	0.000823725	1	1	0.000823725	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	121	NULL	21	0	0	0	0	0	0.000338436	1	1	0.000338436	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	119	NULL	21	0	0	0	0	0	0	1	1	0	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	118	NULL	21	0	0	0	0	0	0.00606167	1	1	0.00606167	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	117	NULL	21	0	0	0	0	0	0.002231	1	1	0.002231	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	116	NULL	21	0	0	0	0	0	0.0117074	1	1	0.0117074	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	115	NULL	21	0	0	0	0	0	0.000234523	1	1	0.000234523	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	112	NULL	21	0	0	0	0	0	0.00103354	1	1	0.00103354	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	111	NULL	21	0	0	0	0	0	0.00411862	1	1	0.00411862	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	110	NULL	21	0	0	0	0	0	0.00709521	1	1	0.00709521	g	mi

1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	107	NULL	21	0	0	0	0	0	0.0148734	1	1	0.0148734	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	106	NULL	21	0	0	0	0	0	0.093659602	1	1	0.093659602	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	100	NULL	21	0	0	0	0	0	0.0080188	1	1	0.0080188	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	98	NULL	21	0	0	0	0	0	691.4180298	1	1	691.4180298	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	91	NULL	21	0	0	0	0	0	0.009115422	1	1	0.009115422	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	90	NULL	21	0	0	0	0	0	691.2800293	1	1	691.2800293	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	87	NULL	21	0	0	0	0	0	0.203301311	1	1	0.203301311	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	79	NULL	21	0	0	0	0	0	0.189212799	1	1	0.189212799	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	66	NULL	21	0	0	0	0	0	8.04E-05	1	1	8.04E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	59	NULL	21	0	0	0	0	0	0.000134926	1	1	0.000134926	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	58	NULL	21	0	0	0	0	0	2.39E-05	1	1	2.39E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	57	NULL	21	0	0	0	0	0	2.40E-05	1	1	2.40E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	56	NULL	21	0	0	0	0	0	2.52E-06	1	1	2.52E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	55	NULL	21	0	0	0	0	0	0.000106667	1	1	0.000106667	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	54	NULL	21	0	0	0	0	0	1.07E-05	1	1	1.07E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	53	NULL	21	0	0	0	0	0	6.30E-06	1	1	6.30E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	52	NULL	21	0	0	0	0	0	3.09E-06	1	1	3.09E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	51	NULL	21	0	0	0	0	0	7.78E-06	1	1	7.78E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	36	NULL	21	0	0	0	0	0	0.000205052	1	1	0.000205052	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	35	NULL	21	0	0	0	0	0	2.14E-05	1	1	2.14E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	31	NULL	21	0	0	0	0	0	0.0137142	1	1	0.0137142	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	5	NULL	21	0	0	0	0	0	0.005582626	1	1	0.005582626	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	3	NULL	21	0	0	0	0	0	0.276655585	1	1	0.276655585	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	2	NULL	21	0	0	0	0	0	4.136309624	1	1	4.136309624	g	mi
1,1,2016,7,5,15,25,25025,250250,2,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	2	1	NULL	21	0	0	0	0	0	0.194723397	1	1	0.194723397	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	122	NULL	21	0	0	0	0	0	0.00118709	1	1	0.00118709	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	121	NULL	21	0	0	0	0	0	0.000487712	1	1	0.000487712	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	119	NULL	21	0	0	0	0	0	0	1	1	0	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	118	NULL	21	0	0	0	0	0	0.0087372	1	1	0.0087372	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	117	NULL	21	0	0	0	0	0	0.002404	1	1	0.002404	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	116	NULL	21	0	0	0	0	0	0.0201681	1	1	0.0201681	g	mi

1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	115	NULL	21	0	0	0	0	0	0.000339537	1	1	0.000339537	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	112	NULL	21	0	0	0	0	0	0.00148975	1	1	0.00148975	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	111	NULL	21	0	0	0	0	0	0.00593545	1	1	0.00593545	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	110	NULL	21	0	0	0	0	0	0.010227	1	1	0.010227	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	107	NULL	21	0	0	0	0	0	0.0160267	1	1	0.0160267	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	106	NULL	21	0	0	0	0	0	0.161345005	1	1	0.161345005	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	100	NULL	21	0	0	0	0	0	0.0115581	1	1	0.0115581	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	98	NULL	21	0	0	0	0	0	1148.48999	1	1	1148.48999	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	91	NULL	21	0	0	0	0	0	0.015141946	1	1	0.015141946	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	90	NULL	21	0	0	0	0	0	1148.310059	1	1	1148.310059	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	87	NULL	21	0	0	0	0	0	0.291081756	1	1	0.291081756	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	79	NULL	21	0	0	0	0	0	0.27168569	1	1	0.27168569	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	66	NULL	21	0	0	0	0	0	0.000160731	1	1	0.000160731	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	59	NULL	21	0	0	0	0	0	0.000194461	1	1	0.000194461	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	58	NULL	21	0	0	0	0	0	3.45E-05	1	1	3.45E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	57	NULL	21	0	0	0	0	0	3.46E-05	1	1	3.46E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	56	NULL	21	0	0	0	0	0	3.63E-06	1	1	3.63E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	55	NULL	21	0	0	0	0	0	0.000153719	1	1	0.000153719	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	54	NULL	21	0	0	0	0	0	1.54E-05	1	1	1.54E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	53	NULL	21	0	0	0	0	0	9.07E-06	1	1	9.07E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	52	NULL	21	0	0	0	0	0	4.47E-06	1	1	4.47E-06	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	51	NULL	21	0	0	0	0	0	1.12E-05	1	1	1.12E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	36	NULL	21	0	0	0	0	0	0.000295501	1	1	0.000295501	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	35	NULL	21	0	0	0	0	0	3.08E-05	1	1	3.08E-05	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	31	NULL	21	0	0	0	0	0	0.0227817	1	1	0.0227817	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	5	NULL	21	0	0	0	0	0	0.007485085	1	1	0.007485085	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	3	NULL	21	0	0	0	0	0	0.356667012	1	1	0.356667012	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	2	NULL	21	0	0	0	0	0	5.52515316	1	1	5.52515316	g	mi
1,1,2016,7,5,15,25,25025,250250,1,21,0,0,0,0,00	1	1	2016	7	5	15	25	25025	250250	1	1	NULL	21	0	0	0	0	0	0.279074788	1	1	0.279074788	g	mi

Source: KBE and Massport.

Fuel Storage and Handling

As in previous years, VOC emissions from fuel storage and handling were calculated using methods based on EPA's AP-42[1] document. Calculations account for evaporative emissions from breathing losses, working losses, and spillage from aboveground storage tanks, underground storage tanks, and aircraft refueling. In 2003, additional information became available on the fire training fuel, Tek-Flame®. Emissions of VOCs from this fuel were estimated by AEDT. **Table I-9** presents Logan Airport's fuel throughput by category.

Stationary Sources

Stationary sources include the Central Heating and Cooling Plant, emergency generators, snow melters, space heaters, and boilers. Emission factors from EPA's AP-42 or NO_x Reasonably Available Control Technology (RACT) compliance testing were combined with the actual 2016 fuel throughput of the stationary sources to obtain emissions of VOCs, NO_X, CO, and PM with a diameter of less than or equal to 10 micrograms or 2.5 micrograms (PM_{10}/$PM_{2.5}$).

Title V of the 1990 Clean Air Act (CAA) Amendments requires facilities with air emissions to document their emissions and obtain a single permit combining all sources. The permitting program ensures that all emission sources are accounted for, the proper permits have been received, and permit conditions are being followed. A Title V Air Operating Permit covers all of the stationary sources at Logan Airport including boilers, emergency generators, snow melters, fire training, cooling towers, paint booths, deicing facilities, and storage tanks. **Table I-10** presents Logan Airport's stationary source fuel throughput by fuel category.

1 Compilation of Air Pollutant Emission Factors, AP-42, Office of Air Quality Planning and Standards, EPA, Fifth Edition, 1995.

Table I-9 Fuel Throughput by Fuel Category (gallons)

Fuel Category	1999	2000	2001	2002	2003	2004	2005	2006	2007
Jet Fuel	354,095,516	441,901,932	416,748,819	358,190,362	319,439,910	373,996,141	368,645,392	364,450,864	367,585,187
Fire Training Fuel[1]	N/A	N/A	N/A	N/A	13,719	12,227	8,105	5,000	8,631
Aviation Gas	99,726	90,922	60,691	35,111	32,515	34,717	52,487	35,098	29,067
Auto Gas	7,200,000	7,569,206	6,181,472	5,754,740	5,436,322	5,803,442	5,903,424	6,028,931	6,022,237
Diesel	768,106	839,751	1,239,904	1,067,847	1,030,185	1,078,665	1,567,688	1,164,493	1,141,335
Heating Oil No.2	480,733	494,500	582,283	340,492	370,903	381,852	367,899	259,768	423,181
Heating Oil No.62	1,600,893	1,555,527	1,641,693	1,079,283	1,122,975	2,940,752	3,098,126	1,396,529	1,073,260

Fuel Category	2008	2009	2010	2011	2012	2013	2014	2015	2016
Jet Fuel	345,631,788	327,358,619	335,693,997	340,421,373	343,731,127	349,397,940	370,222,342	374,985,216	456,003,328
Fire Training Fuel[1]	5,971	3,510	800	3,810	2,587	5,400	3,753	7,619	6,153
Aviation Gas	25,037	18,238	15,268	14,064	12,306	14,422	12,514	10,225	10,654
Auto Gas	5,693,178	5,736,724	5,696,505	5,487,952	6,694,626	6,800,936	7,007,591	7,432,165	7,794,957
Diesel	1,071,707	1,121,241	1,168,761	1,099,720	878,499	1,094,714	1,178,805	1,473,720	1,233,200
Heating Oil No.2	303,143	409,049	319,727	384,906	210,794	289,665	289,956	294,704	520,977
Heating Oil No.6[2]	16,385	368,690	9,010	11,285	6,786	17,721	77,146	0	0

Source: Massport, 2017.
N/A Not available.
1 Fire Training Fuel used in 1999-2002 was Jet A Fuel while in 2003 through 2014 it was Tek-Flame®. 2012 includes 100 gallons of avgas, 2013 includes 400 gallons of avgas, 2014 includes 338 gallons of avgas, 2015 includes 742 gallons of avgas, and 2016 includes 494 gallons of avgas.
2 Effective November 2014, Massport no longer uses No. 6 heating oil at the CHP and was replaced with No. 2 heating oil.

Table I-10 Stationary Source Fuel Throughput by Fuel Category (gallons)

Fuel Category	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Natural Gas (ft^3)	183,943,000	283,720,049	199,500,000	268,359,282	201,714,114	62,610,000	92,460,000	112,390,000	338,430,000
Heating Oil No. 2	480,733	494,500	582,283	340,492	370,903	381,852	367,899	259,768	423,181
Heating Oil No. 6[1]	1,600,893	1,555,527	1,641,693	1,079,283	1,122,975	2,940,752	3,098,126	1,396,529	1,073,260
Diesel Fuel[2]	57,441	N/A	N/A	N/A	N/A	67,198	77,848	77,848	258,606
Fire Training Fuel[3]	23,000	N/A	N/A	N/A	13,719	12,227	8,105	5,000	8,631

Fuel Category	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Natural Gas (ft^3)	458,680,000	430,810,000	449,640,000	479,830,000	360,523,000	402,496,000	418,805,000	463,170,000	429,502,000
Heating Oil No. 2	303,143	409,050	319,727	384,906	210,794	289,665	289,956	294,704	520,977
Heating Oil No. 6[1]	16,385	368,690	9,010	11,285	6,786	17,721	77,146	0	0
Diesel Fuel[2]	146,718	145,778	116,511	218,081	42,109	231,130	124,480	381,581	90,850
Fire Training Fuel[3]	5,971	3,510	800	3,810	2,587	5,400	3,753	7,619	6,153

Source: Massport, 2017.
N/A Not available.
1 Effective November 2014, Massport no longer uses No. 6 heating oil at the CHP and was replaced with No. 2 heating oil.
2 Diesel fuel was from the stationary snow melter usage. Starting in 2007, portable snow melter usage was also included.
3 Fire Training Fuel used in 1999-2002 was Jet A Fuel while in 2003 through 2015 it was Tek-Flame®. 2012 includes 100 gallons of avgas, 2013 includes 400 gallons of avgas, 2014 includes 338 gallons of avgas, 2015 includes 742 gallons of avgas, and 2016 includes 494 gallons of avgas.

Tables I-11 through **I-17** contain the 1993 through 2009 Emissions Inventory summary tables for Logan Airport.

Table I-11 Estimated VOC Emissions (in kg/day) at Logan Airport 1993-2001[1]

Aircraft/GSE Model:	**Logan Dispersion Modeling System (LDMS)**					**EDMS v3.22**	**EDMS v4.21**	**EDMS v4.03**	
Motor Vehicle Model:	**MOBILE5a**					**MOB 5a_h**	**MOB 6.2.03**	**MOBILE 6.0**	
Year:	1993	1994	1995	1996	1997	1998	1999[2]	2000	2001
Aircraft Sources									
Air carriers	1,958	1,554	1,407	1,390	1,227	736	653	514	374
Commuter aircraft	943	543	531	622	498	154	196	140	113
Cargo aircraft	89	244	236	214	207	43	318	207	149
General aviation	51	48	36	24	27	13	141	42	43
Total aircraft sources	3,041	2,389	2,210	2,250	1,959	946	1,308	903	679
Ground Service Equipment[3]	636	533	521	497	530	145	243	153	143
Motor Vehicles									
Ted Williams Tunnel through-traffic	N/A	N/A	N/A	N/A	N/A	N/A	15	12	10
Parking/curbside	173	148	127	102	102	118	101	89	77
On-airport vehicles[4]	238	215	179	223	205	258	256	206	170
Total motor vehicle sources	411	363	306	325	307	376	372	307	257
Other Sources									
Fuel storage/handling	408	434	318	356	381	372	352	412	372
Miscellaneous sources[5]	5	5	5	6	6	2	16	2	2
Total other sources	413	439	323	362	387	374	368	414	374
Total Airport Sources	4,501	3,724	3,360	3,434	3,183	1,841	2,291	1,777	1,453

Source: KBE and Massport.

Notes:

N/A Not available.

kg/day Kilograms per day. One kg/day is approximately equivalent to 0.40234 tons per year (tpy).

MOB MOBILE model for motor vehicle emissions (MOB5a_h=MOBILE5a_h, MOB6.2.03=MOBILE6.2 version .03)

1 The emissions inventory for 1990 is shown in Chapter 7. Emission inventories for 1991 and 1992 were not prepared.

2 Year 1999 emissions were last re-calculated using EDMS v4.21 in the 2004 ESPR Air Quality Analysis.

3 Beginning in 1996 and later, emissions include vehicles and equipment converted to alternative fuels. APU emissions are also included.

4 1999 emissions inventory include reductions attributable to CNG shuttle buses.

5 Includes the Central Heating and Cooling Plant, emergency electricity generation, and other stationary sources. Fire Training emissions were included in 1999. Diesel snow melter usage was added in 1999.

Table I-12 Estimated VOC Emissions (in kg/day) at Logan Airport 2002-2009

Aircraft/GSE Model:	**EDMS v4.11**		**EDMS v4.21**	**EDMS v4.5**		**EDMS v5.0.1**		**EDMS v5.0.2**		**EDMS v5.1**		**EDMS v5.1.2**
Motor Vehicle Model:	**MOBILE 6.0**	**MOB 6.2.01**	**MOBILE 6.2.03**									
Year:	**2002**	**2003**	**2004**	**2005**	**2006**		**2007**		**2008**		**2009**	
Aircraft Sources												
Air carriers	248	208	292	271	227	511	435	381	324	286	237	235
Commuter aircraft	75	95	127	140	125	371	479	409	253	176	131	133
Cargo aircraft	127	94	110	41	19	46	129	112	107	70	71	71
General aviation	52	61	127	147	147	236	226	206	201	171	78	78
Total aircraft sources	502	458	656	599	518	1,164[1]	1,269	1,108	885	703	517	517
Ground Service Equipment[2]	247	227	187	178	167	77	78	78	66	66	56	56
Motor Vehicles												
Ted Williams Tunnel through-traffic	9	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]
Parking/curbside[4]	51	45	38	37	33	33	31	31	25	25	22	22
On-airport vehicles	152	135	129	118	106	106	104	104	82	82	71	71
Total motor vehicle sources	212	180	167	155	139	139	135	135	107	107	93	93
Other Sources												
Fuel storage/handling	329	297	341	340	336	336	338	338	320	320	307	307
Miscellaneous sources[5]	2	3	9	13	8	8	14	14	13	12	7	7
Total other sources	331	300	350	353	344	344	352	352	333	332	314	314
Total Airport Sources	1,292	1,165	1,360	1,285	1,168	1,724	1,834	1,673	1,391	1,208	980	980

Source: KBE and Massport
Notes: Years 2006 to 2009 were computed with previous years EDMS version to provide for a common basis of comparison.
Kg/day Kilograms per day. One kg/day is equivalent to approximately 0.40234 tons per year (tpy).
1 The 2006 increase in aircraft VOC emissions is largely attributable to the addition of aircraft main engine startup emissions.
2 GSE emissions include aircraft APUs as well as vehicles and equipment converted to alternative fuels.
3 Due to the new roadway configuration and opening of the Ted Williams Tunnel there was no Ted Williams Tunnel through- traffic at Logan Airport beginning in 2003.
4 Parking/curbside is based on VMT analysis.
5 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

Table I-13	Estimated NO_X Emissions (in kg/day) at Logan Airport 1993-2001[1]								
Aircraft/GSE Model:	**Logan Dispersion Modeling System (LDMS)**					**EDMS v3.22**	**EDMS v4.21**	**EDMS v4.03**	
Motor Vehicle Model:	**MOBILE5a**					**MOB 5a_h**	**MOB 6.2.03**	**MOBILE 6.0**	
Year:	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999[2]**	**2000**	**2001**
Aircraft Sources									
Air carriers	4,271	4,317	3,861	3,781	4,150	4,471	4,183	4,202	3,707
Commuter aircraft	202	158	192	137	159	203	166	125	233
Cargo aircraft	213	257	332	363	262	254	286	284	267
General aviation	13	13	17	18	21	5	12	49	34
Total aircraft sources	4,699	4,745	4,402	4,299	4,592	4,933	4,647	4,660	4,241
Ground Service Equipment[3]	722	617	607	588	622	317	444	333	305
Motor Vehicles									
Ted Williams Tunnel through-traffic	N/A	N/A	N/A	N/A	N/A	N/A	28	26	22
Parking/curbside	25	24	24	24	24	37	39	52	46
On-airport vehicles[4]	240	239	229	257	244	372	449	425	369
Total motor vehicle sources	265	263	253	281	268	409	516	503	437
Other Sources									
Fuel storage/handling[5]	0	0	0	0	0	0	0	0	0
Miscellaneous sources[6]	278	330	320	275	244	284	165	211	185
Total other sources	278	330	320	275	244	284	165	211	185
Total Airport Sources	5,964	5,955	5,582	5,443	5,726	5,943	5,772	5,707	5,168

Source: KBE and Massport.
N/A Not available.
Kg/day Kilograms per day. One kg/day is approximately equivalent to 0.40234 tons per year (tpy).
MOB MOBILE model for motor vehicle emissions (MOB5a_h=MOBILE5a_h, MOB6.2.03=MOBILE6.2 version .03)
1 The emissions inventory for 1990 is shown in Chapter 7. Emission inventories for 1991 and 1992 were not prepared.
2 Year 1999 emissions were last re-calculated using EDMS v4.21 in the 2004 ESPR Air Quality Analysis.
3 Beginning in 1996 and later, emissions include vehicles and equipment converted to alternative fuels. APU emissions are also included.
4 1999 emissions inventory include reductions attributable to CNG shuttle buses.
5 Fuel storage and handling facilities are not sources of NOx emissions.
6 Includes the Central Heating and Cooling Plant, emergency electricity generation, and other stationary sources. Fire Training emissions were included in 1999. Diesel snow melter usage was added in 1999.

Table I-14 Estimated NO_X Emissions (in kg/day) at Logan Airport 2002-2009

Aircraft/GSE Model:	**EDMS v4.11**		**EDMS v4.21**	**EDMS v4.5**		**EDMS v5.0.1**		**EDMS v5.0.2**		**EDMS v5.1**		**EDMS v5.1.2**
Motor Vehicle Model:	**MOBILE 6.0**	**MOB 6.2.01**	**MOBILE 6.2.03**									
Year:	**2002**	**2003**	**2004**	**2005**	**2006**		**2007**		**2008**		**2009**	
Aircraft Sources												
Air carriers	2,721	2,479	2,949	2,880	2,849	3,044	3,120	3,121	3,031	3,031	2,944	2,952
Commuter aircraft	208	185	245	225	195	256	353	354	319	319	309	234
Cargo aircraft	246	213	215	211	192	125	248	248	233	233	215	204
General aviation	38	45	49	50	49	60	56	56	43	43	27	23
Total aircraft sources	3,213	2,922	3,458	3,366	3,285	3,485	3,777	3,779	3,626	3,626	3,495	3,413
Ground Service Equipment[1]	322	291	333	312	280	300	299	299	257	257	219	219
Motor Vehicles												
Ted Williams Tunnel through-traffic	20	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]
Parking/curbside[3]	32	28	21	22	19	19	18	18	15	15	13	13
On-airport vehicles	341	302	267	269	238	238	233	233	182	182	153	153
Total motor vehicle sources	393	330	288	291	257	257	251	251	197	197	166	166
Other Sources												
Fuel storage/handling[4]	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous sources[5]	175	151	211	218	109	109	128	128	124	124	181	181
Total other sources	175	151	211	218	109	109	128	128	124	124	181	181
Total Airport Sources	4,103	3,694	4,290	4,187	3,931	4,151	4,455	4,457	4,204	4,204	4,061	3,979

Source: KBE and Massport
Notes: Years 2006 to 2009 were computed with previous years EDMS version to provide for a common basis of comparison.
Kg/day Kilograms per day. One kg/day is approximately equivalent to 0.40234 tons per year (tpy).
1 GSE emissions include APUs as well as vehicles and equipment converted to alternative fuels.
2 Due to the new roadway configuration and opening of the Ted Williams Tunnel there was no Ted Williams Tunnel through-traffic at Logan Airport beginning in 2003.
3 Parking/curbside data is based on VMT analysis.
4 Fuel storage/handling facilities are not a source of NOx emissions.
5 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

Table I-15 Estimated CO Emissions (in kg/day) at Logan Airport 1993-2001[1]

Aircraft/GSE Model:	**Logan Dispersion Modeling System (LDMS)**					**EDMS v3.22**	**EDMS v4.21**	**EDMS v4.03**	
Motor Vehicle Model:	**MOBILE5a**					**MOB5a_h**	**MOB 6.2.03**	**MOBILE 6.0**	
Year:	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999[2]**	**2000**	**2001**
Aircraft Sources									
Air carriers	5,663	4,660	4,691	4,812	4,698	3,079	3,754	2,994	2,475
Commuter aircraft	1,309	927	934	859	770	482	1,404	1,188	1,072
Cargo aircraft	344	572	598	580	514	218	503	400	323
General aviation	353	356	339	549	654	269	940	295	407
Total aircraft sources	7,669	6,515	6,562	6,800	6,636	4,048	6,601	4,877	4,277
Ground Service Equipment[3]	7,482	6,187	6,029	5,740	6,098	5,113	4,532	5,335	5,193
Motor Vehicles									
Ted Williams Tunnel through-traffic	N/A	N/A	N/A	N/A	N/A	N/A	151	133	121
Parking/curbside	952	820	650	644	586	772	437	495	440
On-airport vehicles[4]	1,575	1,451	1,087	1,514	1,283	1,883	2,547	2,245	2,001
Total motor vehicle sources	2,527	2,271	1,737	2,158	1,869	2,655	3,135	2,873	2,562
Other Sources									
Fuel storage/handling[5]	0	0	0	0	0	0	0	0	0
Miscellaneous sources[6]	26	30	29	39	37	37	168	27	24
Total other sources	26	30	29	39	37	37	168	27	24
Total Airport Sources	17,704	15,003	14,357	14,737	14,640	11,853	14,436	13,112	12,056

Source: KBE and Massport.
Kg/day Kilograms per day. One kg/day is approximately equivalent to 0.40234 tons per year (tpy).
N/A Not available.
MOB MOBILE model for motor vehicle emissions (MOB5a_h=MOBILE5a_h, MOB6.2.03=MOBILE6.2 version .03)
1 The emissions inventory for 1990 is shown in Chapter 7. Emission inventories for 1991 and 1992 were not prepared.
2 Year 1999 emissions were last re-calculated using EDMS v4.21 in the 2004 ESPR Air Quality Analysis.
3 Beginning in 1996 and later, emissions include vehicles and equipment converted to alternative fuels. APU emissions are also included.
4 1999 emission inventory include reductions attributable to CNG shuttle buses.
5 Fuel storage and handling facilities are not sources of CO emissions.
6 Includes the Central Heating and Cooling Plant, emergency electricity generation, and other stationary sources. Fire Training emissions were included in 1999. Diesel snow melter usage was added in 1999.

Table I-16 Estimated CO Emissions (in kg/day) at Logan Airport 2002-2009

Aircraft/GSE Model:	EDMS v4.11		EDMS v4.21	EDMS v4.5		EDMS v5.0.1		EDMS v5.0.2		EDMS v5.1		EDMS v5.1.2
Motor Vehicle Model:	**MOBILE 6.0**	**MOB 6.2.01**	**MOBILE 6.2.03**									
Year:	**2002**	**2003**	**2004**	**2005**	**2006**		**2007**		**2008**		**2009**	
Aircraft Sources												
Air carriers	2,156	2,128	2,985	2,895	2,828	3,167	2,973	2,973	2,710	2,710	2,460	2,448
Commuter aircraft	783	846	1,010	1,010	950	1,587	2,484	2,484	2,436	2,436	2,364	2,795
Cargo aircraft	285	209	229	174	138	158	241	241	255	255	256	266
General aviation	256	276	416	437	398	442	401	403	345	345	145	150
Total aircraft sources	3,480	3,459	4,640	4,516	4,314	5,354	6,099	6,101	5,746	5,746	5,225	5,659
Ground Service Equipment[1]	5,170	4,758	3,586	3,531	3,409	1,586	1,904	1,904	1,609	1,609	1,364	1,364
Motor Vehicles												
Ted Williams Tunnel through-traffic	112	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]
Parking/curbside[3]	295	253	180	179	144	144	139	139	117	117	107	107
On-airport vehicles	1,872	1,685	1,412	1,290	1,036	1,036	1,038	1,038	834	834	740	740
Total motor vehicle sources	2,279	1,938	1,592	1,469	1,180	1,180	1,177	1,177	951	951	847	847
Other Sources												
Fuel storage/handling[4]	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous sources[5]	23	22	33	40	24	24	51	51	55	55	55	55
Total other sources	23	22	33	40	24	24	51	51	55	55	55	55
Total Airport Sources	10,952	10,177	9,851	9,556	8,927	8,144	9,231	9,233	8,361	8,361	7,491	7,925

Source: KBE and Massport
Notes: Years 2006 to 2009 were computed with previous years EDMS version to provide for a common basis of comparison.
Kg/day Kilograms per day. One kg/day is approximately equivalent to 0.40234 tons per year (tpy).
1 GSE emissions include APUs as well as vehicles and equipment converted to alternative fuels.
2 Due to the new roadway configuration and opening of the Ted Williams Tunnel there was no Ted Williams Tunnel through-traffic at Logan Airport beginning in 2003.
3 Parking/curbside information is based on VMT analysis.
4 Fuel storage/handling facilities are not a source of CO emissions.
5 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

Table I-17 Estimated $PM_{10}/PM_{2.5}$ Emissions (in kg/day) at Logan Airport, 2005-2009[1,2]

Aircraft/GSE Model:	**EDMS v4.5**		**EDMS v5.0.1**		**EDMS v5.0.2**		**EDMS v5.1**		**EDMS v5.1.2**
Motor Vehicle Model:	**MOBILE 6.2.03**								
Year:	**2005**	**2006**		**2007**		**2008**		**2009**	
Aircraft Sources									
Air carriers	25	25	38	35	67	63	42	43	36
Commuter aircraft	1	1	2	6	14	11	6	5	5
Cargo aircraft	2	3	2	3	6	5	4	4	3
General aviation	2	2	2	2	5	5	4	2	2
Total aircraft sources	30	31	44	46	92	84	56	54	46
Ground Service Equipment[3]	11	9	9	10	10	8	15	14	14
Motor Vehicles									
Parking/curbside[4]	1	1	1	<1	<1	<1	<1	<1	<1
On-airport vehicles	8	8	8	9	9	7	7	6	6
Total motor vehicle sources	9	9	9	9	9	7	7	6	6
Other Sources									
Fuel storage/handling[5]	0	0	0	0	0	0	0	0	0
Miscellaneous sources[6]	34	16	16	17	17	3	3	5	5
Total other sources	34	16	16	17	17	3	3	5	5
Total Airport Sources	84	65	78	82	128	102	81	79	71

Source: KBE and Massport
Notes: Years 2006 to 2009 were computed with previous years EDMS version to provide for a common basis of comparison.
Kg/day Kilograms per day. One kg/day is approximately equivalent to 0.40234 tons per year (tpy); PM – particulate matter
1 It is assumed that all PM are less than 2.5 microns in diameter (PM2.5).
2 2005 is the first year that PM10/PM2.5 emissions were included in the Logan Airport ESPR/EDR emission inventories.
3 GSE emissions include APUs as well as vehicles and equipment converted to alternative fuels.
4 Parking/curbside is based on VTM analysis.
5 Fuel storage and handling facilities are not sources of PM emissions.
6 Includes the Central Heating and Cooling Plant, emergency electricity generation, fire training, snow melters, and other stationary sources.

Greenhouse Gas Emissions Inventory for 2016

The Massachusetts Executive Office of Energy and Environmental Affairs (EEA) has published the *MEPA Greenhouse Gas Emissions Policy and Protocol*.[2] These guidelines require that certain projects undergoing review under the Massachusetts Environmental Policy Act (MEPA) quantify the greenhouse gas (GHG) emissions generated by proposed projects, and identify measures to avoid, minimize, or mitigate such emissions.[3] Even though the *2016 EDR* does not assess any proposed projects and is therefore not subject to the GHG policy, Massport has voluntarily prepared an emission inventory of GHG emissions directly and indirectly associated with Logan Airport.

In April 2009, the Transportation Research Board Airport Cooperative Research Program (ACRP); published the *Guidebook on Preparing Airport Greenhouse Gas Emission Inventories (ACRP Report 11)*, which provides recommended instructions to airport operators on how to prepare an airport-specific GHG emissions inventory.[4] The 2016 GHG emissions estimates include aircraft (within the ground taxi/delay and up to 3,000 feet), GSE, APU, motor vehicles, a variety of stationary sources, and electricity usage. Aircraft cruise emissions over the 3,000-foot level were not included. This work was accomplished following the EEA guidelines and uses widely-accepted emission factors that are considered appropriate for this application, including International Organization for Standardization New England electricity-based values.

Methodology

Airport GHG emissions are calculated in much the same way as criteria pollutants,[5] through the use of input data such as activity levels or material throughput rates (i.e., fuel usage, VMT, electrical consumption) that are applied to appropriate emission factors (i.e., in units of GHG emissions per gallon of fuel).

In this case, the input data were either based on Massport records, or data and information derived from the latest version of the FAA AEDT (AEDT 2c SP2). **Table I-18** summarizes the data and information used in the 2016 GHG inventory.

Massport will update the GHG Emissions Inventory for Logan Airport annually.

---

2 Revised MEPA Greenhouse Gas Emissions Policy and Protocol, Massachusetts Executive Office of Energy and Environmental Affairs, effective May 10, 2010.

3 These GHGs are comprised primarily of carbon dioxide (CO2), methane (CH4), nitrous oxides (N2O), and three groups of fluorinated gases (i.e., sulfur hexafluoride [SF6], hydrofluorocarbons [HFCs], and perfluorocarbons [PFCs]). GHG emission sources associated with airports are generally limited to CO2, CH4, and N2O.

4 Transportation Research Board, Airport Cooperative Research Panel, ACRP Report 11, Project 02-06, Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories (in production). See http://onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_011.pdf for the full report.

5 Criteria pollutants are pollutants for which there are National Ambient Air Quality Standards (i.e., carbon monoxide, sulfur dioxide, nitrogen dioxide, etc.).

Table I-18 Logan Airport Greenhouse Gas (GHG) Inventory Input Data and Information for 2016

Activity	Fuel Type	Usage	Units	Source
Aircraft				
Aircraft Taxi	Jet A[1]	19,455,006	gallons	AEDT 2c SP2
	AvGas[2]	455	gallons	AEDT 2c SP2
Engine Startup[6]	Jet A	104,490	gallons	EDMS v5.1.4
Aircraft Ground up to 3,000 feet	Jet A[1]	17,812,612	gallons	AEDT 2c SP2
	AvGas[2]	513	gallons	AEDT 2c SP2
Aircraft Support Equipment				
GSE	Diesel	638,425	gallons	Massport
	Gasoline	548,115	gallons	Massport
	Propane	798	gallons	AEDT 2c SP2
	CNG	0	ft^3	AEDT 2c SP2
APU	Jet A	934,480	gallons	AEDT 2c SP2
Motor Vehicles				
On-airport Vehicles	Composite[3]	64,546,848	VMT	Massport
On-airport Parking/Curbsides	Composite[3]	1,427,467	Idle hours	Massport
Massport Shuttle Bus	CNG	269,135	GEG	Massport
	Diesel	Defleeted 2014	gallons	Massport
Massport Express Bus	Diesel	211,799	gallons	Massport
Massport Fire Rescue	Diesel	20,000	gallons	Massport
Agricultural Equipment	Diesel	83,600	gallons	Massport
Massport Fleet Vehicles (Honda Civic)	CNG	2,752	GEG	Massport
Massport Fleet Vehicles (Fueled Onsite)	Gasoline	202,104	gallons	Massport
Massport Fleet Vehicles (Fueled Offsite)	Gasoline	83,500	gallons	Massport
Massport Fleet Vehicles (Fueled Onsite)	Diesel	83,643	gallons	Massport
Off-airport Vehicles (Public)	Composite[3]	187,616,704	VMT	Massport
Off-airport Vehicles (Airport Employees)	Composite[3]	4,122,697	VMT	Massport
Off-airport Vehicles (Tenant Employees)	Composite[3]	55,684,012	VMT	Massport
Stationary and Portable Sources				
Boilers and Space Heaters	No 2 Oil	537,884	gallons	Massport
	No 6 Oil	0	gallons	Massport

6 The EDMS fuel usage for Aircraft Engine Startup was reported as a surrogate because AEDT does not calculate this fuel usage.

Table I-18 Logan Airport Greenhouse Gas (GHG) Inventory Input Data and Information for 2016 (Continued)

Activity	Fuel Type	Usage	Units	Source
Aircraft Support Equipment (Cont'd.)				
	Natural Gas	438	million ft^3	Massport
Generators	Diesel	36,791	gallons	Massport
Snow melters	ULSD	90,850	gallons	Massport
	CNG	1.54	million ft^3	Massport
Fire Training Facility	Tekflame	5,659	gallons	Massport
	AvGas	494	gallons	Massport
Electrical Consumption – Massport	-	16,337,490	kWh	Massport
Electrical Consumption – Tenant/Common Area	-	168,885,976	kWh	Massport

Sources: Massport and KBE.
Notes: APU – Auxiliary power units; CNG – compressed natural gas; GEG – gasoline equivalent gallons; GSE – ground support equipment; kWh – kilowatt hours; VMT – vehicle miles traveled; ULSD – ultra low sulfur diesel.
1 Jet A density of 6.84 pounds per gallon.
2 AvGas density of 6.0 pounds per gallon.
3 Composite means gasoline, diesel, CNG, and liquefied petroleum gas (LPG) fueled motor vehicles.

Emission factors were obtained from the U.S. Energy Information Administration, the Intergovernmental Panel on Climate Change (IPCC), EPA's MOVES, and the most recent version of EPA's GHG Emission Factors Hub (November 2015).[7,8,9,10] **Table I-19** presents emission factors for carbon dioxide (CO_2), nitrous oxide (N_2O), and methane (CH_4) for 2016.

7 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, 2006, www.ipcc-nggip.iges.or.jp/public/2006gl/index.html.

8 U.S. Energy Information Administration, Voluntary Reporting of Greenhouse Gases Program. Fuel and Energy Source Codes and Emission Coefficients, www.eia.doe.gov/oiaf/1605/coefficients.html.

9 EPA, GHG Emissions Factors Hub (November 2015) https://www.epa.gov/climateleadership/center-corporate-climate-leadership-ghg-emission-factors-hub. The most recent version of the Emission Factors Hub includes updates to emission factors for stationary and mobile combustion sources, new electricity emission factors from EPA's Emissions & Generation Resource Integrated Database (eGRID) and the IPCC Fifth Assessment Report (AR4/AR5).

10 U.S. Environmental Protection Agency, MOVES Emissions Model, http://www.epa.gov/otaq/models/moves/.

Table I-19 Greenhouse Gas (GHG) Emission Factors for 2016

Sources	Fuel	CO_2	N_2O	CH_4	Units
Aircraft[1]	Jet A	21.5	0.00066	-[5]	lb/gallon
	AvGas	18.3	0.00024	0.01556	lb/gallon
Ground Support Equipment/ Auxiliary Power Units[1]	Diesel	22.5	0.00057	0.00126	lb/gallon
	Gasoline	19.4	0.00049	0.00110	lb/gallon
	CNG	120.0	0.00023	0.00226	lb/1000 ft^3
	Propane	12.6	0.00011	0.00060	lb/gallon
	Jet A	21.5	0.00066	-[5]	lb/gallon
Motor Vehicles[1,2]	Composite	472	0.00005	0.0044	g/mile
	Composite	4,147	0.00022	0.01888	g/hour
	CNG	120.0	0.00023	0.00226	lb/1000 ft^3
	Diesel	22.5	0.00057	0.00126	lb/gallon
	Gasoline	19.4	0.00018	0.0008	lb/gallon
Stationary and Portable[1]	No. 2 Oil	22.5	0.00018	0.00090	lb/gallon
	No. 6 Oil	24.8	0.00020	0.00099	lb/gallon
	Natural Gas	120.0	0.00023	0.00226	lb/1000 ft^3
	ULSD	22.5	0.00018	0.00090	lb/gallon
Fire Training Facility[1]	Tekflame[3]	12.6	0.00011	0.00060	lb/gallon
	AvGas	18.3	0.00024	0.01556	lb/gallon
Electrical Consumption[4]	-	0.86	0.000026	0.000011	lb/kW-hr

Sources: Massport and KBE.

Notes: CH_4 – methane; CNG – compressed natural gas; CO_2 – carbon dioxide; g- grams; kWh – kilowatt hour; lb – pound; N_2O – nitrous oxides; ULSD – Ultra Low Sulfur Diesel.

1 Environmental Protection Agency, GHG Emissions Factors Hub (November 2015), https://www.epa.gov/climateleadership/center-corporate-climate-leadership-ghg-emission-factors-hub.

2 EPA, MOVES2014a, http://www.epa.gov/otaq/models/moves/.

3 As propane.

4 Environmental Protection Agency, Emissions & Generation Resource Integrated Database (eGRID2012), October 2015, http://www.epa.gov/climateleadership/documents/emission-factors.pdf.

5 Contributions of CH_4 emissions from commercial aircraft are reported as zero. Years of scientific measurement campaigns conducted at the exhaust exit plane of commercial aircraft gas turbine engines have repeatedly indicated that CH_4 emissions are consumed over the full emission flight envelope [Reference: Aircraft Emissions of Methane and Nitrous Oxide during the Alternative Aviation Fuel Experiment, Santoni et al., Environ. Sci. Technol., July 2011, Volume 45, pp. 7075-7082]. As a result, EPA published that: "…methane is no longer considered to be an emission from aircraft gas turbine engines burning Jet A at higher power settings and is, in fact, consumed in net at these higher powers." [Reference: EPA, Recommended Best Practice for Quantifying Speciated Organic Gas Emissions from Aircraft Equipped with Turbofan, Turbojet, and Turboprop Engines, May 27, 2009 [EPA-420-R-09-901], http://www.epa.gov/otaq/aviation.htm]. In accordance with the following statements in the 2006 IPCC Guidelines (IPCC 2006), FAA does not calculate CH_4 emissions for either the domestic or international bunker commercial aircraft jet fuel emissions inventories. "Methane (CH_4) may be emitted by gas turbines during idle and by older technology engines, but recent data suggest that little or no CH_4 is emitted by modern engines." "Current scientific understanding does not allow other gases (e.g., N_2O and CH_4) to be included in calculation of cruise emissions." (IPCC 1999).

Results

Table I-20 presents the results of the 2016 GHG emissions inventory for Logan Airport by emission source (i.e., aircraft, GSE, motor vehicles, and stationary sources) and compound (i.e., CO_2, N_2O, and CH_4), respectively.

Table I-20 Greenhouse Gas (GHG) Emissions (MMT CO2 Eq)[1] for 2016

Activity	CO_2	N_2O	CH_4	Total
Aircraft Sources				
Aircraft Taxi	0.22	<0.01	-[2]	0.19
Engine Startup	<0.01	<0.01	<0.01	<0.01
Aircraft AGL to 3,000 feet	0.17	<0.01	<0.01	0.22
Aircraft Support Equipment				
GSE	0.01	<0.01	<0.01	0.01
APU	0.01	<0.01	-[2]	0.01
Motor Vehicles				
On-airport Vehicles	0.03	<0.01	<0.01	0.03
On-airport Parking/Curbsides	0.01	<0.01	<0.01	0.01
Massport Shuttle Buses	<0.01	<0.01	<0.01	<0.01
Massport Fleet Vehicles	0.01	<0.01	<0.01	0.01
Off-airport Vehicles (Public)	0.05	<0.01	<0.01	0.06
Off-airport Vehicles (Airport Employees)	<0.01	<0.01	<0.01	<0.01
Off-airport Vehicles (Tenant Employees)	0.03	<0.01	<0.01	0.03
Stationary Sources				
Boilers	0.03	<0.01	<0.01	0.03
Generators, Snow melters, etc.	<0.01	<0.01	<0.01	<0.01
Fire Training Facility	<0.01	<0.01	<0.01	<0.01
Electrical Consumption	0.06	<0.01	<0.01	0.05

Sources: Massport and KBE.

1 Units expressed as million metric tons of CO_2 equivalent (MMT CO2 Eq): 1 metric ton = 1.1 short tons.

2 Contributions of CH_4 emissions from commercial aircraft are reported as zero. Years of scientific measurement campaigns conducted at the exhaust exit plane of commercial aircraft gas turbine engines have repeatedly indicated that CH_4 emissions are consumed over the full emission flight envelope [Reference: Aircraft Emissions of Methane and Nitrous Oxide during the Alternative Aviation Fuel Experiment, Santoni et al., Environ. Sci. Technol., July 2011, Volume 45, pp. 7075-7082]. As a result, EPA published that: "…methane is no longer considered to be an emission from aircraft gas turbine engines burning Jet A at higher power settings and is, in fact, consumed in net at these higher powers." [Reference: EPA, Recommended Best Practice for Quantifying Speciated Organic Gas Emissions from Aircraft Equipped with Turbofan, Turbojet, and Turboprop Engines, May 27, 2009 [EPA-420-R-09-901], http://www.epa.gov/otaq/aviation.htm]. In accordance with the following statements in the 2006 IPCC Guidelines (IPCC 2006), FAA does not calculate CH_4 emissions for either the domestic or international bunker commercial aircraft jet fuel emissions inventories. "Methane (CH_4) may be emitted by gas turbines during idle and by older technology engines, but recent data suggest that little or no CH_4 is emitted by modern engines." "Current scientific understanding does not allow other gases (e.g., N_2O and CH_4) to be included in calculation of cruise emissions." (IPCC 1999).

Table I-21 compares the total GHG emission from Logan Airport in 2016 to the total GHG emissions for Massachusetts.

Table I-21 Logan Airport Greenhouse Gas (GHG) Emissions Compared to Massachusetts Totals[1]

	CO_2	N_2O	CH_4	Totals
Logan Airport Emissions (2016)[2]	0.64	<0.01	<0.01	0.65
Massachusetts[3]	68.7	0.8	1.1	70.6
Percent of Logan Airport to Massachusetts[4]	<1%	<1%	<1%	<1%

Sources: Massport and KBE.
1 Units expressed as million metric tons of CO_2 equivalents (MMT CO_2 Eq): 1 metric ton = 1.1 short tons.
2 Total from Massport, tenants, and public categories.
3 Climate Analysis Indicators Tool (CAIT US) Version 4.0. (Washington, DC: World Resources Institute, 2012)
4 Percentages represent the relative amount Logan Airport-related emissions compared to the state totals.

Table I-22 provides a comparison between Airport-related GHG emissions from 2007 through 2016. Total GHG emissions in 2016 were slightly higher (2 percent) than 2015 levels. To equally compare to previous years, the 2016 emissions are summarized in a manner similar to previous years.

Table I-22 Comparison of Estimated Total Greenhouse Gas (GHG) Emissions (MMT of CO_2eq) at Logan Airport – 2007 through 2016

Source	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Direct Emissions[2]										
Aircraft[3]	0.22	0.21	0.19	0.18	0.19	0.19	0.19	0.20	0.21	0.19
GSE/APUs	0.08	0.08	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01
Motor vehicles[4]	0.03	0.03	0.03	0.03	0.04	0.03	0.05	0.05	0.05	0.05
Other sources[5]	0.04	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
Total Direct Emissions	0.37	0.35	0.27	0.27	0.28	0.26	0.29	0.29	0.32	0.29
Indirect Emissions[6]										
Aircraft[7]	0.18	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.22
Motor vehicles[8]	0.05	0.05	0.05	0.05	0.06	0.05	0.08	0.07	0.08	0.09
Electrical consumption[9]	0.09	0.08	0.07	0.07	0.08	0.08	0.06	0.06	0.06	0.06
Total Indirect Emissions	0.32	0.30	0.29	0.29	0.30	0.30	0.31	0.30	0.32	0.36
Total Emissions[10]	0.69	0.65	0.56	0.56	0.58	0.57	0.60	0.60	0.63	0.65
Percent of State Totals[11]	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Sources: Massport and KBE.

1 MMT – million metric tons of CO_2 equivalents (1 MMT = 1.1M Short Tons). CO_2 equivalents (CO_2eq) are bases for reporting the three primary GHGs (e.g., CO_2, N_2O and CH_4) in common units. Quantities are reported as "rounded" and truncated values for ease of addition.

2 Direct emissions are those that occur in areas located within the Airport's geographic boundaries.

3 Direct aircraft emissions based engine start-up, taxi-in, taxi-out and ground-based delay emissions.

4 Direct motor vehicle emissions based on on-site vehicle miles traveled (VMT).

5 Other sources include Central Heating and Cooling Plant, emergency generators, snow melters and live fire training facility.

6 Indirect emissions are those that occur off the Airport site.

7 Indirect aircraft emissions are based on take-off, climb-out and landing emissions which occur up to an altitude of 3,000 ft., the limits of the landing/take-off (LTO) cycle

8 Indirect motor vehicle emissions based on off-site Airport-related VMT and an average round trip distance of approximately 60 miles.

9 Electrical consumption emissions occur off-airport at power generating plants.

10 Total Emissions = Direct + Indirect.

11 Percentage based on relative amount of Airport total of direct emissions to statewide total from World Resources Institute (cait.wri.org).

Measured NO_2 Concentrations

This section presents the results of Massport's long-term ambient (i.e., outdoor) air quality monitoring program for NO_2 – a pollutant associated with aircraft activity and other fuel combustion sources. Between 1982 and 2011, Massport collected NO_2 concentration data at numerous locations both on the Airport and in neighboring residential communities. The purpose of this monitoring program was to track long-term trends in NO_2 levels and to compare the results to the NAAQS for this pollutant. In 2011, Massport determined that the Logan NO_2 Monitoring Program had achieved its objectives with the significant and stable decrease in NO_2 emissions since 1999 and thus discontinued the program in 2011.

When it was operational, this monitoring program used passive diffusion tube technology for a period of one week each month for 12 months of the year at each of the monitoring stations. The samples of NO_2, along with Quality Assurance/Quality Control (QA/QC) samples, were then analyzed in a laboratory.

Table I-23 presents the final year NO_2 monitoring data (i.e., 2011). For comparative purposes, historical data from 1999 are similarly shown in **Table I-23**. The table also includes NO_2 data collected under a separate effort by MassDEP using continuous monitors at four Boston-area locations.

As shown on **Table I-23**, the 2011 NO_2 levels were somewhat higher than in 2010. However, this occurrence is consistent with the cyclical trend of the average levels over the past several years[11]. Importantly, there remains a long-term trend of decreasing NO_2 concentrations at both the Massport and MassDEP monitoring sites since 1999. Other notable observations of the 2011 data reveal the following:

- Annual NO_2 concentrations at all Massport and MassDEP monitoring locations were below the annual NO_2 NAAQS of 100 micrograms per cubic meter ($\mu g/m^3$) in 2011.
- The Massport-collected data compare relatively closely with data collected by the MassDEP. The average of all Massport monitoring sites was 29.8 $\mu g/m^3$ compared to 32.3 $\mu g/m^3$ for the four MassDEP Boston-area monitors.
- The highest NO_2 concentrations in 2011 from the Massport program occurred in areas characterized by high levels of motor vehicle traffic (i.e., Main Terminal Area [Site 8] and Maverick Square [Site 12]).

11 Spatial and temporal changes in measured NO_2 levels from year to year are typical and should not be used to define short-term results. Rather, NO_2 levels are better assessed by looking at the trends over several years.

Table I-23 Massport and MassDEP Annual NO_2 Concentration Monitoring Results (µg/m^3)

Monitoring Site	Site No.	Year 1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Massport Monitoring Sites														
Runway 9	1	61.0	58.2	41.6	45.8	33.9	30.1	35.0	31.9	17.3	31.3	32.2	32.3	38.7
Runway 4R	2	55.6	44.6	41.4	36.9	32.5	30.9	30.7	29.0	17.2	20.2	19.2	21.9	25.7
Runway 33L	3	47.7	42.6	39.4	33.3	30.8	25.4	24.5	26.3	24.2	21.6	16.9	25.0	29.8
Runway 27	4	42.9	37.8	35.8	30.3	25.5	24.1	22.7	22.3	16.9	18.3	17.6	19.4	23.3
Runaway 22L	5	47.5	39.8	38.2	33.8	27.8	23.7	22.1	24.9	17.1	21.3	20.1	21.9	29.0
Runway 22R	6	60.6	59.2	51.6	45.0	32.3	29.7	32.9	25.1	24.8	29.7	27.8	33.1	30.6
Runway 15R	7	47.0	43.4	44.3	42.6	40.8	28.7	27.7	28.7	20.5	24.2	23.9	26.7	29.7
Main Terminal Area	8	70.8	87.0	80.7	69.3	44.3	44.7	46.2	43.5	29.5	41.7	37.7	43.9	49.0
Webster St., Jeffries Point	11	52.4	45.5	43.4	39.1	32.5	28.3	31.3	31.3	22.7	25.2	23.9	27.0	30.1
Maverick Square, E. Bos	12	81.2	72.2	68.5	61.3	47.9	46.5	41.4	45.6	36.0	41.3	38.2	42.5	43.5
Bremen St., E. Boston	13	59.1	52.6	52.0	46.2	39.1	35.7	37.6	37.1	27.8	30.1	28.6	31.9	35.3
Shore St. E. Boston	14	45.7	38.5	38.8	35.0	27.2	24.0	24.9	22.4	18.1	19.7	18.3	20.7	26.7
Orient Heights Yacht Club	15	45.1	46.9	47.7	43.1	29.4	25.2	25.5	25.1	19.6	21.1	18.3	22.5	26.7
Bayswater St. E. Boston	16	45.2	45.5	48.3	41.2	28.4	22.8	30.4	23.1	18.4	20.2	17.8	21.0	25.9
Annavoy St. E. Boston	17	40.8	39.2	44.4	33.7	24.7	21.4	23.3	21.0	18.2	19.6	17.3	20.9	25.8
Pleasant St. Winthrop	18	42.0	39.3	37.8	32.3	27.9	22.6	23.4	21.4	17.8	20.2	17.7	20.1	24.4
Court Road, Winthrop	19	40.0	36.1	33.8	27.4	24.0	19.2	22.3	21.0	16.3	17.1	16.7	18.4	22.7
Cottage Park Yacht Club	20	37.1	50.9	45.9	36.7	22.5	19.1	27.7	21.4	16.3	18.4	17.8	17.8	22.5
Point Shirley, Winthrop	21	33.1	37.7	38.6	24.4	22.7	17.4	17.2	20.2	15.7	15.6	14.9	17.5	21.6
Deer Island	22	36.3	31.9	33.8	33.1	21.3	17.8	16.9	17.8	13.0	17.0	14.7	16.7	20.7
Runway 4R–9	23	42.2	66.0	42.3	33.4	28.6	24.1	27.1	26.3	19.2	22.4	21.2	21.6	26.5
Runway 33L–4R	24	44.3	41.7	41.8	33.5	28.1	24.3	22.3	25.7	20.9	25.2	20.0	23.6	26.2

Table I-23 Massport and MassDEP Annual NO2 Concentration Monitoring Results (μg/m³) (Continued)

Monitoring Site	Site No.	Year 1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Massport Monitoring Sites (continued)														
Runway 22R–33L	25	62.4	50.3	49.4	42.2	33.8	31.7	29.4	34.5	22.9	25.1	25.3	29.5	34.9
Jeffries Point Park/Marginal St.	26	68.6	49.8	45.0	42.0	35.2	30.5	32.5	31.7	24.4	27.0	25.6	28.6	33.1
Harborwalk	27	54.3	48.5	47.4	43.5	35.6	35.5	29.3	34.2	24.2	26.1	24.5	28.3	34.9
Logan Athletic Fields	29	NA	69.1	67.6	54.9	41.9	40.2	37.5	37.0	24.6	28.8	26.8	30.8	37.8
Brophy Park, Jeffries Point	30	NA	48.0	45.2	41.0	36.5	31.2	32.9	31.3	24.8	26.6	24.6	26.8	30.8
Average of all Monitoring Sites		**50.5**	**50.5**	**47.5**	**40.0**	**31.7**	**28.0**	**28.7**	**28.7**	**21.0**	**24.3**	**22.5**	**25.6**	**29.8**
MassDEP Monitoring Sites[1]														
Long Island Road	A	20.7	24.4	22.6	22.6	16.9	12.6	13.2	13.2	13.2	13.2	11.3	13.6	13.4
Harrison Avenue	B	NA	45.1	47.0	45.1	43.2	37.4	35.8	35.8	37.7	37.7	33.9	32.1	33.1
Kenmore Square	C	56.4	54.5	56.8	47.0	47.0	51.7	43.3	43.3	39.6	41.5	37.7	36.0	38.4
East First Street	D	39.5	37.6	43.2	39.5	39.5	36.8	33.9	39.6	37.7	30.2	28.3	24.0	25.4

Notes: The NAAQS is 100 μg/m³.
Massport determined that the Logan NO_2 Monitoring Program had achieved its objectives with the significant and stable decrease in NO_2 emissions since 1999 and thus discontinued the program in 2011.
N/A Not available.
μg/m³ micrograms/cubic meter.
1 NO_2 monitoring sites operated by the MassDEP.

Air Quality Initiative (AQI)

Massport developed the AQI as a 15-year voluntary program with the overall goal to maintain NO_X emissions associated with Logan Airport at, or below, 1999 levels. The *2015 EDR* presented the results of the final year of this program, and the final year of data are shown below. The AQI had four primary commitments, shown below, along with Massport's progress in meeting the AQI commitments.

- **Expand on the air quality initiatives already in-place at Logan Airport.** See **Table 7-12** for the initiatives in place at the time the AQI was developed.
- **As necessary to maintain NO_X emissions at or below 1999 levels, retire emissions credits, giving priority to mobile sources.** Massport updated the AQI inventory of NO_X emissions annually to reflect

new information and changing conditions associated with the Airport's operations. **Table I-24** presents the updated NO_x emissions inventory and shows that, in 2015, again it was not necessary to purchase and retire mobile source emission credits to maintain NO_X emissions at, or below, 1999 levels.

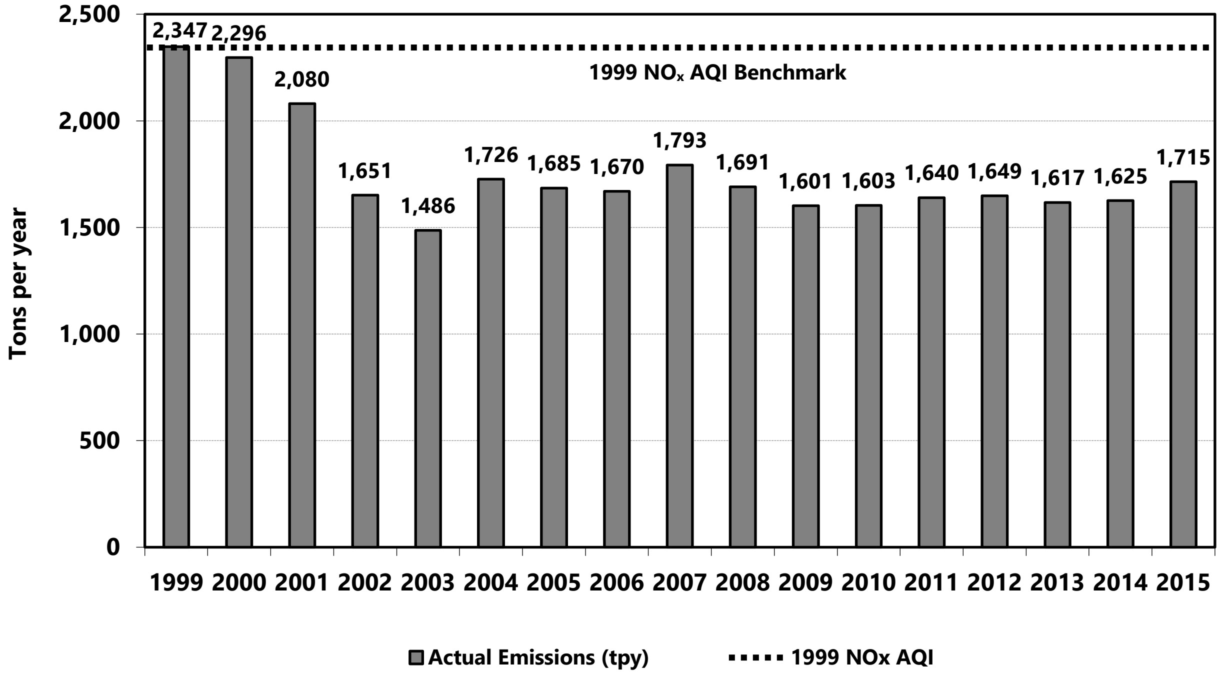
- **Report the status and progress of the AQI in the ESPR or EDR.** Massport reported on the status of the AQI in the Logan Airport EDRs and ESPRs since 2001 (**Table I-24**).
- **Continue to work at international and national levels to decrease air emissions from aviation sources.** Massport maintains memberships and active participation in a number of organizations involved in addressing aviation-related environmental issues, including air quality. These include serving on Environmental Committees of the American Association of Airport Executives (AAAE) and Airports Council International–North America (ACI-NA).

As shown in **Table I-24**, NO_X emissions at Logan Airport in 2015 (net total with reductions) were approximately 632 tpy lower than the 1999 AQI benchmark. Since 1999, this trend represents a 27 percent decrease by 2015. Between 1999 and 2015, the greatest reductions of NO_X emissions were associated with aircraft, GSE, and on-Airport motor vehicles at 17 percent, 71 percent, and 87 percent reductions, respectively.

For ease of review, **Figure I-1** also compares the 1999 AQI threshold level of 2,347 tpy of NO_X emissions to NO_X emissions for 2001 through 2015. Cumulatively, and as of December 31, 2015, NO_X emissions at Logan Airport were approximately 10,049 tons below the benchmark set by the AQI.

Based upon these results, the 1999 threshold of NO_x emissions at Logan Airport was never surpassed and thus full compliance with the AQI was achieved. However, NO_x will continue to be reported in future EDRs/ESPRs as part of the Logan Airport emissions inventory.

Figure I-1 Modeled NOx Emissions Compared to AQI[1]



Source: Massport

1 Includes emission reductions from the use of alternative fuel vehicles, shuttle buses, and ground service equipment. See **Table I-24**.

As part of the reporting process, the AQI also called for an itemization of NO_x emissions generated by activities at Logan Airport according to the individual airline operator. **Table I-25** shows the estimated amounts of NO_x air emissions in 2015 generated by each airline in units of tpy and tons per LTO.

Based on **Table I-25**, international carriers are the higher NO_x emitters per LTO because their longer stage lengths require aircraft equipped with larger and/or additional engines and heavier takeoff weights. Overall, international carriers emitted 20 percent of the total aircraft NO_x emissions at Logan Airport in 2015. Other notable findings included:

- Carriers with the greatest number of flights tended to generate the highest percentage of total NO_X emissions;
- Combined, the four largest air carriers (by LTO), emitted 49 percent of the total aircraft NO_X emissions in 2015;
- Commercial airlines (excludes cargo and GA) accounted for 93 percent of total aircraft NO_X emissions in 2015;
- Cargo aircraft operators accounted for 5 percent of total aircraft NO_X emissions in 2015; and
- GA aircraft accounted for 1 percent of total aircraft NO_X emissions in 2015.

Table I-24 AQI Inventory Tracking of Modeled NOx Emissions (in tpy)[1] for Logan Airport

	Actual Conditions[2]								
Year	**1999[3]**	**2000**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Total Annual Emissions	2,347	2,315	1,609	1,608	1,647	1,654	1,627	1,628	1,605
Above (Below) 1999 Levels Before Reductions	N/A	(32)	(738)	(739)	(700)	(693)	(720)	(719)	(628)
Potential Reductions/ Increases[4]									
Alternative Fuel Vehicles/Shuttle Bus	(11)	(4)	(4)	(2)	(1)	0	(6)	0	0
Alternate Fuel Ground Service Equipment[5]	(14)	(14)	(4)	(3)	(6)	(5)	(4)	(3)	(4)
Total Potential Reductions	(25)	(19)	(8)	(5)	(7)	(5)	(10)	(3)	(4)
Above (Below) 1999 Levels After Reduction	(25)	(51)	(746)	(744)	(707)	(698)	(730)	(722)	(632)
Credit Trading[6]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Net Total w/Reductions and Credits	2,322	2,296	1,601	1,603	1,640	1,649	1,617	1,625	1,715

Source: Massport

Notes: Values in parentheses, such as "(250)" are negative values. Values without parentheses are positive values.

N/A Not available.

1 For consistency with the AQI, the NO_x emission values in this table are reported in tpy. The EDR/ESPR Emissions Inventory values are reported in kg/day. A conversion factor of 0.40234 is used to convert kg/day to tpy.

2 The 2009 analysis was completed using EDMS v5.1.2 and MOBILE6.2.03. The 2010 through 2012 analysis was completed using EDMS v5.1.3 and MOBILE6.2.03. The 2013 analysis was completed using EDMS v5.1.4.1 and MOVES2010b. The 2014 analysis was completed using EDMS v5.1.4.1 and MOVES2014. The 2015 analysis was completed using EDMS v5.1.4.1 and MOVES2014a.

3 The year 1999 is the "baseline" year for the AQI. Thus, 2,347 tpy is considered the AQI threshold for NO_x emissions.

4 Other initiatives that Massport and Logan Airport tenants may use for possible emission reductions include: Central Heating and Cooling Plant boilers, 400-Hz power at gates, and low NO_x fuels in Logan Express buses.

5 Massport's current plan for the conversion of GSE to alternative fuels is being re-evaluated based on the new diesel rule (2007). GSE AFV credits were based on fuel type data obtained from the aerodrome vehicle permit applications beginning in 2007.

6 Since the AQI threshold is not exceeded in 2015, nor are the emissions expected to exceed the threshold in the near future, no credits will need to be purchased.

Table I-25 Contribution of NO_x Air Emissions by Airline in 2015 (Estimated)

	Total Emissions (tons/year)		Normalized Emissions (tons/lto)		Total Emissions (tons/year)		Normalized Emissions (tons/lto)
Air Carrier, by Airline	**NO_x**	**LTOs**	**NO_x per LTO**	**Air Carrier, by Airline**	**NO_x**	**LTOs**	**NO_x per LTO**
ABX Air	0.07	3	0.023	Miami Air International	0.27	25	0.011
Aer Lingus	27.32	987	0.028	Mountain Air Cargo	0	5	<0.001
Aeromexico	1.71	172	0.01	Netjets	3.62	2,349	0.002
Air Canada[1]	7.29	3,978	0.003	No Airline	16.75	8,693	0.002
Air France	23.71	455	0.052	Norwegian	0.22	18	0.012
Air Transport International	2.88	151	0.019	PenAir	0.97	1,874	0.001
Air Wisconsin / US Airways Express	4.38	2,499	0.002	Piedmont Airlines	0.33	390	0.001
AirTran Airways	0.1	14	0.007	Pinnacle Airlines	16.73	3,642	0.005
Alaska Airlines	18.44	1,514	0.012	Porter Airlines	1.77	2,046	0.001
Alitalia	7.44	281	0.026	PSA Airlines	0.01	3	0.003
American Airlines	261.57	24,177	0.011	Republic Airlines	6.35	2,502	0.003
Angel Flight America	0.01	275	<0.001	Royal Air	0.01	14	0.001
Atlantic Southeast Airlines	7.63	2,461	0.003	SATA International	4.67	271	0.017
Atlas Air	3.03	109	0.028	Shuttle America	7.24	2,645	0.003
Bombardier Business Jet Solutions	0.5	340	0.001	Sky Regional / Air Canada Express	4.99	1,892	0.003
British Airways	93.46	1,289	0.073	SkyWest Airlines	0.74	274	0.003
Cape Air	0.48	17,997	<0.001	Southwest Airlines	101.82	10,757	0.009
Cathay Pacific	5.55	139	0.04	Spirit Airlines	24.87	2,448	0.01
Cobalt Air	0.21	876	<0.001	Sun Country Airlines	8.15	707	0.012
Copa Airlines	3.53	323	0.011	Swift Air	0.19	23	0.008
Delta Air Lines	190.7	16,956	0.011	Swiss International Air Lines	11.28	355	0.032
El Al	2.25	76	0.03	TACV - Cabo Verde Airlines	0.53	30	0.018
Emirates Airline	18.56	458	0.041	Talon Air	0.4	191	0.002
Executive Jet Mgmt	0.64	242	0.003	Tradewind Aviation	0.04	173	<0.001

Table I-25 Contribution of NOx Air Emissions by Airline in 2015 (Estimated) (Continued)

	Total Emissions (tons/year)		Normalized Emissions (tons/lto)		Total Emissions (tons/year)		Normalized Emissions (tons/lto)
Air Carrier, by Airline	**NO_x**	**LTOs**	**NOx per LTO**	**Air Carrier, by Airline**	**NO_x**	**LTOs**	**NO_x per LTO**
FedEx Express	60.41	1,762	0.034	Travel Management Company	0.66	533	0.001
Flight Options	0.32	256	0.001	Turkish Airlines	12.18	364	0.033
Go! Hawaii	0.73	219	0.003	United Airlines	151.93	12,322	0.012
GoJet Airlines	2.61	655	0.004	UPS Airlines	19.55	769	0.025
Hainan Airlines	9.94	372	0.027	US Airways	38.43	4,422	0.009
Iberia	5.79	168	0.034	Virgin America	17.5	1,713	0.01
Icelandair	14.5	683	0.021	Virgin Atlantic Airways	15.24	351	0.043
Japan Airlines	9.72	364	0.027	Wiggins Airways	0.03	222	<0.001
JetBlue Airways	311.73	42,918	0.007	WOW Air	3.8	223	0.017
Lufthansa	36.32	844	0.043	Xojet	0.47	209	0.002
				Total	**1,605.29**	**186,468**	**0.00914**

Source: Massport and KBE.

Notes: Other International may include: AeroMexico, Saudi Arabian Airlines, etc.
The "Other" Categories may include airlines with less than 10 operations.
Normalized emissions are based on a Landing and Takeoff Cycle (LTO).
This list combines the major airlines with their commuters (i.e., Jazz with Air Canada).
Cargo carriers include: ABX, Atlas, FedEx, Mountain Air Cargo, UPS, and Wiggins.
GA – General Aviation

1 Includes Jazz.

This Page Intentionally Left Blank.

J

Water Quality/Environmental Compliance and Management

This appendix provides detailed information in support of Chapter 8, *Water Quality/Environmental Compliance and Management*:

- Table J-13 Logan Airport February 2016 Wet Weather Deicing Monitoring Results – North, West, Porter Street, and Runway/Perimeter Stormwater Outfalls
- Table J-14 Logan Airport March 2016 Wet Weather Deicing Monitoring Results – North, West Porter Street, and Runway/Perimeter Stormwater Outfalls
- Table J-15 Logan Airport Stormwater Outfall NPDES Water Quality Monitoring Results – 1993 to 2016
- Table J-16 Logan Airport Oil and Hazardous Material Spills and Jet Fuel Handling – 1990 to 2016
- Table J-17 Type and Quantity of Oil and Hazardous Material Spills at Logan Airport – 1999 to 2016
- Table J-18 MCP Activities Status of Massport Sites at Logan Airport
- EnviroNews/Sustainable Massport

  Vol. 42, Issue 1 – January 2016

  Vol. 42, Issue 2 – May 2016

  Vol. 42, Issue 3 – August 2016

  Vol. 42, Issue 4 – December 2016

Table J-1 Logan Airport NPDES Permit (No. MA0000787) Stormwater Outfall Monitoring Requirements (2007)

Monitoring Event	**North Outfall 001**		**West Outfall 002**		**Maverick Outfall 003**	
	Field Measurement	**Laboratory Analysis**	**Field Measurement**	**Laboratory Analysis**	**Field Measurement**	**Laboratory Analysis**
Monthly Dry Weather	Not Required	Oil and Grease TSS[1] Benzene Surfactant Fecal Coliform *Enterococcus*	Not Required	Oil and Grease TSS[1] Benzene Surfactant Fecal Coliform *Enterococcus*	Not Required	Oil and Grease TSS[1] Benzene Surfactant Fecal Coliform *Enterococcus*
Monthly Wet Weather	pH Flow Rate[6]	Oil and Grease TSS[1] Benzene[2] Surfactant Fecal Coliform *Enterococcus*	pH Flow Rate[6]	Oil and Grease TSS[1] Benzene[2] Surfactant Fecal Coliform *Enterococcus*	pH Flow Rate[6]	Oil and Grease TSS[1] Benzene[2] Surfactant Fecal Coliform *Enterococcus*
Quarterly Wet Weather	pH Flow Rate[6]	PAHs[3]: - Benzo(a)anthracene - Benzo(a)pyrene - Benzo(b)fluoranthene - Benzo(k)fluoranthene - Chrysene -Dibenzo(a,h)anthracene - Indeno(1,2,3-cd)pyrene - Naphthalene	pH Flow Rate[6]	PAHs[3]: - Benzo(a)anthracene - Benzo(a)pyrene - Benzo(b)fluoranthene - Benzo(k)fluoranthene - Chrysene -Dibenzo(a,h)anthracene - Indeno(1,2,3-cd)pyrene - Naphthalene	pH Flow Rate[6]	PAHs[3]: - Benzo(a)anthracene - Benzo(a)pyrene - Benzo(b)fluoranthene - Benzo(k)fluoranthene - Chrysene -Dibenzo(a,h)anthracene - Indeno(1,2,3-cd)pyrene - Naphthalene
Deicing Episode (2/Deicing Season)	Not Required	Ethylene Glycol Propylene Glycol BOD5[4] COD[5] Total Ammonia Nitrogen Nonylphenol Tolyltriazole	Not Required	Ethylene Glycol Propylene Glycol BOD5[4] COD[5] Total Ammonia Nitrogen Nonylphenol Tolyltriazole	Not Required	Not Required
Whole Effluent Toxicity (1st and 3rd Year Deicing Season)	Not Required	Menidia beryllina Arbacia punctulata	Not Required	Menidia beryllina Arbacia punctulata	Not Required	Not Required
Treatment System Sampling (Internal Outfalls)[7]	pH Quantity, Gallons	Oil and Grease TSS[1] Benzene[2]	Not Required	Not Required	Not Required	Not Required

Table J-1 Logan Airport NPDES Permit (No. MA0000787) Stormwater Outfall Monitoring Requirements (2007) (Continued)

Monitoring Event	**Northwest Outfall 005**		**Porter Outfall 003 (3 upstream locations)**		**Select Runway/Perimeter Outfalls**	
	Field Measurement	**Laboratory Analysis**	**Field Measurement**	**Laboratory Analysis**	**Field Measurement**	**Laboratory Analysis**
Monthly Dry Weather	Not Required	Not Required	Not Required	Oil and Grease TSS[1] Benzene Surfactant Fecal Coliform *Enterococcus*	Not Required	Not Required
Monthly Wet Weather	Not Required	Not Required	pH Flow Rate	Oil and Grease TSS[1] Benzene[2] Surfactant Fecal Coliform *Enterococcus*	Not Required	Not Required
Quarterly Wet Weather	pH Flow Rate[6]	Oil and Grease TSS[1] Benzene[2]	pH Flow Rate[6]	PAHs[3]: - Benzo(a)anthracene - Benzo(a)pyrene - Benzo(b)fluoranthene - Benzo(k)fluoranthene - Chrysene -Dibenzo(a,h)anthracene - Indeno(1,2,3-cd)pyrene - Naphthalene	pH	Oil and Grease TSS[1] Benzene[2]
Deicing Episode (2/Deicing Season)	Not Required	Not Required	Not Required	Ethylene Glycol Propylene Glycol BOD5[4] COD[5] Total Ammonia Nitrogen Nonylphenol Tolytriazole	Not Required	Ethylene Glycol Propylene Glycol BOD5[4] COD[5] Total Ammonia Nitrogen Nonylphenol Tolytriazole
Whole Effluent Toxicity (1st and 3rd Year Deicing Season)	Not Required	Not Required	Not Required	Menidia beryllina Arbacia punctulata	Not Required	Not Required
Treatment System Sampling (Internal Outfalls)[7]	Not Required	Not Required	Not Required	Not Required	Not Required	Not Required

Source: Massport
Notes: Requirements are from NPDES Permit MA0000787, issued July 31, 2007.
1 TSS - Total Suspended Solids
2 Benzene must be collected with HDPE bailer.
3 PAH - Polycyclic Aromatic Hydrocarbons
4 BOD - Biological Oxygen Demand
5 COD - Chemical Oxygen Demand
6 Flow Rate will be estimated based on measured precipitation and the hydraulic model developed for the Logan Airport drainage system.
7 Outfalls 001D and 001E samples collected by Swissport.

Table J-2 Fire Training Facility NPDES Permit (No. MA0032751) Stormwater Outfall Monitoring Requirements (2014)

Monitoring Event	Outfall Serial Number 001	
	Field Measurement	**Laboratory Analysis**
Each Discharge Event[1]	Flow Rate[2] pH	TSS[3] Oil and Grease[4] Total BTEX[5] Toluene Benzene Ethylbenzene Xylene PAHs[5,6]
Whole Effluent Toxicity (once per year during discharge event)	Not Required	Acute Toxicity[7]

Source: Massport

Notes: Requirements are from NPDES Permit MA0032751, issued November 1, 2006.
All samples, except for wet testing, shall be collected after treatment and prior to discharge from above ground holding tank.

1 Flows from more than one training session may be held in treatment train for several weeks. Treatment and subsequent discharge through Outfall 001 is usually triggered by tank levels. Sampling will be conducted during each discharge event with the sampling point after the GAC unit and prior to discharge from the above ground holding tank. Each sample shall be a composite of three equally weighted (same volume) grab samples taken at the bottom, middle, and top of the above ground tank.

2 Total flow volume shall be reported monthly in gallons and the maximum flow rate in gallons per minute shall be reported for each month.

3 TSS - Total Suspended Solids

4 Oil and grease is measured using EPA Method 1664.

5 BTEX and PAH compounds shall be analyzed using EPA approved methods. Testing method used and method detection level for each parameter will be included in each DMR submittal.

6 PAH - Polycyclic Aromatic Hydrocarbons

7 The permittee shall conduct one acute toxicity test per year. The test results shall be submitted by the last day of the full month following completion of the test in accordance with protocols defined in the permit.

Table J-3 Logan Airport 2016 Monthly Monitoring Results for First Quarter — North, West, and Maverick Street Stormwater Outfalls

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)	*Klebsiella* (cfu/100mL)
001A – North Outfall	---	Wet Weather	5.2	0.7	NS	NS	NS	NS	NS	NS	NS	NS
002A – West Outfall	---	Wet Weather	17.34	1.51	NS	NS	NS	NS	NS	NS	NS	NS
004A – Maverick Street Outfall	---	Wet Weather	1.19	0.08	NS	NS	NS	NS	NS	NS	NS	NS
001C – North Outfall	1/6/2016	Dry Weather				<4.0	15	<1.0	0.120	20	440	NA
002C – West Outfall	1/6/2016	Dry Weather				<4.0	18	<1.0	0.230	140	20	NA
004C – Maverick Street Outfall	1/6/2016	Dry Weather				<4.0	9.9	<1.0	0.230	260	50	NA
001A – North Outfall	2/3/2016	Wet Weather	3.3	0.9	6.71	<4.0	9.0	<1.0	0.110	3,200	480	NA
002A – West Outfall	2/3/2016	Wet Weather	12.4	1.9	6.71	<4.0	5.0	<1.0	0.150	400	20	NA
004A – Maverick Street Outfall	2/3/2016	Wet Weather	0.8	0.1	6.21	<4.0	5.7	<1.0	0.120	55	60	NA
001C – North Outfall	2/15/2016	Dry Weather				<4.0	16	<1.0	0.080	2.0	1,100	NA
002C – West Outfall	2/15/2016	Dry Weather				<4.0	5.6	<1.0	0.050	3.0	<2.0	NA
004C – Maverick Street Outfall	2/15/2016	Dry Weather				<4.0	<5.0	<1.0	<0.050	140	150	NA
001A – North Outfall	3/2/2016	Wet Weather	4.1	0.4	6.04	<4.0	10	<1.0	0.050	160	390	NA
002A – West Outfall	3/2/2016	Wet Weather	15.1	1.1	6.52	<4.0	15	<1.0	0.200	100	200	NA
004A – Maverick Street Outfall	3/2/2016	Wet Weather	1.0	0.1	**5.59**	<4.0	5.2	<1.0	0.180	790	220	NA
001C – North Outfall	3/8/2016	Dry Weather				<4.0	11	<1.0	0.130	140	460	NA
002C – West Outfall	3/8/2016	Dry Weather				<4.0	5.3	<1.0	0.070	180	10	NA
004C – Maverick Street Outfall	3/8/2016	Dry Weather				<4.0	<5.0	<1.0	0.050	4,500	260	NA
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.												
Discharge Limitations												
Maximum Daily			Report	Report	6.0 to 8.5	15 mg/L	100 mg/L	Report	Report	Report	Report	
Average Monthly			Report	Report	6.0 to 8.5	—	Report	Report	Report	Report	Report	

Source: Massport.

Notes: Bold values exceed maximum daily discharge limitation.

Flow rates were estimated for outfalls 001, 002, and 004 by using the SWMM model developed for Logan Airport.

For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and *Enterococcus*) a value of 1 was employed for those results measured below the laboratory detection limit.

1 *Klebsiella* is an indication of non-fecal coliform bacteria and is tested for at the North Outfall when fecal coliform concentration exceeds 5,000 cfu/100ml.

NA Not Analyzed.

TSS Total Suspended Solids.

NS Not Sampled. A wet weather sampling event was not conducted during the month of January 2016 due to lack of precipitation.

Table J-4 Logan Airport 2016 Monthly Monitoring Results for First Quarter — Porter Street Stormwater Outfall

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)
003 - Porter Street Outfall 1	---	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	---	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 3	---	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall Average		Wet Weather	3.57	0.30	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 1	1/6/2016	Dry Weather				<4.0	39	<1.0	0.270	1,000	240
003 - Porter Street Outfall 2	1/6/2016	Dry Weather				<4.0	5.0	<1.0	0.090	30	30
003 - Porter Street Outfall 3	1/6/2016	Dry Weather				<4.0	<5.0	<1.0	0.220	<10	<10
003 - Porter Street Outfall Average		Dry Weather				0.0	15	0.0	0.193	31.1	19.3
003 - Porter Street Outfall 1	2/3/2016	Wet Weather	-	-	6.61	<4.0	14	<1.0	0.190	<10	10
003 - Porter Street Outfall 2	2/3/2016	Wet Weather	-	-	6.90	8.0	48	<1.0	0.700	10	30
003 - Porter Street Outfall 3	2/3/2016	Wet Weather	-	-	6.67	<4.0	31	<1.0	0.330	70	160
003 - Porter Street Outfall Average		Wet Weather	2.56	0.33	6.73	2.7	31	0.0	0.407	9.0	36
003 - Porter Street Outfall 1	2/15/2016	Dry Weather				<4.0	170	<1.0	0.160	2.0	12
003 - Porter Street Outfall 2	2/15/2016	Dry Weather				<4.0	49	<1.0	0.120	2.0	<2.0
003 - Porter Street Outfall 3	2/15/2016	Dry Weather				<4.0	17.0	<1.0	0.070	<2.0	<2.0
003 - Porter Street Outfall Average		Dry Weather				0.0	79	0.0	0.117	1.6	2.3
003 - Porter Street Outfall 1	3/2/2016	Wet Weather	-	-	6.56	<4.0	8.0	<1.0	0.130	50	290
003 - Porter Street Outfall 2	3/2/2016	Wet Weather	-	-	6.11	<4.0	<5.0	<1.0	0.160	<10	<10
003 - Porter Street Outfall 3	3/2/2016	Wet Weather	-	-	6.46	<4.0	<5.0	<1.0	0.150	<10	<10
003 - Porter Street Outfall Average		Wet Weather	2.10	0.20	6.38	0.0	3.0	0.0	0.147	4.0	7.0
003 - Porter Street Outfall 1	3/8/2016	Dry Weather				<4.0	41	<1.0	0.170	<10	<10
003 - Porter Street Outfall 2	3/8/2016	Dry Weather				<4.0	28	<1.0	0.250	<10	<10
003 - Porter Street Outfall 3	3/8/2016	Dry Weather				<4.0	12	<1.0	0.120	<10	50
003 - Porter Street Outfall Average		Dry Weather				0.0	27	0.0	0.180	0.0	3.7
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily			Report	Report	6.0 to 8.5	Report	Report	Report	Report	Report	Report
Average Monthly			Report	Report	6.0 to 8.5	—	Report	Report	Report	Report	Report

Source: Massport.

Notes: Flow rates were estimated for outfalls 001, 002, 003 and 004 by using the SWMM model developed for Logan Airport.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and Enterococcus) a value of 1 was employed for those results measured below the laboratory detection limit.

TSS Total Suspended Solids.

NA Not Analyzed.

NS Not Sampled. A wet weather sampling event was not conducted during the month of January 2016 due to lack of precipitation.

Table J-5 Logan Airport 2016 Monthly Monitoring Results for Second Quarter — North, West, and Maverick Street Stormwater Outfalls

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)	*Klebsiella*[1] (cfu/100mL)
001A – North Outfall	4/12/2016	Wet Weather	5.5	0.5	**5.50**	<4.0	17	<1.0	0.130	210	80	NA
002A – West Outfall	4/12/2016	Wet Weather	10.3	1.1	6.55	<4.0	35	<1.0	0.170	160	80	NA
004A – Maverick Street Outfall	4/12/2016	Wet Weather	0.8	0.05	7.42	4.0	35	<1.0	0.230	66,000	600	NA
001C – North Outfall	4/11/2016	Dry Weather				<4.0	19	<1.0	0.090	450	420	NA
002C – West Outfall	4/11/2016	Dry Weather				<4.0	18	<1.0	0.060	130	10	NA
004C – Maverick Street Outfall	4/11/2016	Dry Weather				<4.0	6.4	<1.0	0.050	3,400	360	NA
001A – North Outfall	5/24/2016	Wet Weather	3.6	0.3	6.94	<4.0	9.0	<1.0	0.250	40	450	NA
002A – West Outfall	5/24/2016	Wet Weather	12.85	0.90	7.48	<4.0	39	<1.0	0.240	2,800	1,800	NA
004A – Maverick Street Outfall	5/24/2016	Wet Weather	0.88	0.04	7.08	<4.0	9.3	<1.0	0.140	1,000	500	NA
001C – North Outfall	5/12/2016	Dry Weather				<4.0	<5.0	<1.0	0.130	2,900	230	NA
002C – West Outfall	5/12/2016	Dry Weather				<4.0	11	<1.0	0.520	910	<10	NA
004C – Maverick Street Outfall	5/12/2016	Dry Weather				<4.0	16	<1.0	<0.050	3,800	480	NA
001A – North Outfall	6/28/2016	Wet Weather	1.9	0.1	7.13	<4.0	22	<1.0	1.430	3,600	1,400	NA
002A – West Outfall	6/28/2016	Wet Weather	6.9	0.46	7.33	<4.0	16	<1.0	0.790	16,000	2,100	NA
004A – Maverick Street Outfall	6/28/2016	Wet Weather	0.64	0.013	7.85	<4.0	8.9	<1.0	0.460	5,500	90	NA
001C – North Outfall	6/13/2016	Dry Weather				<4.0	16	<1.0	0.350	>80,000	1,300	8,000
002C – West Outfall	6/13/2016	Dry Weather				<4.0	7.2	<1.0	0.180	41,000	46,000	NA
004C – Maverick Street Outfall	6/13/2016	Dry Weather				<4.0	5.8	<1.0	0.050	6,800	1,700	NA
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.												
Discharge Limitations												
Maximum Daily			Report	Report	6.0 to 8.5	15 mg/L	100 mg/L	Report	Report	Report	Report	
Average Monthly			Report	Report	6.0 to 8.5	—	Report	Report	Report	Report	Report	

Source: Massport.

Notes: Flow rates were estimated for outfalls 001, 002, 003 and 004 by using the SWMM model developed for Logan Airport.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and Enterococcus) a value of 1 was employed for those results measured below the laboratory detection limit.

1 *Klebsiella* is an indication of non-fecal coliform bacteria and is tested for at the North Outfall when fecal coliform concentration exceeds 5,000 cfu/100ml.

TSS Total Suspended Solids.

NA Not Analyzed.

Table J-6 Logan Airport 2016 Monthly Monitoring Results for Second Quarter — Porter Street Stormwater Outfall

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)
003 - Porter Street Outfall 1	4/12/2016	Wet Weather	-	-	7.00	<4.0	22	<1.0	0.190	610	800
003 - Porter Street Outfall 2	4/12/2016	Wet Weather	-	-	7.62	11.0	14	<1.0	0.090	<10	<10
003 - Porter Street Outfall 3	4/12/2016	Wet Weather	-	-	7.62	<4.0	<5.0	<1.0	0.080	30	50
003 - Porter Street Outfall Average		Wet Weather	1.40	0.20	7.41	3.7	12	0.0	0.120	26	34
003 - Porter Street Outfall 1	4/11/2016	Dry Weather				<4.0	11	<1.0	0.150	<10	<10
003 - Porter Street Outfall 2	4/11/2016	Dry Weather				5.6	<5.0	<1.0	0.240	<10	20
003 - Porter Street Outfall 3	4/11/2016	Dry Weather				<4.0	15.0	<1.0	0.110	<10	120
003 - Porter Street Outfall Average		Dry Weather				1.9	9.0	0.0	0.167	1.0	13.4
003 - Porter Street Outfall 1	5/24/2016	Wet Weather	-	-	7.82	4.7	25	<1.0	0.090	130	390
003 - Porter Street Outfall 2	5/24/2016	Wet Weather	-	-	7.94	<4.0	5.0	<1.0	0.130	150	1,400
003 - Porter Street Outfall 3	5/24/2016	Wet Weather	-	-	7.70	<4.0	<5.0	<1.0	0.230	680	3,800
003 - Porter Street Outfall Average		Wet Weather	2.60	0.20	7.82	1.6	10	0.0	0.150	237	1,275
003 - Porter Street Outfall 1	5/12/2016	Dry Weather				<4.0	92	<1.0	0.070	<10	40
003 - Porter Street Outfall 2	5/12/2016	Dry Weather				<4.0	8.0	<1.0	0.190	10.0	130
003 - Porter Street Outfall 3	5/12/2016	Dry Weather				<4.4	11	<1.0	0.130	<10	30
003 - Porter Street Outfall Average		Dry Weather				0.0	37	0.0	0.130	2.2	53.8
003 - Porter Street Outfall 1	6/28/2016	Wet Weather	-	-	6.92	<4.0	40	<1.0	0.880	13,000	800
003 - Porter Street Outfall 2	6/28/2016	Wet Weather	-	-	7.50	<4.0	<5.0	<1.0	0.130	<10	510
003 - Porter Street Outfall 3	6/28/2016	Wet Weather	-	-	8.01	<4.0	6.0	<1.0	0.700	1,300	2,100
003 - Porter Street Outfall Average		Wet Weather	1.94	0.09	7.48	0.0	15	0.00	0.570	257	950
003 - Porter Street Outfall 1	6/13/2016	Dry Weather				<4.0	27	<1.0	0.140	30	90
003 - Porter Street Outfall 2	6/13/2016	Dry Weather				<4.0	49	<1.0	0.330	10	20
003 - Porter Street Outfall 3	6/13/2016	Dry Weather				<4.0	<5.0	<1.0	0.130	110	10
003 - Porter Street Outfall Average		Dry Weather				0.0	25	0.0	0.200	32.1	26.2
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily			Report	Report	6.0 to 8.5	Report	Report	Report	Report	Report	Report
Average Monthly			Report	Report	6.0 to 8.5	—	Report	Report	Report	Report	Report

Source: Massport.

Notes: Flow rates were estimated for outfalls 001, 002, 003, and 0034 by using the SWMM model developed for Logan Airport.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and Enterococcus) a value of 1 was employed for those results measured below the laboratory detection limit.

TSS Total Suspended Solids.

Table J-7 Logan Airport 2016 Monthly Monitoring Results for Third Quarter — North, West, and Maverick Street Stormwater Outfalls

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)	*Klebsiella*[1] (cfu/100mL)
001A – North Outfall	7/29/2016	Wet Weather	0.4	0.1	7.30	<4.0	26	<1.0	1.540	33,000	10,000	600
002A – West Outfall	7/29/2016	Wet Weather	1.40	0.19	7.36	<4.0	16	<1.0	1.10	48,000	3,800	NA
004A – Maverick Street Outfall	7/29/2016	Wet Weather	0.12	0.0092	7.42	<4.0	6.4	<1.0	0.400	4,600	1,200	NA
001C – North Outfall	7/13/2016	Dry Weather				<4.0	24	<1.0	0.290	1,600	1,200	NA
002C – West Outfall	7/13/2016	Dry Weather				<4.0	8.1	<1.0	0.290	16,000	180	NA
004C – Maverick Street Outfall	7/13/2016	Dry Weather				<4.0	9.2	<1.0	0.370	5,100	450	NA
001A – North Outfall	8/22/2016	Wet Weather	2.9	0.2	7.41	<4.0	6.0	<1.0	0.130	14,000	7,300	6,000
002A – West Outfall	8/22/2016	Wet Weather	10.09	0.58	7.35	<4.0	67	<1.0	0.140	25,000	6,300	NA
004A – Maverick Street Outfall	8/22/2016	Wet Weather	0.83	0.02	7.15	<4.0	19	<1.0	0.110	42,000	1,700	NA
001C – North Outfall	8/19/2016	Dry Weather				<4.0	6.9	<1.0	0.210	38,000	2,200	13,000
002C – West Outfall	8/19/2016	Dry Weather				<4.0	13	<1.0	0.210	49,000	420	NA
004C – Maverick Street Outfall	8/19/2016	Dry Weather				<4.0	7.6	<1.0	0.410	260	40	NA
001A – North Outfall	9/19/2016	Wet Weather	0.76	0.098	7.30	11	100	<1.0	1.38	29,000	11,000	<10
002A – West Outfall	9/19/2016	Wet Weather	2.876	0.338	7.08	<4.0	12	<1.0	1.07	32,000	5,600	NA
004A – Maverick Street Outfall	9/19/2016	Wet Weather	0.211	0.002	7.13	<4.0	12	<1.0	0.600	>80,000	1,700	NA
001C – North Outfall	9/9/2016	Dry Weather				<4.0	5.3	<1.0	0.410	64,000	11,000	<10
002C – West Outfall	9/9/2016	Dry Weather				<4.0	14	<1.0	0.530	33,000	320	NA
004C – Maverick Street Outfall	9/9/2016	Dry Weather				<4.0	8.5	<1.0	0.410	13,000	1,000	NA
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.												
Discharge Limitations												
Maximum Daily			Report	Report	6.0 to 8.5	15 mg/L	100 mg/L	Report	Report	Report	Report	Report
Average Monthly			Report	Report	6.0 to 8.5	----	Report	Report	Report	Report	Report	Report

Source: Massport

Notes: Bold values exceed maximum daily discharge limitation.

Flow rates were estimated for outfalls 001, 002, and 004 by using the SWMM model developed for Logan Airport.

For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and *Enterococcus*) a value of 1 was employed for those results measured below the laboratory detection limit.

1 *Klebsiella* is an indication of non-fecal coliform bacteria and is tested for at the North Outfall when fecal coliform concentration exceeds 5,000 cfu/100ml.

TSS Total Suspended Solids.

NA Not Analyzed.

Table J-8 Logan Airport 2016 Monthly Monitoring Results for Third Quarter — Porter Street Stormwater Outfall

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)
003 - Porter Street Outfall 1	7/29/2016	Wet Weather	-	-	7.62	<4.0	74	<1.0	0.510	820	1,300
003 - Porter Street Outfall 2	7/29/2016	Wet Weather	-	-	8.03	<4.0	38	<1.0	0.310	80	770
003 - Porter Street Outfall 3	7/29/2016	Wet Weather	-	-	7.81	<4.0	29	<1.0	0.750	1,100	2,600
003 - Porter Street Outfall Average		Wet Weather	0.38	0.05	7.82	0.0	35	0.0	0.523	416	1,376
003 - Porter Street Outfall 1	7/13/2016	Dry Weather				<4.0	18	<1.0	0.240	110	30
003 - Porter Street Outfall 2	7/13/2016	Dry Weather				<4.0	14	<1.0	0.090	<10	45
003 - Porter Street Outfall 3	7/13/2016	Dry Weather				<4.0	<10	<1.0	0.170	220	10
003 - Porter Street Outfall Average		Dry Weather				0.0	11	0.0	0.167	28.9	23.8
003 - Porter Street Outfall 1	8/22/2016	Wet Weather	-	-	7.10	<4.0	<5.0	<1.0	0.110	15,000	3,700
003 - Porter Street Outfall 2	8/22/2016	Wet Weather	-	-	7.81	<4.0	<5.0	<1.0	0.070	<10	80
003 - Porter Street Outfall 3	8/22/2016	Wet Weather	-	-	6.70	<4.0	<5.0	<1.0	0.110	80	1,200
003 - Porter Street Outfall Average		Wet Weather	2.22	0.14	7.20	0.0	0.0	0.00	0.097	106	708
003 - Porter Street Outfall 1	8/19/2016	Dry Weather				<4.0	65	<1.0	0.160	2,400	1,500
003 - Porter Street Outfall 2	8/19/2016	Dry Weather				<4.0	10	<1.0	0.150	<10	<10
003 - Porter Street Outfall 3	8/19/2016	Dry Weather				<4.0	290	<1.0	0.170	20	330
003 - Porter Street Outfall Average		Dry Weather				0.0	122	0.0	0.160	36.3	79.1
003 - Porter Street Outfall 1	9/19/2016	Wet Weather	-	-	7.31	5.2	110	<1.0	0.750	5,100	5,300
003 - Porter Street Outfall 2	9/19/2016	Wet Weather	-	-	8.11	<4.0	27	<1.0	0.150	120	3,200
003 - Porter Street Outfall 3	9/19/2016	Wet Weather	-	-	7.49	<4.0	<5.0	<1.0	0.420	2,700	4,000
003 - Porter Street Outfall Average		Wet Weather	0.66	0.07	7.64	1.7	46	0.00	0.440	1,182	4,078
003 - Porter Street Outfall 1	9/9/2016	Dry Weather				<4.0	57	<1.0	0.210	3,000	3,100
003 - Porter Street Outfall 2	9/9/2016	Dry Weather				<4.0	6.0	<1.0	0.110	20.0	10
003 - Porter Street Outfall 3	9/9/2016	Dry Weather				<4.0	22	<1.0	0.150	140	5,100
003 - Porter Street Outfall Average		Dry Weather				0.0	28	0.0	0.157	203.3	540.7
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily			Report	Report	6.0 to 8.5	Report	Report	Report	Report	Report	Report
Average Monthly			Report	Report	6.0 to 8.5	—	Report	Report	Report	Report	Report

Source: Massport.

Notes: Bold values exceed maximum daily discharge limitation.
Flow rates were estimated for outfall 003 by using the SWMM model developed for Logan Airport.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and Enterococcus) a value of 1 was employed for those results measured below the laboratory detection limit.

TSS Total Suspended Solids.

Table J-9 Logan Airport 2016 Monthly Monitoring Results for Fourth Quarter — North, West, and Maverick Street Stormwater Outfalls

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)	*Klebsiella*[1] (cfu/100mL)
001A – North Outfall	10/21/2016	Wet Weather	6.36	0.550	6.85	<4.0	12	<1.0	0.530	48,000	3,600	<10
002A – West Outfall	10/21/2016	Wet Weather	22.05	1.99	6.96	<4.0	11	<1.0	0.330	53,000	420	NA
004A – Maverick Street Outfall	10/21/2016	Wet Weather	1.58	0.12	7.35	<4.0	<5.0	<1.0	0.210	4,500	290	NA
001C – North Outfall	10/7/2016	Dry Weather				<4.0	7.6	<1.0	0.120	23,000	1,600	<10
002C – West Outfall	10/7/2016	Dry Weather				<4.0	11	<10	0.100	400	20	NA
004C – Maverick Street Outfall	10/7/2016	Dry Weather				<4.0	10	<1.0	0.070	2,700	200	NA
001A – North Outfall	11/15/2016	Wet Weather	3.28	0.24	6.90	<4.0	7.8	<1.0	0.280	67,000	2,300	17,000
002A – West Outfall	11/15/2016	Wet Weather	8.17	0.72	7.35	<4.0	38	<1.0	0.400	3,900	750	NA
004A – Maverick Street Outfall	11/15/2016	Wet Weather	0.80	0.05	7.38	<4.0	**260**	<1.0	0.300	3,500	3,000	NA
001C – North Outfall	11/9/2016	Dry Weather				<4.0	9.2	<1.0	0.210	52,000	1,100	17,000
002C – West Outfall	11/9/2016	Dry Weather				<4.0	7.4	<1.0	0.090	250	50	NA
004C – Maverick Street Outfall	11/9/2016	Dry Weather				<4.0	13	<1.0	0.140	1,200	40	NA
001A – North Outfall	12/12/2016	Wet Weather	2.730	0.546	6.80	<4.0	8.6	<1.0	0.130	3,400	770	NA
002A – West Outfall	12/12/2016	Wet Weather	11.192	1.327	7.45	<4.0	25	<1.0	0.210	2,700	400	NA
004A – Maverick Street Outfall	12/12/2016	Wet Weather	0.794	0.058	6.44	<4.0	<5.0	<1.0	0.360	240	130	NA
001C – North Outfall	12/21/2016	Dry Weather				<4.0	11	<1.0	0.230	28,000	480	<10
002C – West Outfall	12/21/2016	Dry Weather				<4.0	12	<1.0	0.330	150	80	NA
004C – Maverick Street Outfall	12/21/2016	Dry Weather				<4.0	12	<1.0	0.360	150	<10	NA
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.												
Discharge Limitations												
Maximum Daily			Report	Report	6.0 to 8.5	15 mg/L	100 mg/L	Report	Report	Report	Report	Report
Average Monthly			Report	Report	6.0 to 8.5	–	Report	Report	Report	Report	Report	Report

Source: Massport.
Notes: Bold values exceed maximum daily discharge limitation.
Flow rates were estimated for outfalls 001, 002, and 004 by using the SWMM model developed for Logan Airport.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and Enterococcus) a value of 1 was employed for those results measured below the laboratory detection limit.
1 *Klebsiella* is an indication of non-fecal coliform bacteria and is tested for at the North Outfall when fecal coliform concentration exceeds 5,000 cfu/100ml.
TSS Total Suspended Solids.
NA Not Analyzed.

Table J-10 Logan Airport 2016 Monthly Monitoring Results for Fourth Quarter — Porter Street Stormwater Outfall

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)
003 - Porter Street Outfall 1	10/21/2016	Wet Weather	-	-	7.78	<4.0	55	<1.0	0.270	250	210
003 - Porter Street Outfall 2	10/21/2016	Wet Weather	-	-	7.87	<4.0	<5.0	<1.0	0.160	100	80
003 - Porter Street Outfall 3	10/21/2016	Wet Weather	-	-	6.92	<4.0	<5.0	<1.0	0.130	500	3,500
003 - Porter Street Outfall Average		Wet Weather	4.26	0.42	7.52	0.0	18	0.0	0.187	232	389
003 - Porter Street Outfall 1	10/7/2016	Dry Weather				< 4.0	92	< 1.0	0.140	130	80
003 - Porter Street Outfall 2	10/7/2016	Dry Weather				< 4.0	15	< 1.0	0.100	<10	10
003 - Porter Street Outfall 3	10/7/2016	Dry Weather				< 4.0	7.3	< 1.0	0.060	<10	<10
003 - Porter Street Outfall Average		Dry Weather				0.0	38	0.0	0.100	5.1	9.3
003 - Porter Street Outfall 1	11/15/2016	Wet Weather	-	-	7.14	<4.0	110	<1.0	0.230	40	70
003 - Porter Street Outfall 2	11/15/2016	Wet Weather	-	-	7.75	<4.0	15	<1.0	0.310	<10	300
003 - Porter Street Outfall 3	11/15/2016	Wet Weather	-	-	6.81	<4.0	6.2	<1.0	0.240	<10	460
003 - Porter Street Outfall Average		Wet Weather	1.39	0.16	7.23	0.0	44	0.0	0.260	3.4	213
003 - Porter Street Outfall 1	11/9/2016	Dry Weather				29	6.7	<1.0	0.160	<10	10
003 - Porter Street Outfall 2	11/9/2016	Dry Weather				<4.0	16	<1.0	0.120	<10	<10
003 - Porter Street Outfall 3	11/9/2016	Dry Weather				<4.0	<5.0	<1.0	0.160	10	170
003 - Porter Street Outfall Average		Dry Weather				9.7	7.6	0.0	0.147	2.2	12
003 - Porter Street Outfall 1	12/12/2016	Wet Weather	-	-	6.83	<4.0	31	<1.0	0.210	110	460
003 - Porter Street Outfall 2	12/12/2016	Wet Weather	-	-	6.41	4.6	22	<1.0	0.090	<10	90
003 - Porter Street Outfall 3	12/12/2016	Wet Weather	-	-	6.37	<4.0	<5.0	<1.0	0.100	230	530
003 - Porter Street Outfall Average		Wet Weather	2.847	0.261	6.54	1.5	18	0.0	0.133	29	280
003 - Porter Street Outfall 1	12/21/2016	Dry Weather				<4.0	490	<1.0	0.270	<10	<10
003 - Porter Street Outfall 2	12/21/2016	Dry Weather				11	120	<1.0	0.170	<10	50
003 - Porter Street Outfall 3	12/21/2016	Dry Weather				4.0	9.0	<1.0	0.290	<10	<10
003 - Porter Street Outfall Average		Dry Weather				3.7	206	0.0	0.243	1.0	3.7
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily			Report	Report	6.0 to 8.5	Report	Report	Report	Report	Report	Report
Average Monthly			Report	Report	6.0 to 8.5	—	Report	Report	Report	Report	Report

Source: Massport.

Notes: Bold values exceed maximum daily discharge limitation.
Flow rates were estimated for outfall 003 using the SWMM model developed for Logan Airport.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and Enterococcus) a value of 1 was employed for those results measured below the laboratory detection limit.
The modeled Maverick Street Outfall on average ended up being negative because of tidal effects.

Table J-11 Logan Airport 2016 Quarterly Wet Weather Monitoring Results – North, West, Maverick Street, and Porter Street Stormwater Outfalls

	Date	pH (S.U.)	Benzo(a)-anthracene (µg/L)	Benzo(a)-pyrene (µg/L)	Benzo(b)-fluoranthene (µg/L)	Benzo(k)-fluoranthene (µg/L)	Chrysene (µg/L)	Dibenzo(a,h,)-anthracene (µg/L)	Indeno(1,2,3-cd)-pyrene (µg/L)	Naphthalene (µg/L)	Total PAHs (µg/L)
001 - North Outfall	3/2/2016	6.04	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
002 - West Outfall	3/2/2016	6.52	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
004 - Maverick Street Outfall	3/2/2016	5.59	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 1	3/2/2016	6.56	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 2	3/2/2016	6.11	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 3	3/2/2016	6.46	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall Average		6.38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
001 - North Outfall	6/28/2016	7.13	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
002 - West Outfall	6/28/2016	7.33	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
004 - Maverick Street Outfall	6/28/2016	7.85	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 1	6/28/2016	6.92	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 2	6/28/2016	7.50	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 3	6/28/2016	8.01	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall Average	6/28/2016	7.48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
001 - North Outfall	9/19/2016	7.30	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
002 - West Outfall	9/19/2016	7.08	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
004 - Maverick Street Outfall	9/19/2016	7.13	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 1	9/19/2016	7.31	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 2	9/19/2016	8.11	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 3	9/19/2016	7.49	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall Average	9/19/2016	7.64	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
001 - North Outfall	12/12/2016	6.80	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
002 - West Outfall	12/12/2016	7.45	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
004 - Maverick Street Outfall	12/12/2016	6.44	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 1	12/12/2016	6.83	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 2	12/12/2016	6.41	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 3	12/12/2016	6.37	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall Average		6.54	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily		6.0 to 8.5	Report	Report	Report	Report	Report	Report	Report	Report	Total

Source: Massport

Notes: Quarterly Samples were unable to be collected during the first and second quarters. During the first quarter, the perimeter road was mostly inaccessible because of the historic snowfall events, as were many of the sampling locations. There were few rain opportunities late in the season which were not timed well with the tides. During the second quarter, sampling could not be conducted due to thunderstorms and timing of precipitation versus the low tide.
Bold values exceed maximum daily discharge limitation.
For averaging calculations, a value of zero was employed for those results measures below the laboratory detection limit.

PAHs Polynuclear Aromatic Hydrocarbons
ND Not Detected
TSS Total Suspended Solids.

Table J-12 Logan Airport 2016 Quarterly Wet Weather Monitoring Results – Northwest and Runway/Perimeter Stormwater Outfalls

	Date	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (SU)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)
005 - Northwest Outfall	3/2/2016	0.5	0.04	5.68	<4.0	11	<1.0
006Q- Runway/ Perimeter Outfall (A9)	3/2/2016	0.32	0.02	6.14	<4.0	7.0	<1.0
006Q- Runway/ Perimeter Outfall (A15)	3/2/2016	0.11	0.01	6.21	<4.0	<5.0	<1.0
006Q- Runway/ Perimeter Outfall (A19)	3/2/2016	0.05	0.003	6.86	<4.4	<5.0	<1.0
006Q- Runway/ Perimeter Outfall (A21)	3/2/2016	2.73	0.18	6.28	<4.0	9.0	<1.0
006Q- Runway/ Perimeter Outfall (A23)	3/2/2016	0.27	0.02	6.47	<4.0	7.2	<1.0
006Q- Runway/ Perimeter Outfall (A33)	3/2/2016	0.23	0.02	6.99	<4.0	6.0	<1.0
006Q- Runway/ Perimeter Outfall (A38)	3/2/2016	0.34	0.02	6.61	<4.0	<5.0	<1.0
006- Runway/Perimeter Outfall Average		0.58	0.04	6.51	0.0	4.0	0.0
005 - Northwest Outfall	6/28/2016	0.3	0.02	6.95	<4.0	8.0	<1.0
006Q- Runway/ Perimeter Outfall (A9)	6/28/2016	0.17	0.02	7.38	<4.0	<5.0	<1.0
006Q- Runway/ Perimeter Outfall (A15)	6/28/2016	0.06	0.005	7.73	<4.0	<5.0	<1.0
006Q- Runway/ Perimeter Outfall (A19)	6/28/2016	0.03	0.002	7.58	<4.0	8.5	<1.0
006Q- Runway/ Perimeter Outfall (A21)	6/28/2016	1.25	0.10	7.39	<4.0	<5.0	<1.0
006Q- Runway/ Perimeter Outfall (A23)	6/28/2016	0.15	0.01	7.21	<4.0	<5.0	<1.0
006Q- Runway/ Perimeter Outfall (A33)	6/28/2016	0.13	0.01	7.35	<4.0	9.0	<1.0
006Q- Runway/ Perimeter Outfall (A38)	6/28/2016	0.16	0.01	6.99	<4.0	<5.0	<1.0
006- Runway/Perimeter Outfall Average	6/28/2016	0.28	0.02	7.38	0.0	2.4	0.0
005 - Northwest Outfall	9/19/2016	0.1	0.01	7.29	4.6	220	<1.0
006Q- Runway/ Perimeter Outfall (A9)	9/19/2016	0.01	0.003	6.68	9.1	8.0	<1.0
006Q- Runway/ Perimeter Outfall (A15)	9/19/2016	0.01	0.001	7.83	<4.0	<5.0	<1.0
006Q- Runway/ Perimeter Outfall (A18)	9/27/2016	0.00	0.001	6.64	<4.0	22.0	<1.0
006Q- Runway/ Perimeter Outfall (A21)	9/19/2016	0.08	0.02	7.69	4.3	19	<1.0
006Q- Runway/ Perimeter Outfall (A23)	9/19/2016	0.01	0.003	7.29	<4.0	23.0	<1.0
006Q- Runway/ Perimeter Outfall (A33)	9/19/2016	0.01	0.003	7.35	<4.0	14	<1.0

Table J-12 Logan Airport 2016 Quarterly Wet Weather Monitoring Results – Northwest and Runway/Perimeter Stormwater Outfalls (Continued)

006Q- Runway/ Perimeter Outfall (A38)	9/19/2016	0.01	0.002	6.81	<4.0	13	<1.0
006- Runway/Perimeter Outfall Average	9/19/2016	0.02	0.01	7.18	1.9	14.2	0.0
005 - Northwest Outfall	12/12/2016	0.416	0.036	6.15	<4.0	9.0	<1.0
006Q- Runway/ Perimeter Outfall (A9)	12/12/2016	0.218	0.023	6.68	<4.0	<5.0	<1.0
006Q- Runway/ Perimeter Outfall (A15)	12/12/2016	0.080	0.008	6.87	<4.0	<5.0	<1.0
006Q- Runway/ Perimeter Outfall (A20)	12/12/2016	0.102	0.011	6.95	<4.0	<5.0	<1.0
006Q- Runway/ Perimeter Outfall (A21)	12/12/2016	1.433	0.151	6.77	<4.0	12	<1.0
006Q- Runway/ Perimeter Outfall (A23)	12/12/2016	0.174	0.018	6.79	<4.0	<5.0	<1.0
006Q- Runway/ Perimeter Outfall (A33)	12/12/2016	0.123	0.016	7.39	<4.0	5.3	<1.0
006Q- Runway/ Perimeter Outfall (A38)	12/12/2016	0.188	0.017	6.67	<4.0	11	<1.0
006- Runway/Perimeter Outfall Average		0.331	0.035	6.87	0.0	4.0	0.0
Discharge Limitations		Report	Report	Report	Report	Report	Report

Source: Massport
Notes: Bold values exceed maximum daily discharge limitation.
For averaging calculations, a value of zero was employed for those results measures below the laboratory detection limit.
Requirements are from NPDES Permit MA 0000787, issued July 31, 2007.
TSS Total Suspended Solids
ND Not Detected

Table J-13 Logan Airport February 2016 Wet Weather Deicing Monitoring Results – North, West, Porter Street, and Runway/Perimeter Stormwater Outfalls

	Date	Ethylene Glycol, Total (mg/L)	Propylene Glycol, Total (mg/L)	BOD5 (mg/L)	COD (mg/L)	Ammonia Nitrogen (mg/L)	Nonylphenol (µg/L)	4-Methyl-1-H-benzotriazole (µg/L)	5-Methyl-1-H-benzotriazole (µg/L)	Tolytriazole (µg/L)
001B - North Outfall	2/8/2016	<7.0	14	3,500	4,700	0.870	<0.020	33.56	20.02	53.58
002B - West Outfall	2/8/2016	<350	4,400	5,600	8,700	0.889	<0.020	14.64	9.33	23.97
003B - Porter Street Outfall 1	2/8/2016	<7.0	13	220	480	1.33	0.612	2.19	2.10	4.29
003B - Porter Street Outfall 2	2/8/2016	<70	370	580	760	<0.075	<0.020	11.82	13.73	25.55
003B - Porter Street Outfall 3	2/8/2016	<7.0	<7.0	24	96	1.47	<0.020	<0.25	<0.25	ND
003B - Porter Street Outfall Average		0.0	128	275	445	0.93	0.204	4.67	5.28	9.95
006B- Runway/ Perimeter (A9)	2/8/2016	<7.0	<7.0	25	140	0.524	<0.020	5.90	2.28	8.180
006B- Runway/ Perimeter (A15)	2/8/2016	<7.0	<7.0	15	34	0.773	<0.020	3.08	1.03	4.110
006B- Runway/ Perimeter (A19)	2/8/2016	<7.0	8.5	100	160	1.69	<0.020	12.97	5.75	18.72
006B- Runway/ Perimeter (A21)	2/8/2016	<7.0	<7.0	46	48	0.554	<0.020	3.47	0.94 J	4.41 J
006B- Runway/ Perimeter (A23)	2/8/2016	<7.0	40	77	27	0.68	<0.020	5.51	1.54 J	7.05 J
006B- Runway/ Perimeter (A34)	2/8/2016	<140	2,300	70	350	0.822	<0.020	5.690	1.56	7.250
006B- Runway/ Perimeter (A38)	2/8/2016	<7.0	<7.0	88	960	0.108	<0.020	<0.25	<0.25	ND
006B- Runway/Perimeter Outfall Average		0.0	336	60	246	0.736	0.00	5.23	1.87	7.10
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.										
Discharge Limitations										
Average Monthly		Report	Report	Report	Report	Report	Report	Report	Report	Report
Maximum Daily		Report	Report	Report	Report	Report	Report	Report	Report	Report

S

Source: Massport

Notes: For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit.
J = value is an estimate calculated by the lab from the response factors of the other two triazole compounds.
Tolytriazole concentrations calculated as sum of 4-Methly-1-H-benzotriazole and 5-Methyl-1-H-benzotriazole.

BOD5 Five-day Biochemical Oxygen Demand
COD Chemical Oxygen Demand
ND Not Detected

Table J-14 Logan Airport March 2016 Wet Weather Deicing Monitoring Results – North, West, Porter Street, and Runway/Perimeter Stormwater Outfalls

	Date	Ethylene Glycol, Total (mg/L)	Propylene Glycol, Total (mg/L)	BOD5 (mg/L)	COD (mg/L)	Ammonia Nitrogen (mg/L)	Nonylphenol (µg/L)	4-Methyl-1-H-benzotriazole (µg/L)	5-Methyl-1-H-benzotriazole (µg/L)	Tolytriazole (µg/L)
001B - North Outfall	3/21/2016	<70	1,100	1,400	3,300	1.37	<0.020	0.036	0.047	0.083
002B - West Outfall	3/21/2016	<1,400	11,000	14,000	23,000	1.41	<0.020	0.030	0.031	0.061
003B - Porter Street Outfall 1	3/21/2016	<7.0	<7.0	54	210	1.88	1.557	0.003 J	0.004 J	0.007 J
003B - Porter Street Outfall 2	3/21/2016	<35	430	930	2,700	0.159	<0.020	0.03	0.031	0.06
003B - Porter Street Outfall 3	3/21/2016	<7.0	<7.0	23	180	0.80	0.908	<0.001	<0.001	ND
003B - Porter Street Outfall Average	3/21/2016	0.0	143	336	1,030	0.95	0.822	0.010	0.012	0.021
006B- Runway/ Perimeter (A9)	3/21/2016	<7.0	<7.0	3.1	<20	0.832	1.118	0.008	0.002 J	0.01 J
006B- Runway/ Perimeter (A15)	3/21/2016	<7.0	<7.0	2.7	<20	2.49	1.47	0.017	0.004 J	0.021 J
006B- Runway/ Perimeter (A19)	3/21/2016	<7.0	<7.0	5.8	<20	6.68	0.7	0.026	0.009	0.04
006B- Runway/ Perimeter (A21)	3/21/2016	<7.0	<7.0	6.8	280	1.080	0.835	0.01	0.002 J	0.012 J
006B- Runway/ Perimeter (A23)	3/21/2016	<7.0	<7.0	20	60	1.94	1.34	0.017	0.003 J	0.02 J
006B- Runway/ Perimeter (A32)	3/21/2016	<7.0	<7.0	69	89	3.16	1.63	0.023	0.007	0.030
006B- Runway/ Perimeter (A38)	3/21/2016	<7.0	<7.0	8.3	63	0.308	1.28	<0.001	<0.001	ND
006B- Runway/Perimeter Outfall Average		0.0	0.0	17	70	2.36	1.20	0.014	0.004	0.018
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.										
Discharge Limitations										
Average Monthly		Report	Report	Report	Report	Report	Report	Report	Report	Report
Maximum Daily		Report	Report	Report	Report	Report	Report	Report	Report	Report

Source: Massport.

Notes: For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit.
J = value is an estimate calculated by the lab from the response factors of the other two triazole compounds.
Tolytriazole concentrations calculated as sum of 4-Methly-1-H-benzotriazole and 5-Methyl-1-H-benzotriazole.

BOD5 Five-day Biochemical Oxygen Demand
COD Chemical Oxygen Demand
ND Not Detected

Table J-15 Logan Airport Stormwater Outfall NPDES Water Quality Monitoring Results – 1993 to 2016

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# / # = Number of samples at or below NPDES limits / Total number of samples taken[1]																								
Oil and Grease (mg/L)																								
North Outfall	30/31	35/36	33/35	29/35	30/35	35/36	29/30	34/36	28/28	36/36	30/32	32/34	33/35	33/33	29/29	23/23	24/24	24/24	24/24	21/21	20/20	21/21	19/20	23/23
West Outfall	29/30	36/36	34/34	36/36	34/35	36/36	30/30	35/35	27/28	36/36	31/32	33/34	35/35	32/33	28/28	22/23	24/24	24/24	22/24	21/21	21/21	21/21	19/19	23/23
Maverick Street Outfall	29/29	36/36	35/35	36/36	35/35	35/36	30/30	34/34	26/28	35/36	32/32	34/34	35/35	32/33	29/29	22/23	20/21	19/19	23/23	15/15	4/4	20/20	18/18	23/23
Settable Solids[2] (mg/L)																								
North Outfall	19/19	34/35	34/35	32/35	31/34	34/36	30/30	34/36	29/29	32/36	32/32	34/34	33/35	32/34	22/22	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
West Outfall	19/19	32/36	34/34	35/36	34/34	35/36	29/30	36/36	27/28	36/36	31/32	34/34	32/35	33/33	22/22	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TSS (mg/L)																								
North Outfall	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6/6	24/24	24/24	22/23	24/24	21/21	20/21	21/21	20/20	23/23
West Outfall	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5/6	24/24	24/24	23/23	22/24	20/22	21/21	20/21	18/19	23/23
Maverick Street Outfall	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4/6	22/24	20/21	18/19	20/23	14/15	4/4	19/20	18/18	22/23
pH																								
North Outfall	34/35	33/36	35/35	35/35	35/35	36/36	30/30	36/36	29/29	36/36	32/32	34/34	35/35	34/34	26/26	12/12	16/16	11/11	12/12	9/9	8/8	8/8	8/8	10/11
West Outfall	34/34	28/36	33/34	35/36	35/35	36/36	30/30	36/36	29/29	36/36	32/32	34/34	35/35	33/33	26/26	12/12	16/16	11/11	12/12	9/9	9/9	8/8	8/8	11/11
Porter Street Outfall	35/35	30/36	34/34	36/36	35/35	36/36	30/30	36/36	28/28	36/36	32/32	34/34	35/35	33/33	22/22	21/21	48/48	24/24	23/23	26/27	24/27	24/24	19/23	33/33
Maverick Street Outfall	35/35	35/36	35/35	36/36	34/35	36/36	30/30	35/35	28/28	36/36	32/32	34/34	35/35	33/33	26/26	10/10	16/16	10/10	11/11	6/6	2/2	7/7	7/7	10/11

Source: Massport

Notes: Sampling requirements changed in 2007 with the issuance of a new NPDES permit. Results through 2007 are based on NPDES Permit MA0000787, issued March 1, 1978. Stormwater outfall water quality monitoring results collected in accordance with the requirements of former NPDES permit. A portion of the Porter Street Drainage Area was incorporated into the West Drainage Area as part of roadway construction projects at Logan Airport.

N/A Not available.

1 The total number of samples at each outfall varies year to year. In some years, fewer samples are taken due to factors such as construction, weather, and/or tidal conditions.

2 Settleable solids analyses were replaced with TSS in 2008.

Table J-16 Logan Airport Oil and Hazardous Material Spills[1] and Jet Fuel Handling – 1990 to 2016

Year	Total Number of all Spills	Total Number of all Spills >10 gallons	Total Volume of all Spills (Gallons)	Estimated Volume of Jet Fuel Handled (Gallons)	Total Volume of Jet Fuel Spilled (Gallons)
1990	173	N/A	N/A	438,100,000	3,745
1991	186	N/A	N/A	N/A	2,471
1992	195	N/A	N/A	N/A	4,355
1993	188	N/A	N/A	451,900,000	3,131
1994	217	N/A	N/A	476,700,000	4,046
1995	161	N/A	N/A	309,200,000	21,412[2]
1996	159	N/A	N/A	346,700,000	1,321
1997	147	N/A	N/A	377,488,161	2,029[3]
1998	191	N/A	N/A	387,224,004	10,047[4]
1999	196	43	7,151	425,937,051	7,012[5]
2000	136	20	1,318	441,901,932	1,227
2001	139	37	1,924	416,748,819	1,771
2002	101	16	653	358,190,362	559
2003	128	19	10,364	319,439,910	10,188[6]
2004	126	18	894	373,996,141	574
2005	97	15	2,319	368,645,932	585
2006	92	11	752	364,450,864	644
2007	108	7	604	367,585,187	361
2008	99	20	944	345,631,788	662
2009	95	6	1004	327,358,619	915
2010	87	15	476	335,693,997	360
2011	108	12	572	340,421,373	337
2012	132	5	593	343,731,127	439
2013	94	6	452	349,397,940	351
2014	129	17	2,785	370,222,342	785
2015	196	16	1,278	374,985,216	885
2016	231	14	1,158	456,003,328	558

Source: Massport Fire-Rescue Department.
Notes:
N/A Not available.
1 Materials include: jet fuel, hydraulic oil, diesel fuel, gasoline, and other materials such as glycol and paint.
2 One tenant spill, which occurred on October 15, 1995, totaled 18,000 gallons (84 percent of the annual spill total). The spill did not enter the Airport's storm drain system.
3 On October 23, 1997, a fuel line on an aircraft failed, resulting in the release of approximately 2,500 gallons, all but 60 gallons of which were recovered in drums before reaching the ground. Only the 60 gallons is included in the 1997 total.
4 Includes a 7,200-gallon spill that was discovered on September 2, 1998, and a 1,300-gallon spill that occurred on June 3, 1998. Neither spill entered the Airport's storm drain system.
5 Includes a 5,000-gallon spill, none of which entered the Airport's storm drainage system.
6 In 2003, one fuel spill comprised 9,460 gallons or 94 percent of the total volume of the MassDEP/MCP reportable spills that year. The fuel spill was contained and did not enter the drainage system.

Table J-17 Type and Quantity of Oil and Hazardous Material Spills at Logan Airport – 1999 to 2016

	Jet Fuel			Hydraulic Oil			Diesel Fuel			Gasoline			Other		
Year	No. of Spills	Quantity (Gallons)	No. of Spills ⩾ 10 Gallons	No. of Spills	Quantity (Gallons)	No. of Spills ⩾ 10 Gallons	No. of Spills	Quantity (Gallons)	No. of Spills ⩾ 10 Gallons	No. of Spills	Quantity (Gallons)	No. of Spills ⩾ 10 Gallons	No. of Spills	Quantity (Gallons)	No. of Spills ⩾ 10 Gallons
1999	151	7,012	40	24	67	1	13	49	2	5	7	0	3	16	0
2000	115	1,227	18	8	59	2	3	11	0	8	16	0	2	5	0
2001	104	1,771	32	21	92	3	5	30	1	6	26	1	3	5	0
2002	79	559	15	7	38	0	8	37	18	4	8	0	3	11	0
2003	89	10,188	15	15	91	3	15	30	0	7	24	0	2	31	1
2004	82	574	12	17	189	4	14	52	0	7	26	0	6[1]	53[2]	2[3]
2005	66	585	12	14	78	1	7	1,610	2	7	45	0	3[4]	1	0
2006	65	644	9	10	25	0	6	57	1	4	9	0	7	17	1
2007	66	361	4	16	37	0	16	57	1	3	8	0	7	141[5]	2
2008	74	662	19	15	56	2	5	14	0	1	7	0	4	205[6]	1
2009	95	915	6	21	51	0	9	20	0	3	3	0	11	15	0
2010	54	360	12	17	50	1	5	56	2	2	3	0	7	7	0
2011	69	337	10	21	149	1	7	55	1	4	16	0	7	15	0
2012	80	439	4	25	79	1	17	38	0	2	12	0	8	25	0
2013	56	351	5	15	51	0	13	32	0	2	<2	0	7	10	0
2014	81	785	13	24	98	1	17	1,810	2	4	9	0	3	83	1
2015	110	885	10	43	149	3	16	151	2	7	46	1	20	47	0
2016	94	558	8	73	224	4	30	300	2	6	12	0	28	64	0

Source: Massport

Notes:

1 Includes two Unknown spills (14 gallons), plus one spill of each of the following: Ethylene Glycol, Propylene Glycol, AVGAS, and Paint.

2 Ethylene Glycol (25 gallons), Propylene Glycol (10 gallons), AVGAS (1 gallon) and Paint (3 gallons).

3 One spill of Ethylene Glycol; one spill of Propylene Glycol.

4 Includes two spills of an unknown substance and volume.

5 Includes one spill of motor oil (4 gallons); one spill of kerosene (5 gallons); one spill of cooking oil (120 gallons); one spill of fuel oil (10 gallons); one spill from a battery (1 gallon); two spills of an unknown substance (1 gallon).

6 Includes one spill of transformer oil (200 gallons).

Table J-18 MCP Activities Status of Massport Sites at Logan Airport

Location (Release Tracking Number) and MassDEP Reporting Status	Action/Status
1. Fuel Distribution System (3-1287)	
2007	Inspection and Monitoring Status Reports were submitted to the Massachusetts Department of Environmental Protection (MassDEP) detailing monitoring and product recovery efforts along the FDS between September 2006 and September 2007. A Periodic Evaluation Report was submitted in January 2008 which indicated that a Condition of No Substantial Hazard existed at the FDS and a permanent solution was not currently feasible. Massport coordinated with BOSFUEL who prepared construction documents for replacing a portion of the FDS. Construction was conducted under a RAM Plan.
2008	Inspection and monitoring reports were submitted to the MassDEP detailing monitoring and product recovery efforts along the FDS between September 2007 and September 2008. Massport coordinated with BOSFUEL during construction to replace a portion of the FDS. The work was conducted under a RAM Plan that was submitted to the MassDEP in May 2008. A RAM Status Report was submitted in September 2008. Construction of the pipeline replacement was approximately 90 percent complete.
2009	Inspection and monitoring reports were submitted to the MassDEP detailing monitoring and product recovery efforts along the FDS between September 2008 and December 2009. The BOSFUEL project to replace a portion of the FDS continued, with work being completed on pipeline connections, testing of the new fuel line, and abandonment of the old fuel line. RAM Status Reports for the BOSFUEL Project were submitted in February and September 2009.
2010	Inspection and monitoring reports were submitted to the MassDEP detailing monitoring and product recovery efforts along the FDS between September 2009 and September 2010. A RAM Completion Report for the BOSFUEL Project was submitted in February, and the report was revised in March 2010.
2011	A Periodic Review of the Temporary Solution for the FDS was submitted in April 2011. Additionally, three Post-Class C RAO Status Reports were submitted for the FDS in February, June, and December 2011, summarizing the routine inspection and monitoring activities.
2012	Post-Class C RAO Status Reports were submitted in May and November 2012, summarizing the routine inspection and monitoring activities.
2013	Post-Class C RAO Status Reports were submitted in May and November 2013, summarizing the routine inspection and monitoring activities.
2014	Post-Class C RAO Status Reports were submitted in May and November 2014, summarizing the routine inspection and monitoring activities. In addition, a RAM Plan was submitted in April 2014 to address construction in the area of the FDS followed by a RAM Completion Report submitted in August 2014.
2015	Post-Temporary Solution Status Reports were submitted in May and November 2015, summarizing the routine inspection and monitoring activities.
2016	RAO-C 5-year periodic review submitted in July 2016. Two Post-Temporary Solution Status Reports were submitted in 2016 summarizing the routine inspection, monitoring and product recovery activities.
2. North Outfall (3-4837) - CLOSED	
Phase II and Phase III Reports filed in March 1997	Indicated petroleum contamination present at the site was likely the result of decades of airport operation; risk assessment reported no significant risk to human health, or to the aquatic and avian community.
RAO submitted in March 1998	Class C RAO using a Temporary Solution (periodic site monitoring and assessment); remediation steps included (not limited to) installation of a new fuel distribution system and decommissioning of certain fuel lines, and natural biodegradation processes; goal is to have petroleum contamination reduced to an area less than 1,000 square feet. Installation of the new fuel distribution system and decommissioning of sections of the old system were completed. Massport initiated site evaluation to document the reduction of petroleum contamination following the decommissioning of the North Fuel Farm and fuel distribution system.
Post Class C RAO evaluation report submitted in December 2002	Massport has eliminated substantial hazards at this site and submitted a Class C RAO statement. In accordance with applicable regulations, Massport will conduct a periodic evaluation at five-year intervals until a Permanent Solution has been achieved. The next periodic evaluation was scheduled for 2007.
2004	Evaluation report indicated that a "Condition of No Significant Risk" has not been achieved at this site. Massport scheduled another assessment in 2007.
2005	No change in status for 2005.
2006	Massport prepared the five-year review of the Class C RAO for this site, which was due in December 2007.
2007	Massport completed its five-year review of the Class C RAO and transmitted it to MassDEP in December 2007. It was determined that a "Condition of No Significant Risk" has not been achieved at this site at this time. The next five-year re-evaluation will be conducted in 2012.
2008	No change in status.

Table J-18 MCP Activities Status of Massport Sites at Logan Airport (Continued)

Location (Release Tracking Number) and MassDEP Reporting Status	Action/Status
2. North Outfall (3-4837) - CLOSED (Continued)	
2009	No change in status.
2010	No change in status.
2011	No change in status. Massport provided updated data for the MassDEP website.
2012	Response Action Outcome submitted to MassDEP on December 27, 2012. No further MCP response action is required.
3. Former Robie Park (3-10027) - CLOSED	
2005	A Phase I was completed in 2005 with an RAO retraction. The RAO had been completed by the former property owner.
2006	No change in status for 2006.
2007	No change in status for 2007.
2008	A Phase II Scope of Work was prepared on May 9, 2008. A RAM Plan was submitted to MassDEP on September 16, 2008.
2009	A Phase V Remedy Operation Status Plan was submitted on March 31, 2010.
2010	Two Remedy Operation Status Reports were submitted on September 29, 2010 and March 28, 2011. The next status report was scheduled for September 30, 2011.
2011	Phase IV Project Status Reports 2 and 3 were submitted in March and September 2011, respectively.
2012	Phase V Status Reports 4 and 5 were submitted in March and September 2012, respectively.
2013	Phase V Status Reports 6 and 7 were submitted in March and September 2013, respectively.
2014	Phase V Status Reports 8 and 9 were submitted in March and September 2014, respectively.
2015	Phase V Reports 10 and 11 were submitted in March and September 2015, respectively.
2016	A Permanent Solution Statement was submitted in 2016.
4. Former Robie Property (3-23493) - CLOSED	
2005	A Phase I was completed in 2005.
2006	No change in status for 2006.
2007	No change in status for 2007.
2008	A Phase II was submitted to MassDEP on October 21, 2008.
2009	An Activity and Use Limitation (AUL) was recorded with the Suffolk County Registry of Deeds for the site on December 16, 2009.
2010	A Class A-3 RAO was submitted on January 4, 2010, corresponding with the recording of an AUL. On May 21, 2010, a RAM Plan for the Economy Parking Structure was submitted. The first RAM Status Report was submitted on September 21, 2010. An AUL Amendment was recorded on December 9, 2010.
2011	A RAM Completion Statement was submitted on March 15, 2011. Regulatory closure has been achieved. No further response actions are required.
5. Tomahawk Drive (3-27068) - CLOSED	
2007	Release notification form submitted in August 2007.
2008	A Class B-1 RAO was submitted to MassDEP on January 9, 2009. No further response actions were required.
2009	No further response actions were required.
2011	No further response actions required
6. Fire Training Facility (3-28199)	
2008	Oral notification of release was provided to MassDEP/BWSC on December 10, 2008.
2009	A Phase I/Tier classification was submitted on December 17, 2009.
2010	A RAM Plan was submitted to MassDEP on August 6, 2010. A RAM Status Report was submitted to MassDEP on December 3, 2010.

Table J-18 MCP Activities Status of Massport Sites at Logan Airport (Continued)

Location (Release Tracking Number) and MassDEP Reporting Status	Action/Status
6. Fire Training Facility (3-28199) (Continued)	
2011	A RAM Completion Statement was submitted on April 25, 2011. A Phase II Scope of Work was prepared and submitted to MassDEP on January 18, 2011. Phase II and Phase III Reports were submitted on December 8, 2011. A RAM Completion Statement was submitted on April 25, 2011.
2012	Phase 4 Status Report transmitted in June 2012; the Phase IV Remedy Implementation Plan was submitted in December 2012.
2013	Phase 4 Status Report transmitted in June 2013, the Phase IV Completion Report was transmitted in December 2013.
2014	Phase 5 Remedy Operation Status Reports submitted in June and December 2014.
2015	Phase 5 Remedy Operation Status Reports submitted in June and December 2015.
2016	Phase 5 Remedy Operation Status Reports submitted in June and December 2016.
7. Southwest Service Area (3-28792) - CLOSED	
2009	Release notification form was submitted to MassDEP/BWSC on October 8, 2009.
2010	A Class B-1 RAO was submitted to MassDEP on October 18, 2010. No further response actions required.
2011	No further response actions required.
8. Airfield Duct Bank Site (3-29716) - CLOSED	
2010	Release notification form was submitted on December 22, 2010.
2011	A Class A-1 RAO was submitted on December 23, 2011. No further response actions required.
9. West Outfall Release (3-29792) - CLOSED	
2011	Release notification form was submitted on April 8, 2011. Two IRA Status Reports were submitted to MassDEP on June 9 and December 5, 2011. An RAO was submitted on February 13, 2012. No further response actions required.
10. Hertz Parking Lot Site (3-30260) - CLOSED	
2011	Release notification form was submitted on August 29, 2011. A RAM Plan was submitted to MassDEP on September 1, 2011.
2012	A Class A-2 RAO was submitted on September 10, 2012. No Further response actions required.
11. Former Butler Aviation Hangar (3-30654) - CLOSED	
2012	Verbal notification of a release was provided to MassDEP on February 14, 2012, when Rental Car Center construction encountered an unidentified underground storage, and a Release Notification Form was submitted on April 23, 2012. An IRA Plan was submitted May 21, 2012 and IRA Status Reports were submitted on June 18 and December 26, 2012.
2013	Phase I Report and Tier Classification submitted February 21, 2013 and IRA Completion Report submitted on July 11, 2013.
2014	A Permanent Solution Statement was submitted in October 2014. No further response actions required.
12. Taxi Pool Site (3-32022)	
2014	MassDEP notified of 72-hour Reportable Condition on March 10, 2014
2015	Phase I Report and Tier Classification submitted March 9, 2015.
2016	Permanent Solution Statement scheduled to be submitted in 2017
13. Hangar 16 (3-32351) - CLOSED	
2014	Release Notification Form Submitted August 4, 2014.
2015	A RAM Plan was submitted on January 29, 2015; a Phase I Report and Tier Classification were submitted on August 3, 2015; a RAM Completion Report was submitted November 16, 2015; and a Permanent Solution Statement was submitted on January 21, 2016. No further response actions are required.

Source: Massport

Notes: This list includes Massport MCP sites only. Additional sites are the responsibility of Logan Airport tenants. Refer to Figure 8-2 in Chapter 8, *Water Quality/Environmental Compliance and Management,* for location of MCP sites.

AUL	Activity and Use Limitation	Phase I	Initial Site Investigation
MCP	Massachusetts Contingency Plan	Phase II	Comprehensive Site Assessment
RAM	Release Abatement Measure	Phase III	Identification, Evaluation, and Selection of Comprehensive Remedial Actions
RAO	Response Action Outcome	Phase IV	Implementation of Selected Remediation Action
FDS	Fuel Distribution System	Phase V	Operation, Maintenance and/or Monitoring
IRA	Immediate Response Action		

Capital Programs and Environmental Affairs

EnviroNews

A Massport Newsletter

Volume 42, Issue 1
January 2016

INSIDE THIS ISSUE:

2016 Sustainable Massport Calendar

The 2016 Sustainable Massport Calendar is now available for all Massport employees and tenants. The 2016 calendar expanded to showcase sustainability efforts across all Massport facilities, including: Hanscom Field, Worcester Regional Airport, Parks, Real Estate Holdings, and the Port of Boston.

The annual Sustainable Massport Calendar is part of the engagement strategies laid out in the first ever Logan Airport Sustainable Management Plan (SMP), published in 2015. The Logan SMP serves as a roadmap to advance Massport's leadership and commitment to sustainability, by prioritizing and implementing initiatives that emphasize economic viability, operational efficiency, natural resource conservation, and social responsibility. The Sustainable Massport Calendar is one tool to share Massport's sustainability successes, and raise awareness about the organization's commitment to sustainability. Each month within the calendar will highlight a different sustainability-related topic, associated activities which Massport has undertaken and its progress, as well as ideas of programs and actions which individuals can participate in to improve personal sustainability at work and home.

Topics for the year are as follows:

January 2016	Sustainability Awareness
February 2016	Buildings and Facilities
March 2016	Air Quality
April 2016	Parks and Open Space
May 2016	Sustainable Transportation
June 2016	Natural Resources
July 2016	Community-Schools
August 2016	Climate Change Adaptation and Resiliency
September 2016	Energy Efficiency and Greenhouse Gas (GHG) Reduction
October 2016	Community - Health and Wellness
November 2016	Waste Management and Recycling
December 2016	Tenants

If you haven't received a 2016 Calendar or would like additional copies to distribute, please contact Jacob Glickel at jglickel@massport.com.

Recycling Empty Barrels of Firefighting Foam

Massport Facilities and Fire Rescue have given a second life to empty barrels of firefighting foam. Ten barrels are being repurpose at the Mass Audubon's Blue Hills Trailside Museum Center in Milton. The barrels are now being used to hold sand to keep the trails open during the winter months.

Great Job to all involved!

EnviroNews is a newsletter published quarterly for Massport and its tenants. Your comments and suggestions are welcome. Please contact Brenda Enos (benos@massport.com) at 617-568-5963.

Safe Winter Driving

The three P's of Safe Winter Driving:
PREPARE for the trip; PROTECT yourself; and PREVENT crashes on the road

PREPARE

- Check tire tread, headlights, brake lights, windshield wipers and windshield washer fluid prior to driving.
- Completely clear snow and ice off your car – including windows, mirrors, lights, reflectors, hood, roof and trunk.
- Have a snow brush and ice scraper in your vehicle.

PROTECT YOURSELF

- Always use your seat belt while driving or when you are a passenger in a moving vehicle.
- Watch for ice when stepping in and out of the vehicle. Most falls happen when getting in and out of vehicles during the winter months. Use three points of contact while getting in and out and use caution.
- Always wear high visibility clothing when working around vehicles at roadways, garages, container yards and ramp areas.
- Make sure your exhaust pipe is clear of snow. There is danger of carbon monoxide poisoning if snow blocks the pipe while idling. Remember- do not idle more than 5 minutes per MassDEP regulation.

PREVENT CRASHES

- Stopping distances are longer on snow and ice. Slow down and increase distances between vehicles.
- Keep your eyes open for pedestrians walking in the road. Visibility can be low during snow storms. Use caution around terminal and ramp areas where pedestrians could be in or near the road.
- Drive with your headlights on and be sure to keep them clean to improve visibility.
- Use caution when snow banks limit your view of oncoming traffic.
- Be cautious on bridges and overpasses as they are commonly the first areas to become icy.
- Remember that speed limits are meant for dry roads, not roads covered in snow and ice. You should reduce your speed and increase your following distance as road conditions and visibility worsen.

2015 DERA Grant Award, Conley Terminal

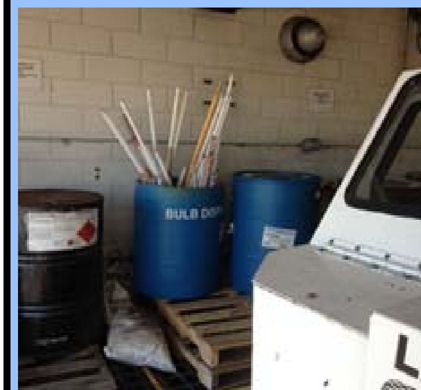
The Massport Maritime Department and the Environmental Management Unit worked collaboratively to secure an EPA grant that will allow for the replacement of diesel generators in five (5) Rubber Tire Gantry Cranes (RTGs) at Conley Terminal in South Boston. This grant was made possible under the Diesel Emissions Reduction Act (DERA) and will contribute $333,185 toward the cost of the project. This was the only project in New England to be selected for FY2015 DERA funding.

This grant will allow Massport to replace five older, Tier III diesel powered generators with current EPA Tier-4F certified units. Along with extending the service life of this critical equipment, Conley Terminal and surrounding communities in South Boston will benefit from reduced air emissions. The new generators represent a significant improvement over the existing units because they emit less emissions while operating and will be equipped with a fuel saver system which will reduce fuel use during standby time. Annually, the new Tier-4F engines are expected to conserve approximately 2,800 gallons of diesel fuel and reduce emissions of nitrogen oxides, particulate matter and carbon dioxide by an estimated 8 tons, 0.5 tons and 155 tons, respectively. The grant funding was formally presented to Massport by the U.S. EPA during a press conference on Friday, December 4th, 2015 at Conley Terminal.

The retrofit of RTGs at Conley Terminal follows on the success of the Massport Clean Truck program. In 2007, Massport and the EPA established a "Clean Truck" program giving owners of older trucks servicing Conley Terminal an incentive to replace the vehicles with ones that are 2007 emission compliant or newer. A total of $1.5 million, including a $500,000 EPA DERA grant provides truck owners with 50 percent of the replacement cost up to $25,000 of older trucks. So far 55 trucks, some up to 25 years old, have been replaced with new models that dra-

Compliance Corner

Universal Waste Compliance



Do you know the difference between Hazardous Waste and Universal Waste?

Many Massport tenants generate regulated universal waste and don't even realize it! Generation of universal waste can come from businesses that utilize administrative office space, storage, restaurants and retail stores. In fact, it is called universal waste because it is generated by nearly every type of business entity and many homeowners as well.

Universal waste is a type of hazardous waste and its storage, handling, transportation and disposal are regulated. However, because of the relatively low hazard associated with these wastes and the large number of entities generating this material, universal waste is regulated differently with reduced compliance requirements compared to those for hazardous waste.

Examples of Universal Waste are:

Used light bulbs (fluorescent tubes, compact fluorescent, halogen, metal halide, high/low pressure sodium and mercury vapor)

Used Batteries (most rechargeable batteries and lead acid batteries)

Mercury Containing Equipment (thermostats, thermometers, barometers, mercury switches, etc.)

Pesticides (unused or recalled pesticides which are collected as waste)

Much like hazardous waste, the level of regulation is defined by the volume generated. Entities storing in excess of 11,000 lbs at any one time are considered Large Quantity Handlers, while those storing less are considered Small Quantity Handlers. In both cases universal waste can only be stored on site for one year or less and must be collected, labeled and disposed of through a licensed handler or disposal facility. Records should be kept to document proper disposal. **Regulated universal wastes should NEVER be disposed of in trash cans, solid waste dumpsters or single stream recycling containers.**

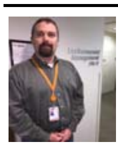
More information is available at the MassDEP web site at:

http://www.mass.gov/eea/docs/dep/recycle/hazardous/univrule.pdf

If you have any questions or concerns about hazardous waste compliance, contact the Massport Environmental Department.

Questions about Environmental/Safety Issues

Who should you contact?

Contact	Phone Number	Email Address
 **Auditing/General**		
Brenda Enos	(617) 568-5963	benos@massport.com
Universal Waste		
Glenn Adams	(617) 568-3542	gadams@massport.com
Safety		
Brian Dinneen	(617) 568-7427	bdinneen@massport.com
Michael McAveeney	(617) 561-3390	mmcaveeney@massport.com
Karisa Hanson	(617) 568-7434	khanson@massport.com
Spill Follow-Up		
James Stolecki	(617) 568-3552	jstolecki@massport.com
NPDES Permitting		
Rosanne Joyce	(617) 568-3516	rjoyce@massport.com
Underground/Aboveground Storage Tanks		
Erik Bankey	(617) 568-3514	ebankey@massport.com
 **Air Quality/Hazardous Waste**		
Ian Campbell	(617) 568-3508	icampbell@massport.com
 **EMS/Sustainability/Recycling**		
Jacob Glickel	(617) 568-3558	jglickel@massport.com

Capital Programs and Environmental Affairs

EnviroNews

A Massport Newsletter

Volume 42, Issue 2
May 2016

INSIDE THIS ISSUE:

EnviroNews is a newsletter published quarterly for Massport and its tenants. Your comments and suggestions are welcome. Please contact Brenda Enos (benos@massport.com) at 617-568-5963.

Logan Annual Sustainability Report

The 2016 Logan Airport Annual Sustainability Report was released on Earth Day, April 22. This report provides a progress summary of sustainability efforts at Boston-Logan International Airport. It highlights notable actions and achievements since the 2015 Sustainability Management Plan was published and characterizes Massport's plans for a Sustainable Massport. As we celebrate our successes this year, we hope that the excitement for sustainability efforts continues to grow throughout the year. Massport strives to be a good neighbor and environmental steward in everything that we do.

The report focuses on progress towards each of Massport's sustainability goals in the following ten resource areas:

- Energy and Greenhouse Gas Emissions
- Water Conservation
- Community, Employee, and Passenger Well-being
- Materials, Waste Management, and Recycling
- Resiliency
- Noise Abatement
- Air Quality Improvement
- Ground Access and Connectivity
- Water Quality/Stormwater
- Natural Resources

Visit www.massport.com/environment to download a copy of the Logan Annual Sustainability Report. If you would like a hard copy please contact Jacob Glickel at jglickel@massport.com.

Compliance Corner

Spills of Hazardous Waste and Hazardous Materials

Despite extensive planning, preventive measures and implementation of Best Management Practices (BMPs), spills of hazardous substances sometimes occur at active commercial and industrial facilities. All Massport owned properties have plans in place to respond to and address these incidents. When in doubt over whether or not to clean up a spill, you can ask yourself the following questions:

- *Is this spill inside of a building and on an impervious surface?*
- *Do I know the cause of this spill?*
- *Am I familiar with the material that was spilled and hazards associated with it?*
- *Is the spill below reportable spill quantities (RQ)?*
- *Am I equipped with proper spill supplies , Personal Protective Equipment (PPE) and training to clean up this spill (only if below RQ)*

If you answered no to any of these questions, you must report this spill to Massport. Notification should be made as soon as possible after discovery of the spill.

Any spill entering the storm drainage system or a surface water body must be promptly reported to Massport to ensure that cleanup is completed and any required regulatory reporting is made.

Spills at Massport owned facilities should be called in to the following numbers:

- *Logan Airport:* *Logan Fire Alarm 617-567-2020*
- *Worcester Airport:* *Worcester ARFF, 508-849-5519*
- *Hanscom Field:* *Hanscom Emergency, 781-869-8080*
- *Maritime Properties*: *Massport Port Office, 617-464-8250*

In most cases, spent cleanup supplies, contaminated packaging and recovered spilled material(s) will become regulated hazardous waste at the conclusion of the cleanup activities. Proper handling and disposal of this waste is always the responsibility of the company responsible for the spill. Massport and their spill response contractors can assist with coordination of proper or ownership transportation and disposal of regulated hazardous waste(s) but Massport cannot take responsibility for this waste. It is up to the company responsible for the spill to make proper arrangements for storage, transportation and disposal of spill related waste(s).

More information is available at the MassDEP web site at http://www.mass.gov/eea/agencies/massdep/about/programs/emergency-response-program.html

If you have any questions or concerns about hazardous waste compliance, contact the Massport Environmental Department.

Massport Safety Manual Revised


Massachusetts Port Authority

massport

Safety and Health Manual

Safety and Security at all facilities is one of the Massport Top 10 Goals. Massport's Safety and Health Manual supports this goal to eliminate unsafe conditions and minimize the impact of hazardous situations. This Manual can benefit Massport by reducing illness and injury to personnel, preventing property damage, and preserving the environment.

Over the past several months, the Safety Unit has been working with many Departmental Units to update the policies and procedures that comprise the Massport Safety and Health Manual. Since the last version of the Manual was distributed, Massport has grown, some regulations have changed, and new technologies have emerged to minimize incidents.

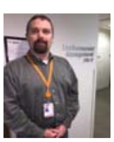
The latest version of the Safety and Health Manual was distributed this April. In order to minimize paper waste, the manual is available to everyone on the Safety Department's tab of the Massport Portal (http://sharepoint/CapitalPrograms/Safety/default.aspx). A limited number of paper manuals will be made available at select locations for those who do not have access to the Massport Portal.

To support the Manual roll out, we will be covering a topic each month for the next year to review the Policy and Procedure Section. It will be supported with Safety Focus (Tool Box) flyers, training and inspections of Safety Equipment related to the subject.

The manual is a living and fluid document. As we review and implement each Policy and Procedure Section, we encourage comments and suggestions to continually improve the Manual for the entire Massport Community.

Questions about Environmental/Safety Issues

Who should you contact?

Contact	Phone Number	Email Address
 **Auditing/General**		
Brenda Enos	(617) 568-5963	benos@massport.com
Universal Waste		
Glenn Adams	(617) 568-3542	gadams@massport.com
Safety		
Brian Dinneen	(617) 568-7427	bdinneen@massport.com
Michael McAveeney	(617) 561-3390	mmcaveeney@massport.com
Spill Follow-Up		
James Stolecki	(617) 568-3552	jstolecki@massport.com
NPDES Permitting		
Rosanne Joyce	(617) 568-3516	rjoyce@massport.com
Underground/Aboveground Storage Tanks		
Erik Bankey	(617) 568-3514	ebankey@massport.com
Air Quality/Hazardous Waste		
 Ian Campbell	(617) 568-3508	icampbell@massport.com
EMS/Sustainability/Recycling		
 Jacob Glickel	(617) 568-3558	jglickel@massport.com

Capital Programs and Environmental Affairs

EnviroNews

A Massport Newsletter

Volume 42, Issue 3
August 2016

INSIDE THIS ISSUE:

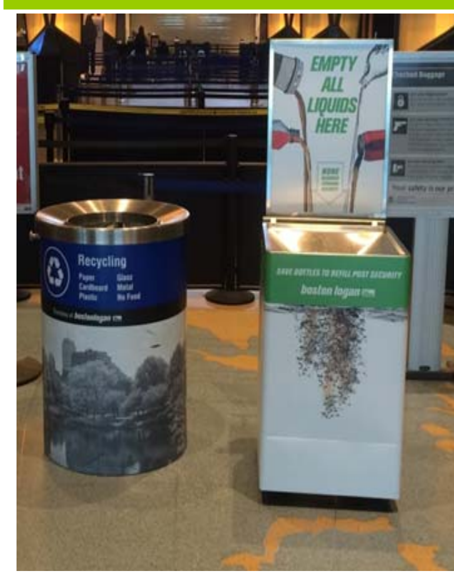
EnviroNews is a newsletter published quarterly for Massport and its tenants. Your comments and suggestions are welcome. Please contact Brenda Enos (benos@massport.com) at 617-568-5963.

Using Soy to Help Keep the Streets Clean

Massport's Fleet Maintenance has been using a bio-based hydraulic fluid in street sweepers serving Logan Airport. Three Elgin Pelican Street Sweepers have been piloting a program on the effectiveness of using a bio-based hydraulic fluid.

Street sweepers are a work horse of the Logan fleet, keeping all the roads and parking lots clean. Bill Crowley, Supervisor for Fleet Maintenance, was looking for a natural alternative that didn't hinder performance. Beginning in July 2015, Bill began the pilot program with one street sweeper and expanded to all three in early 2016. The soy-based hydraulic fluid is more environmentally friendly and, in the event of a release to the environment, easier to clean up. Bill is looking into expanding the use of bio-based hydraulic fluids in other vehicles.

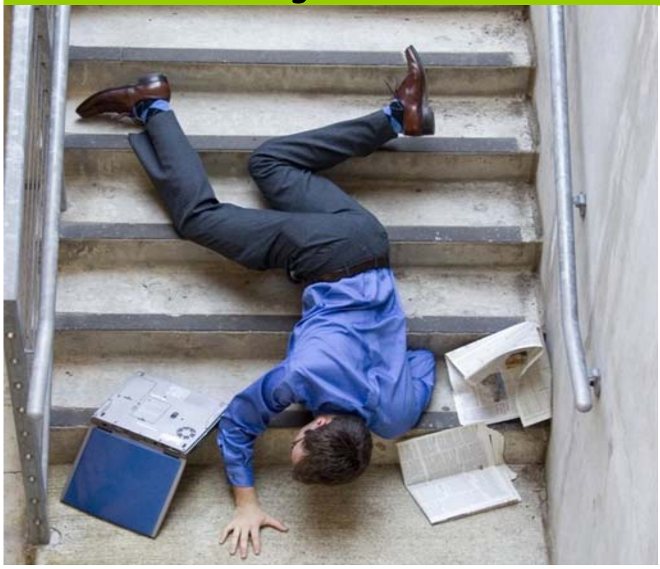
Pour Your Liquid Here



To improve recycling and reduce waste, Massport has installed collection stations at select security checkpoints in Terminals A, C and E. The first two stations in Terminal C were installed in April 2016, and have already collected over 3,000 gallons of liquid that would have normally gone in the trash. Massport expanded to two new locations in Terminal A and E in July.

With the increase in security precautions over the past decade, water and other drinks are not allowed through security checkpoints. Some passengers drink the remaining drops of their drink, but most throw bottle and the remaining liquid in the trash. With the liquid collection stations, passengers are now able to empty their bottles and refill them on the secure side for the remainder of their journey. Operationally, Massport will save on trash hauling costs, increase the recycling rate and reduce the weight of the trash bags for the cleaners, thereby preventing any potential back injuries.

Distracted Walking



A quick internet search of "Distracted Walking" brings up a number of example videos of people falling and potentially being injured. These videos range from the humorous (people walking into mall water fountains) to disturbing (people falling onto train tracks). It has become such a big problem in recent years the National Safety Council, for the first time, has included statistics on cell phone distracted walking.

According to the National Safety Council's *Injury Facts*, distracted walking incidents involving cell phones accounted for more than 11,100 injuries between 2000 and 2011.

- 52% of cell phone distracted walking injuries happen at home
- 68% of those injured are women
- 54% are age 40 or younger
- Nearly 80% of the injuries were due to a fall

This trend will surely continue as more and more of the population begins to use hand held devices and games like *Pokémon GO* become more popular. All of us have seen people using their hand-held devise while walking down the sidewalk, on stairs, and on escalators. Most of us have probably done this as well. It is important to realize that just because we did something yesterday and didn't get hurt, doesn't mean we will have the same outcome today. Hand-held devices are preventing people from seeing potential hazards in front of them. The National Safety Council recommends:

- Never use your hand-held device on stairs and escalators
- Never use a cell phone or other electronic device while walking indoors or outside
- Only cross at designated crosswalks
- Look left, right and left again before crossing the street
- Make eye contact with drivers of oncoming vehicles to make sure they see you
- Never rely on a car to stop
- Don't wear headphones while walking
- Wear bright and/or reflective clothing
- Walk in groups

Walking is a great way to stay healthy, but only if we are smart about it.

Compliance Corner

Refrigerant Management

With typical summertime weather here, we all appreciate having air conditioned spaces where we can escape the heat and humidity. Historically, air conditioning systems have relied on chemicals such as ammonia, carbon dioxide, and others to create a cooling effect. However, modern air conditioning systems rely almost entirely on less toxic synthetic gases called refrigerants. Environmental compliance issues surrounding air conditioning systems have been around since the early 20th Century, originally related to the toxic nature of gases like ammonia when they escaped from their closed-loop systems. With the advent of Freon (chlorofluorocarbons) in the early 20th Century, it was thought that a safe alternative had been found. Unfortunately, even though chlorofluorocarbons do not have immediate toxic effects on people or animals, they do contribute to the depletion of stratospheric ozone. Newer refrigerants have proven to be safer to the ozone layer but have been found more recently to be powerful contributors to global warming.

The important takeaway from all this is although refrigerants do a great job when contained properly, they cause a lot of harm when released to the environment. Since 1990, the Clean Air Act has been used to phase out more harmful refrigerants while encouraging the development and use of newer, less harmful alternatives. Technicians handling refrigerants and servicing refrigerant containing equipment must be certified and use approved equipment for containing refrigerant gas. Intentional venting of refrigerant gas to the atmosphere is illegal!

Even though some refrigerants are available for purchase at retail locations, they are still regulated by the EPA and are harmful to the environment if released. It is the responsibility of the equipment owner to make sure that refrigerant and refrigerant-containing equipment is properly handled to avoid releases to the environment. Prior to disposal of refrigerant-containing equipment, all refrigerant must be properly removed by a licensed technician. Once refrigerant is removed, the piece of equipment is tagged indicating that it no longer contains refrigerant and can be recycled, generally as scrap metal.

Business owners need to ensure that, prior to being placed into dumpsters or recycling containers, refrigerant is removed and the equipment is clearly labeled indicating this. Homeowners can utilize community hazardous waste collection days, hire a licensed contractor or drop off their equipment at a designated drop off location such as a solid waste transfer station.

More information is available at the U.S. EPA website at:

https://www.epa.gov/section608/managing-refrigerant-stationary-refrigeration-and-air-conditioning-equipment

If you have any questions or concerns about refrigerant compliance, contact the Massport Environmental Department at (617) 568-3525.

2016 Safety Fair

SEPTEMBER 21, 2016
10:30 TO 14:30
JetBlue Hangar (Hangar 8)*

***Directly across from the North Gate.**
Accessible from Airside and Landside.
Badged and unbadged employees are welcome!
Parking is limited. Accessible using Massport Economy Parking or Employee Shuttle Buses.

The 2016 SAFETY FAIR is sponsored by the Logan Airport Safety Alliance and JetBlue.

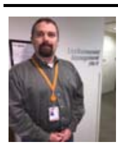
Questions: Contact Brian Dinneen, Massport Safety Manager at 617-568-7427 or bdinneen@massport.com.

SEE A SAFETY PROBLEM? REPORT IT ANONYMOUSLY. RAMP SAFETY HOTLINE

617-568-3600

Questions about Environmental/Safety Issues

Who should you contact?

Contact	Phone Number	Email Address
 **Auditing/General**		
Brenda Enos	(617) 568-5963	benos@massport.com
Universal Waste		
Glenn Adams	(617) 568-3542	gadams@massport.com
Safety		
Brian Dinneen	(617) 568-7427	bdinneen@massport.com
Michael McAveeney	(617) 561-3390	mmcaveeney@massport.com
Rachel Pisa	(617) 568-7434	rpisa@massport.com
Spill Follow-Up		
James Stolecki	(617) 568-3552	jstolecki@massport.com
NPDES Permitting		
Rosanne Joyce	(617) 568-3516	rjoyce@massport.com
Underground/Aboveground Storage Tanks		
Erik Bankey	(617) 568-3514	ebankey@massport.com
 **Air Quality/Hazardous Waste**		
Ian Campbell	(617) 568-3508	icampbell@massport.com
 **EMS/Sustainability/Recycling**		
Jacob Glickel	(617) 568-3558	jglickel@massport.com

K

2016 and 2017 Peak Period Pricing Monitoring Report

This Page Intentionally Left Blank.

BOSTON-LOGAN INTERNATIONAL AIRPORT MONITORING REPORT ON SCHEDULED AND NON-SCHEDULED FLIGHT ACTIVITY

Peak Period Surcharge Regulation
740 CMR 27:00: Massachusetts Port Authority

Report Number: 013

Monitoring Period: Through Sept. 2016

Report Issue Date: May 2016

<u>Note</u>: This report reflects the Boston-Logan Airport flight activity monitoring under 740 CMR 27.03 Peak Period Surcharge Regulation on Aircraft Operations at Boston-Logan International Airport.

<u>Findings</u>: This report includes actual and projected activity data **<u>through September 2016</u>**. Current and projected near-term flight levels at Boston Logan are well below Logan's good weather (VFR) throughput of approximately 120 flights per hour. **As a result, average VFR delays are projected to be minimal and well below the 15 minutes threshold through the analysis period.**

In the event demand conditions at the airport change significantly from the current projection, Massport will issue updates to this report.

<u>Attachments</u>

Table 1: Summary Overview of Peak Period Surcharge Program

Table 2: Summary Overview of Forecast Methodology

Table 3: Projected Aircraft Operations at Logan Airport Projected

Table 4: Projected Hourly Operations, Average Weekday

Table 5: Forecast Logan Average Weekday Operations

<u>Massport Contact:</u>

Mr. Flavio Leo
Director, Aviation Planning and Strategy
617-568-3528
fleo@massport.com

Table 1: Summary Overview of Peak Period Surcharge Program

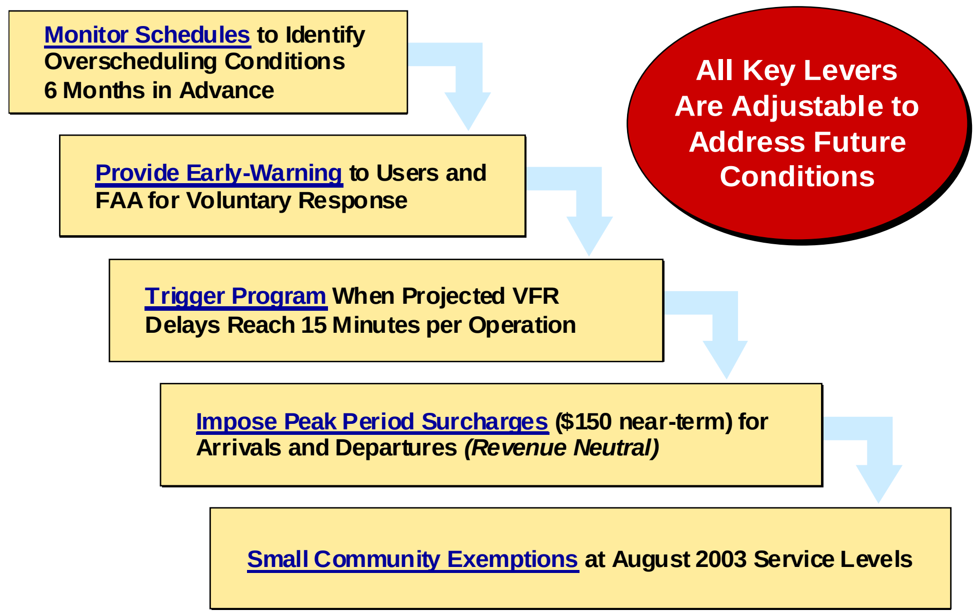
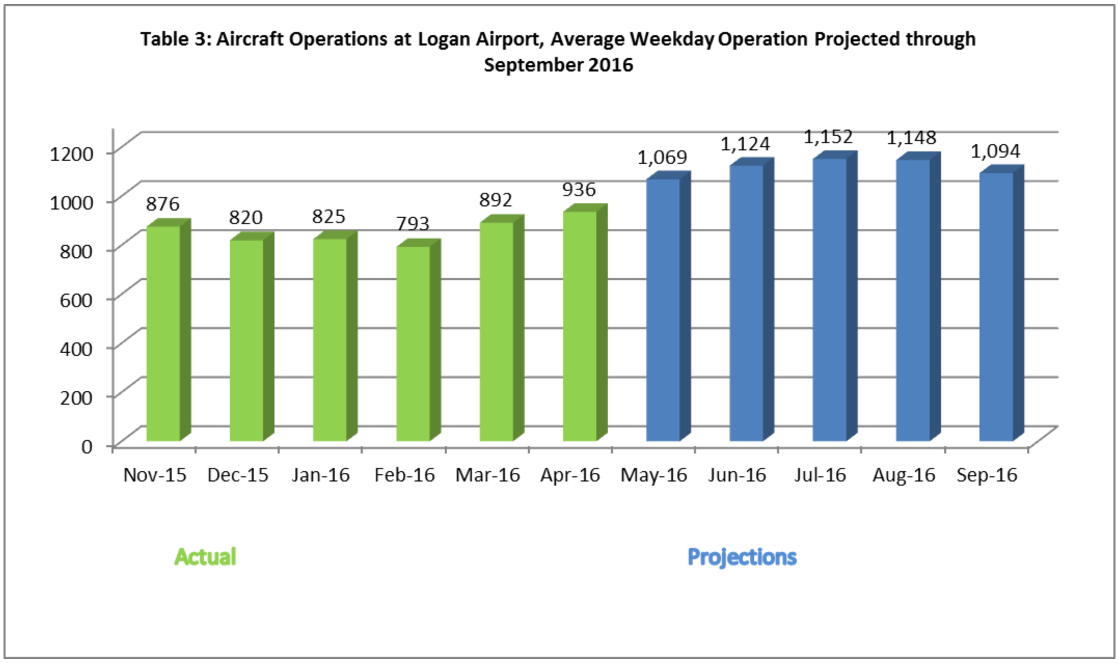


Table 2: Summary Overview of Forecast Methodology

- Scheduled passenger airline flights represent more than 93 percent of total aircraft operations. Passenger airline activity for the Spring and Summer periods were projected based on published advance airline schedules
- Forecasts of monthly activity for other segments (GA, Cargo, Charter) are based on the past three months of actual flight volume and historic patterns of monthly seasonality
- Day-of-week and time of day distributions for non-scheduled segments are based on analysis of Logan radar data
- Projections for each segment were combined to produce the forecast pattern of hourly flight activity for an average weekday, Saturday, and Sunday for the period from February through September

Table 3: Aircraft Operations at Logan Airport



Note: Actual Operations are based on Massport data/air carrier reports and reflect flight cancellations due to weather and other operational impacts.

Table 4: Projected Hourly Operations

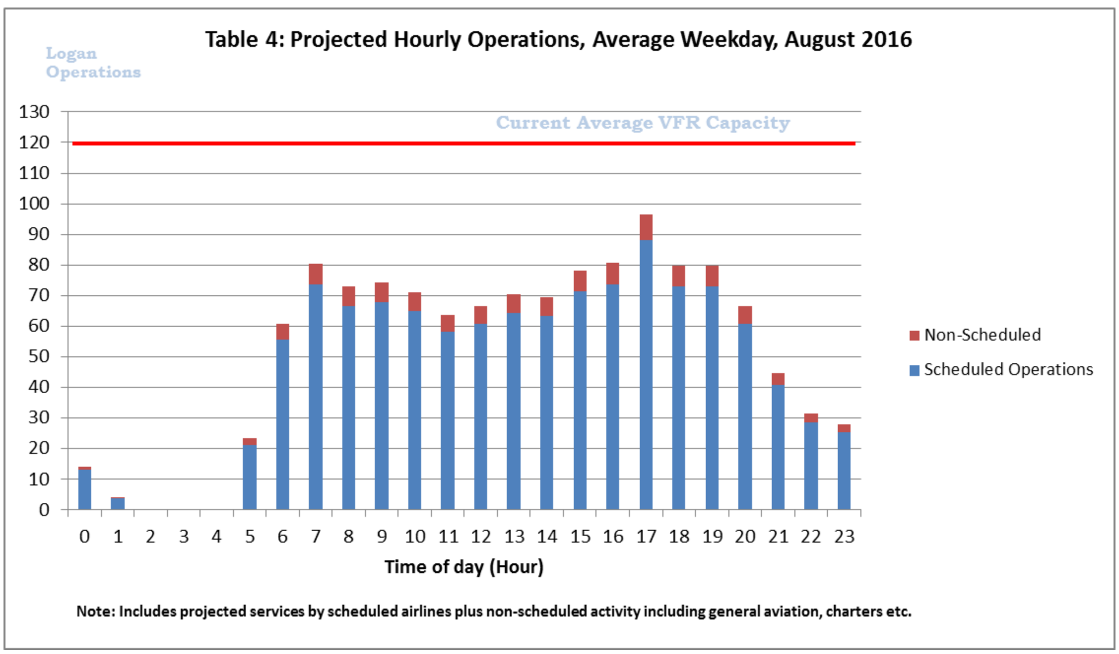


Table 5: Forecast Logan Average Weekday Operations, *Feb. – Sep.*

Forecast Daily Operations								
Hour Range	**Feb-16**	**Mar-16**	**Apr-16**	**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**
0	14	14	12	16	16	16	13	11
1	3	4	3	2	3	4	4	3
2	2	1	0	1	0	0	0	0
3	1	0	0	0	0	0	0	0
4	1	1	0	0	0	0	0	0
5	14	19	17	18	23	26	21	16
6	38	45	51	54	54	58	56	53
7	45	50	58	68	71	66	73	69
8	49	54	76	65	63	66	67	65
9	48	56	63	68	68	71	68	67
10	43	45	45	58	63	66	65	57
11	42	49	50	48	55	57	58	57
12	39	45	52	50	57	61	61	57
13	41	47	53	60	63	61	64	62
14	37	42	55	58	63	66	63	65
15	42	51	59	61	68	70	71	66
16	50	55	66	73	80	81	74	70
17	54	61	79	82	84	87	88	85
18	50	57	75	70	70	71	73	73
19	47	54	64	74	73	75	73	70
20	46	49	52	49	55	58	61	58
21	36	38	35	39	40	38	41	36
22	27	31	25	28	28	31	29	30
23	25	24	30	25	27	24	25	23
Total	**793**	**892**	**1,020**	**1,069**	**1,124**	**1,152**	**1,148**	**1,094**

February – April, actual data

May – September, forecast data

BOSTON-LOGAN INTERNATIONAL AIRPORT MONITORING REPORT ON SCHEDULED AND NON-SCHEDULED FLIGHT ACTIVITY

Peak Period Surcharge Regulation
740 CMR 27:00: Massachusetts Port Authority

Report Number:	**014**
Monitoring Period:	**Through Sept. 2017**
Report Issue Date:	**May 2017**

<u>Note</u>: This report reflects the Boston-Logan Airport flight activity monitoring under 740 CMR 27.03 Peak Period Surcharge Regulation on Aircraft Operations at Boston-Logan International Airport.

<u>Findings</u>: This report includes actual and projected activity data **<u>through September 2017</u>**. Current and projected near-term flight levels at Boston Logan are well below Logan's good weather (VFR) throughput of approximately 120 flights per hour. **As a result, average VFR delays are projected to be minimal and well below the 15 minutes threshold through the analysis period.**

In the event demand conditions at the airport change significantly from the current projection, Massport will issue updates to this report.

<u>Attachments</u>

Table 1: Summary Overview of Peak Period Surcharge Program

Table 2: Summary Overview of Forecast Methodology

Table 3: Projected Aircraft Operations at Logan Airport Projected

Table 4: Projected Hourly Operations, Average Weekday

Table 5: Forecast Logan Average Weekday Operations

<u>Massport Contact:</u>

Mr. Flavio Leo
Director, Aviation Planning and Strategy
617-568-3528
fleo@massport.com

Table 1: Summary Overview of Peak Period Surcharge Program

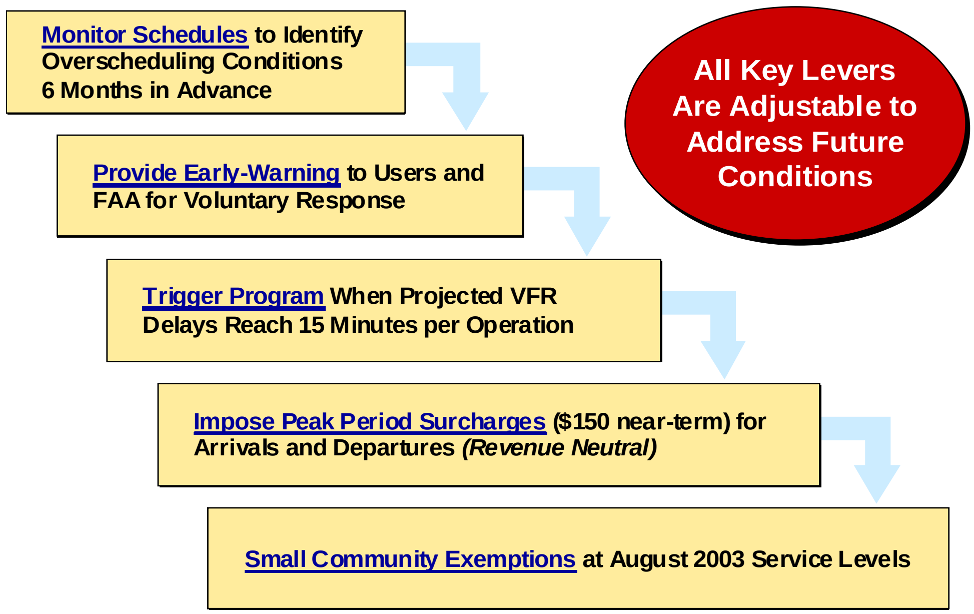


Table 2: Summary Overview of Forecast Methodology

- Scheduled passenger airline flights represent more than 93 percent of total aircraft operations. Passenger airline activity for the Spring and Summer periods were projected based on published advance airline schedules
- Forecasts of monthly activity for other segments (GA, Cargo, Charter) are based on the past three months of actual flight volume and historic patterns of monthly seasonality
- Day-of-week and time of day distributions for non-scheduled segments are based on analysis of Logan radar data
- Projections for each segment were combined to produce the forecast pattern of hourly flight activity for an average weekday, Saturday, and Sunday for the period from February through September

Table 3: Aircraft Operations at Logan Airport

Note: Actual Operations are based on Massport data/air carrier reports and reflect flight cancellations due to weather and other operational impacts.

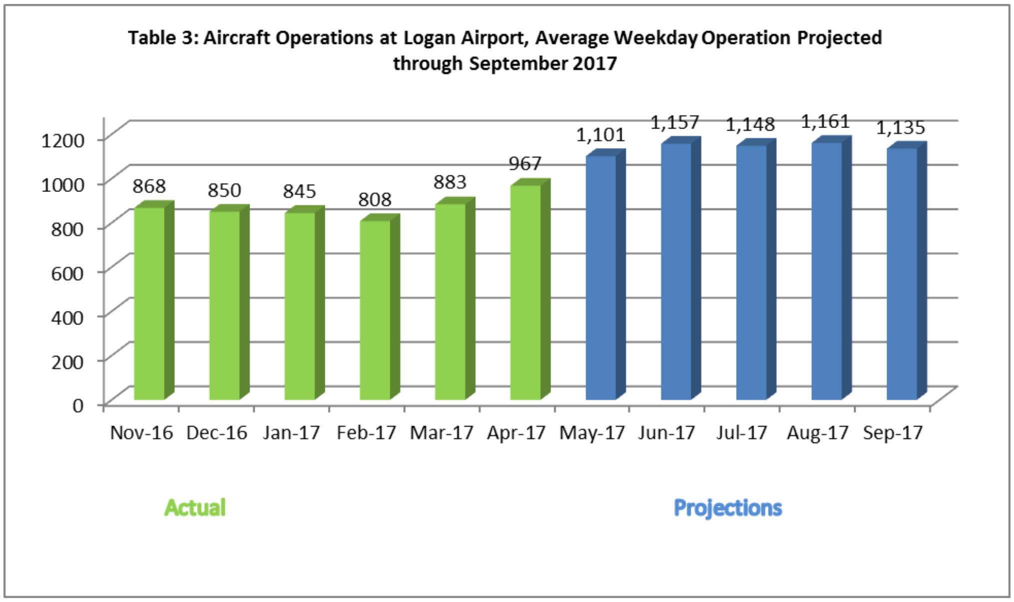
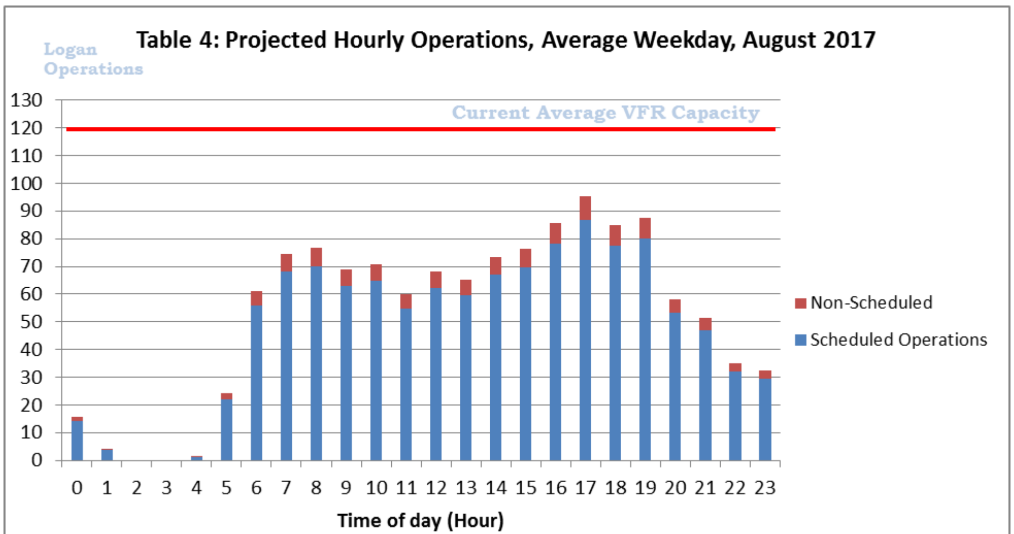


Table 4: Projected Hourly Operations



Note: Includes projected services by scheduled airlines plus non-scheduled activity including general aviation, charters etc.

Table 5: Forecast Logan Average Weekday Operations, *Feb. – Sep.*

Forecast Daily Operations								
Hour Range	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17
0	9	14	12	11	15	16	14	12
1	3	4	3	5	5	5	4	3
2	0	1	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	2	2	0	0	0	0	1	1
5	12	17	18	21	27	30	22	18
6	39	47	54	53	55	52	56	52
7	46	49	61	64	66	66	68	76
8	44	47	80	67	67	64	70	66
9	45	52	66	64	65	63	63	65
10	43	47	48	62	68	66	65	58
11	44	43	53	50	52	53	55	56
12	37	39	55	60	62	62	62	62
13	41	45	56	63	61	57	59	65
14	42	45	57	63	68	68	67	63
15	48	50	62	66	70	67	70	62
16	57	55	70	78	77	82	78	79
17	57	58	83	77	87	86	87	87
18	52	59	79	74	75	69	78	78
19	51	56	67	77	82	81	80	75
20	48	52	55	43	48	52	53	48
21	40	41	36	44	47	46	47	45
22	27	34	26	34	35	33	32	33
23	20	25	31	25	28	28	30	29
Total	**808**	**883**	**1,071**	**1,101**	**1,157**	**1,148**	**1,161**	**1,135**

February - Apr are actual data

May - September is forecast data

L

Reduced/Single Engine Taxiing at Logan Airport Memoranda

This Appendix provides detailed information in support of Chapter 7, *Air Quality/ Emissions Reduction:*

- Memorandum from Edward C. Freni, Massport Director of Aviation, to the Boston Logan Airline Committee, Regarding Single/Reduced-Engine Taxiing and the Use of Idle Reverse Thrust as Strategies to Reduce Aircraft-Generated Emissions and Noise at Boston Logan, Dated May 18, 2016
- Memorandum from Edward C. Freni, Director of Aviation, To Boston Logan Air Carriers and Chief Pilots, Single/Reduced-Engine Taxiing and Other Strategies to Reduce Aircraft-Generated Emissions and Noise at Boston Logan, Dated May 30, 2017
- Simaiakis, I, Khadilkar, H., Balakrishnan, H., Reynolds, T.G., Hansman, R.J., Reilly, B., and Urlass, S. "Demonstration of Reduced Airport Congestion Through Pushback Rate Control." *Ninth USA/Europe Air Traffic Management Research and Development Seminar (ATM2011)*.

This Page Intentionally Left Blank.

massport

Massachusetts Port Authority
One Harborside Drive
East Boston, MA 02128-2909
Telephone (617) 568-5000
www.massport.com

To: Boston Airline Committee

From: Edward C. Freni
Director of Aviation

Date: May 18, 2016

RE: Single/Reduced-Engine Taxiing and Other Strategies to Reduce Aircraft- Generated Emissions and Noise at Boston Logan

As an important user of Boston-Logan International Airport ("Boston Logan"), you are an essential partner in our efforts to ensure that Boston Logan operates in the safest, most dependable and environmentally responsible manner feasible. Our success in implementing physical and technological improvements and piloting cutting-edge safety enhancements at Boston Logan is based, in part, on continuing to evaluate and promote operational measures with the potential to reduce environmental impacts from various landside and airside operations.

Important measures that have been identified are:

1.) Single/reduced-engine taxiing,
2.) Use of idle-reverse thrust, and
3.) Retrofitting older A320 aircraft with "vortex generators" to reduce aircraft noise.

Based on outreach to the Logan air carrier community, it is clear that single- or reduced-engine taxiing is being voluntarily implemented by the vast majority of air carriers at Boston Logan. I write to you again to encourage your continued use of this fuel-saving emissions reduction strategy, subject to pilot discretion and to the extent consistent with your established operating safety procedures.

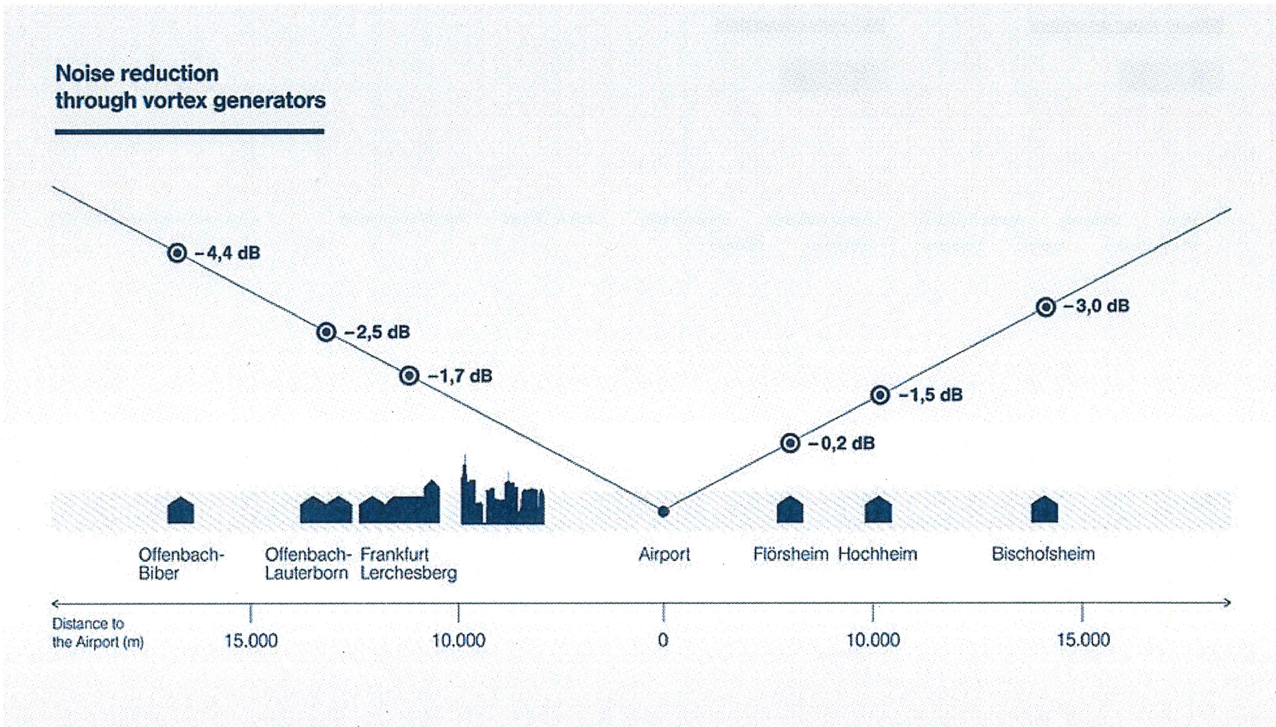
I also encourage your use of idle reverse thrust (or minimize the use of reverse thrust) on landing, as a second operational measure, again, only at the discretion of the pilot and only to the extent consistent with your established operational safety procedures. This measure provides noise relief to our nearest neighbors and, at the same time, provides companion benefits to you, such as reducing fuel burn and engine wear. Clearly, the use of this procedure must be consistent with operational conditions at Boston Logan, including runway surface conditions and whether LAHSO is in use.

Finally, I again want to share with you information regarding recent industry efforts to retrofit A320 aircraft with "vortex generators" to reduce airframe noise. Although the A320 is a fully noise-compliant/modern aircraft, this is an excellent example of additional, incremental actions we can take as an industry to reduce operational impacts on the environment. Attached please find more information related to this technology.

Thank you for your continued work to enhance Boston Logan's operational safety and efficiency, while improving its environmental footprint. If you have any questions or would like to discuss any aspect of this letter, please feel free to contact me or Mr. Flavio Leo, Director of Planning and Strategy, at 617-568-3528.

Edward C. Freni
Director of Aviation

Attachments



Flight Noise Reduction Investment **Technical Upgrades** Noise Research Noise-Reducing Procedures Dialogue

Retrofitting the existing fleet

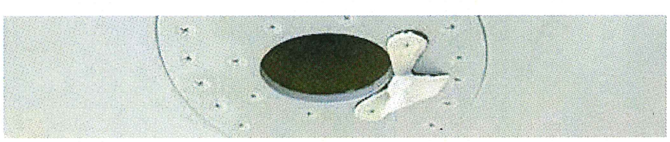
The Lufthansa Group is also retrofitting older aircraft in its fleet with noise-reducing technologies. In this connection the Group is working closely with the German Aerospace Center (DLR) and the various aircraft manufacturers.

Lufthansa is retrofitting more than 200 aircraft with vortex generators so that they will fly more quietly in the future.

In February 2014 Lufthansa became the first airline in the world to take delivery of an Airbus A320 equipped with vortex generators. A total of 157 aircraft in the existing fleet will be equipped with the new noise-reducing component, so that, when the expected new deliveries are added in, more than 200 A320 aircraft in total will be flying more quietly. As result, every second Lufthansa landing in Frankfurt and one in three in Munich will become audibly quieter. Overfly measurements revealed that the vortex generators are able to eliminate two unpleasant tones and thereby lower the aircraft's total noise level on approach by up to four decibels at distances between 17 and 10 kilometers from the runway. Thus the Lufthansa Group has realized a key objective of the "Alliance for More Noise Protection", a joint initiative of the Lufthansa Group, Fraport, the airline association BARIG, DFS, the Airport and Region Forum (FFR), and the government of the State of Hesse.

A320 audio tests

A320 audio tests with and without vortex generators on the **final approach at Frankfurt Airport** from the Offenbach-Lauterborn monitoring point



Press Releases

25.06.2015
Lufthansa now flying much quieter
12.02.14
Lufthansa takes delivery of world's first aircraft with vortex generators
29.10.13
Lufthansa to make majority of short-haul aircraft quieter

Sustainability Report

To find out more about responsibility within the Lufthansa Group, read the latest sustainability report Balance (E-Paper).

Order or download the report.

Weitersagen

More Themes

Overview

Without vortex generators **With vortex generators**

A320 audio tests with and without vortex generators on the **final approach at Munich Airport** from the Massenhausen monitoring point

Without vortex generators **With vortex generators**

massport
Massachusetts Port Authority
One Harborside Drive
East Boston, MA 02128-2909
Telephone (617) 568-5000
www.massport.com

TO: Boston Logan Air Carriers, Chief Pilots

FROM: Edward C. Freni
Director of Aviation

DATE: May 30, 2017

RE: Single/Reduced-Engine Taxiing and Other Strategies to Reduce Aircraft-Generated Emissions and Noise at Boston Logan

As an important user of Boston-Logan International Airport ("Boston Logan"), you are an essential partner in our efforts to ensure that Boston Logan operates in the safest, most dependable and environmentally responsible manner feasible. Our success in implementing physical and technological improvements and piloting cutting-edge safety enhancements at Boston Logan is based, in part, on continuing to evaluate and promote operational measures with the potential to reduce environmental impacts from various landside and airside operations.

Important measures that have been identified are:

1.) Single/reduced-engine taxiing,
2.) Use of idle-reverse thrust, and
3.) Retrofitting older A320 aircraft with "vortex generators" to reduce aircraft noise.

Based on outreach to the Logan air carrier community, it is clear that single- or reduced-engine taxiing is being voluntarily implemented by the vast majority of air carriers at Boston Logan. I write to you again to encourage your continued use of this fuel-saving emissions reduction strategy, subject to pilot discretion and to the extent consistent with your established operating safety procedures.

I also encourage your use of idle reverse thrust (or minimize the use of reverse thrust) on landing, as a second operational measure, again, only at the discretion of the pilot and only to the extent consistent with your established operational safety procedures. This measure provides noise relief to our nearest neighbors and, at the same time, provides companion benefits to you, such as reducing fuel burn and engine wear. Clearly, the use of this procedure must be consistent with operational conditions at Boston Logan, including runway surface conditions and whether LAHSO is in use.

Finally, I again want to share with you information regarding recent industry efforts to retrofit A320 aircraft with "vortex generators" to reduce airframe noise. Although the A320 is a fully noise-compliant/modern aircraft, this is an excellent example of additional, incremental actions we can take as an industry to reduce operational impacts on the environment. Attached please find more information related to this technology.

I encourage you to share this letter with your flight crews and thank you for your continued work to enhance Boston Logan's operational safety and efficiency, while improving its environmental footprint. If you have any questions or would like to discuss any aspect of this letter, please feel free to contact me or Mr. Flavio Leo, Director of Planning and Strategy, at 617-568-3528.

Edward C. Freni
Director of Aviation

Attachment

An even quieter approach: Airbus introduces air flow deflectors on the A320 Family

10 JULY 2014 NEWS IN BRIEF

Building on the A320 Family's established reputation for quiet operations, Airbus is reducing noise levels even further for its popular single-aisle product line with the introduction of small underwing air flow deflectors. Positioned just ahead of underwing cavities for the fuel over-pressure protection system, these devices prevent the cavities from generating a "whistling" sound which can sometimes be heard on the ground when the engines are at idle during final approach. Air flow deflectors were implemented in production A320 jetliners this spring and are also available as a retrofit modification.

Tags : INNOVATION A320 FAMILY NOISE

Demonstration of Reduced Airport Congestion Through Pushback Rate Control

I. Simaiakis, H. Khadilkar, H. Balakrishnan, T. G. Reynolds and R. J. Hansman
Department of Aeronautics and Astronautics
Massachusetts Institute of Technology
Cambridge, MA, USA

B. Reilly
Boston Airport Traffic Control Tower
Federal Aviation Administration
Boston, MA, USA

S. Urlass
Office of Environment and Energy
Federal Aviation Administration
Washington, DC, USA

***Abstract*—Airport surface congestion results in significant increases in taxi times, fuel burn and emissions at major airports. This paper describes the field tests of a congestion control strategy at Boston Logan International Airport. The approach determines a suggested rate to meter pushbacks from the gate, in order to prevent the airport surface from entering congested states and to reduce the time that flights spend with engines on while taxiing to the runway. The field trials demonstrated that significant benefits were achievable through such a strategy: during eight four-hour tests conducted during August and September 2010, fuel use was reduced by an estimated 12,000-15,000 kg (3,900-4,900 US gallons), while aircraft gate pushback times were increased by an average of only 4.3 minutes for the 247 flights that were held at the gate.**

Keywords- departure management, pushback rate control, airport congestion control, field tests

I. INTRODUCTION

Aircraft taxiing on the surface contribute significantly to the fuel burn and emissions at airports. The quantities of fuel burned, as well as different pollutants such as Carbon Dioxide, Hydrocarbons, Nitrogen Oxides, Sulfur Oxides and Particulate Matter, are proportional to the taxi times of aircraft, as well as other factors such as the throttle settings, number of engines that are powered, and pilot and airline decisions regarding engine shutdowns during delays.

Airport surface congestion at major airports in the United States is responsible for increased taxi-out times, fuel burn and emissions [1]. Similar trends have been noted in Europe, where it is estimated that aircraft spend 10-30% of their flight time taxiing, and that a short/medium range A320 expends as much as 5-10% of its fuel on the ground [2]. Domestic flights in the United States emit about 6 million metric tonnes of CO_2, 45,000 tonnes of CO, 8,000 tonnes of NOx, and 4,000 tonnes of HC taxiing out for takeoff; almost half of these emissions are at the 20 most congested airports in the country. The purpose of the Pushback Rate Control Demonstration at Boston Logan International Airport (BOS) was to show that a significant portion of these impacts could be reduced through measures to limit surface congestion.

This work was supported by the Federal Aviation Administration's Office of Environment and Energy through MIT Lincoln Laboratory and the Partnership for AiR Transportation Noise and Emissions Reduction (PARTNER).

A simple airport congestion control strategy would be a state-dependent pushback policy aimed at reducing congestion on the ground. The *N-control* strategy is one such approach, and was first considered in the Departure Planner project [3]. Several variants of this policy have been studied in prior literature [4, 5, 6, 7]. The policy, as studied in these papers, is effectively a simple threshold heuristic: if the total number of departing aircraft on the ground exceeds a certain threshold, further pushbacks are stopped until the number of aircraft on the ground drops below the threshold. By contrast, the *pushback rate control* strategy presented in this paper does not stop pushbacks once the surface is in a congested state; instead it regulates the rate at which aircraft pushback from their gates during high departure demand periods so that the airport does not reach undesirable highly congested states.

A. Motivation: Departure throughput analysis

The main motivation for our proposed approach to reduce taxi times is an observation of the performance of the departure throughput of airports. As more aircraft pushback from their gates onto the taxiway system, the throughput of the departure runway initially increases because more aircraft are available in the departure queue. However, as this number, denoted N, exceeds a threshold, the departure runway capacity becomes the limiting factor, and there is no additional increase in throughput. We denote this threshold as N^*. This behavior can be further parameterized by the number of arrivals. The dependence of the departure throughput on the number of aircraft taxiing out and the arrival rate is illustrated for one runway configuration in Figure 1 using 2007 data from FAA's Aviation System Performance Metrics (ASPM) database. Beyond the threshold N^*, any additional aircraft that pushback simply increase their taxi-out times [8]. The value of N^* depends on the airport, arrival demand, runway configuration, and meteorological conditions. During periods of high demand, the pushback rate control protocol regulates pushbacks from the gates so that the number of aircraft taxiing out stays close to a specified value, N_{ctrl}, where $N_{\text{ctrl}} > N^*$, thereby ensuring that the airport does not reach highly-congested states. While the choice of N_{ctrl} must be large enough to maintain runway utilization, too large a value will be overly conservative, and result in a loss of benefit from the control strategy.

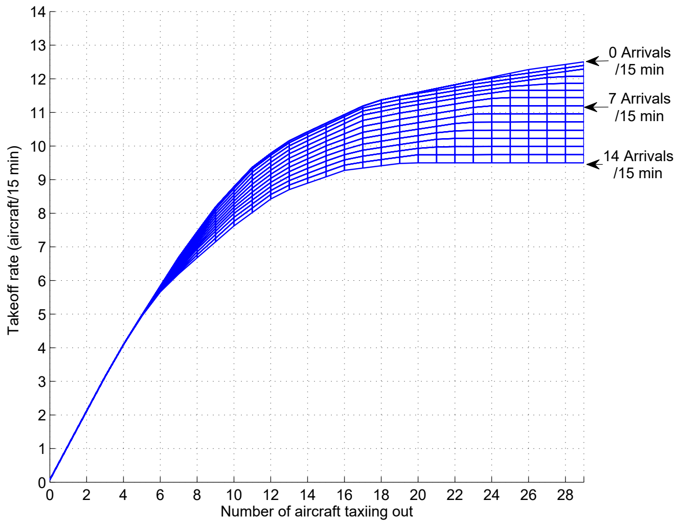


Fig. 1: Regression of the departure throughput as a function of the number of aircraft taxiing out, parameterized by the arrival rate for 22L, 27 | 22L, 22R configuration, under VMC [9].

II. DESIGN OF THE PUSHBACK RATE CONTROL PROTOCOL

The main design consideration in developing the pushback rate control protocol was to incorporate effective control techniques into current operational procedures with minimal additional controller workload and procedural modifications. After discussions with the BOS facility, it was decided that suggesting a rate of pushbacks (to the BOS Gate controller) for each 15-min period was an effective strategy that was amenable to current procedures.

The two important parameters that need to be estimated in order to determine a robust control strategy are the N^* threshold and the departure throughput of the airport for different values of N. These parameters can potentially vary depending on meteorological conditions, runway configuration and arrival demand (as seen in Figure 1), but also on the fleet mix and the data sources we use.

A. Runway configurations

BOS experiences Visual Meteorological Conditions (VMC) most of the time (over 83% of the time in 2007). It has a complicated runway layout consisting of six runways, five of which intersect with at least one other runway, as shown in Figure 2. As a result, there are numerous possible runway configurations: in 2007, 61 different configurations were reported. The most frequently-used configurations under VMC are 22L, 27 | 22L, 22R; 4L, 4R | 4L, 4R, 9; and 27, 32 | 33L, where the notation 'R1, R2 | R3, R4' denotes arrivals on runways R1 and R2, and departures on R3 and R4. The above configurations accounted for about 70% of times under VMC.

We note that, of these frequently used configurations, 27, 32 | 33L involves taxiing out aircraft across active runways. Due to construction on taxiway "November" between runways 15L and 22R throughout the duration of the demo, departures headed to 22R used 15L to cross runway 22R onto taxiway "Mike". This resulted in departing aircraft crossing active runways in the 27, 22L | 22L, 22R configuration as well.

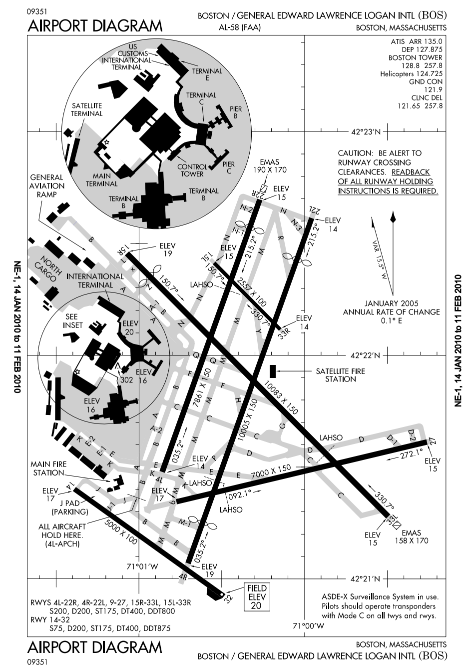


Fig. 2: BOS airport diagram, showing alignment of runways.

During our observations prior to the field tests as well as during the demo periods, we found that under Instrument Meteorological Conditions (IMC), arrivals into BOS are typically metered at the rate of 8 aircraft per 15 minutes by the TRACON. This results in a rather small departure demand, and there was rarely congestion under IMC at Boston during the evening departure push. For this reason, we focus on configurations most frequently used during VMC operations for the control policy design.

B. Fleet mix

Qualitative observations at BOS suggest that the departure throughput is significantly affected by the number of propeller-powered aircraft (props) in the departure fleet mix. In order to determine the effect of props, we analyze the tradeoff between takeoff and landing rates at BOS, parameterized by the number of props during periods of high departure demand.

Figure 3 shows that under Visual Meteorological Conditions (VMC), the number of props has a significant impact on the departure throughput, resulting in an increase at a rate of nearly one per 15 minutes for each additional prop departure. This observation is consistent with procedures at BOS, since air traffic controllers fan out props in between jet departures, and therefore the departure of a prop does not significantly interfere with jet departures. The main implication of this observation for the control strategy design at BOS was that props could be exempt from both the pushback control as well as the counts of aircraft taxiing out (N). Similar analysis also shows that heavy departures at BOS do not have a significant

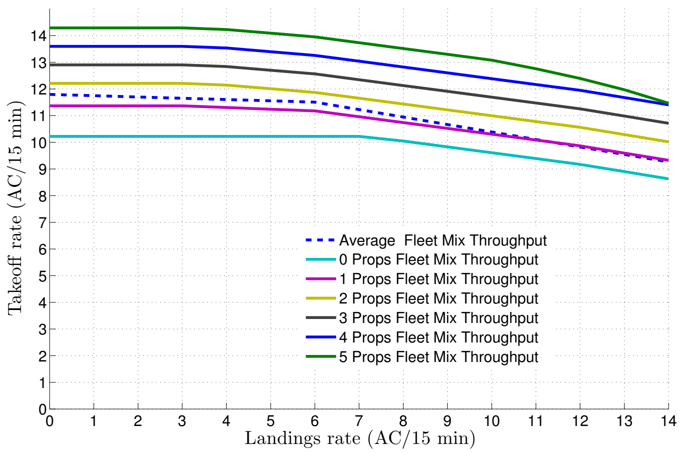


Fig. 3: Regression of the takeoff rate as a function of the landing rate, parameterized by the number of props in a 15-minute interval for 22L, 27 | 22L, 22R configuration, under VMC [9].

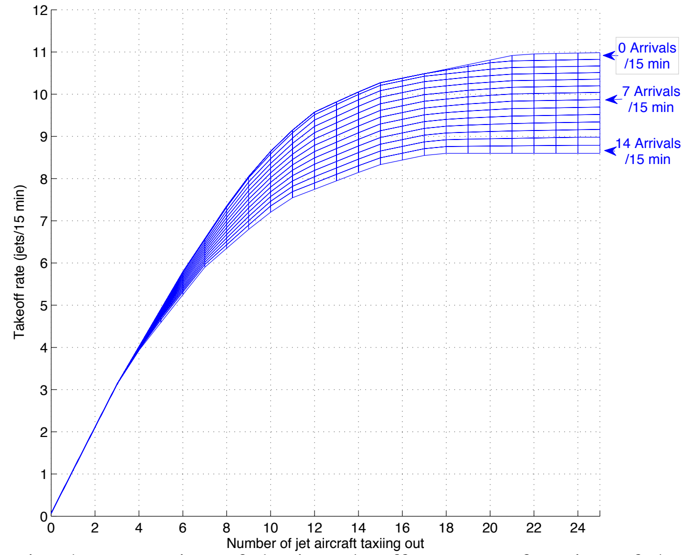


Fig. 4: Regression of the jet takeoff rate as a function of the number of departing jets on the ground, parameterized by the number of arrivals for 22L, 27 | 22L, 22R configuration, under VMC [9].

impact on departure throughput, in spite of the increased wake-vortex separation that is required behind heavy weight category aircraft. This can be explained by the observation that air traffic controllers at BOS use the high wake vortex separation requirement between a heavy and a subsequent departure to conduct runway crossings, thereby mitigating the adverse impact of heavy weight category departures [9].

Motivated by this finding, we can determine the dependence of the jet (i.e., non-prop) departure throughput as a function of the number of jet aircraft taxiing out, parameterized by the number of arrivals, as illustrated in Figure 4. This figure illustrates that during periods in which arrival demand is high, the jet departure throughput saturates when the number of jets taxiing out exceeds 17 (based on ASPM data).

C. Data sources

It is important to note that Figure 1, Figure 3 and Figure 4 are determined using ASPM data. Pushback times in ASPM are determined from the brake release times reported through the ACARS system, and are prone to error because about 40% of the flights departing from BOS do not automatically report these times [10]. Another potential source of pushback and takeoff times is the Airport Surface Detection Equipment Model X (or ASDE-X) system, which combines data from airport surface radars, multilateration sensors, ADS-B, and aircraft transponders [11]. While the ASDE-X data is likely to be more accurate than the ASPM data, it is still noisy, due to factors such as late transponder capture (the ASDE-X tracks only begin after the pilot has turned on the transponder, which may be before or after the actual pushback time), aborted takeoffs (which have multiple departure times detected), flights cancelled after pushback, etc. A comparison of both ASDE-X and ASPM records with live observations made in the tower on August 26, 2010 revealed that the average difference between the number of pushbacks per 15-minutes as recorded by ASDE-X and by visual means is 0.42, while it is -3.25 for ASPM and visual observations, showing that the ASPM records differ considerably from ASDE-X and live observations. The above comparison motivates the recalibration of airport performance curves and parameters using ASDE-X data in addition to ASPM data. This is because ASPM data is not available in real-time and will therefore not be available for use in real-time deployments, and the ASDE-X data is in much closer agreement to the visual observations than ASPM.

We therefore conduct similar analysis to that shown in Figure 4, using ASDE-X data. The results are shown in Figure 5. We note that the qualitative behavior of the system is similar to what was seen with ASPM data, namely, the jet throughput of the departure runway initially increases because more jet aircraft are available in the departure queue, but as this number exceeds a threshold, the departure runway capacity becomes the limiting factor, and there is no additional increase in throughput. By statistically analyzing three months of ASDE-X data from Boston Logan airport using the methodology outlined in [9], we determine that the average number of active jet departures on the ground at which the surface saturates is 12 jet aircraft for the 22L, 27 | 22L, 22R configuration, during periods of moderate arrival demand. This value is close to that deduced from Figure 5, using visual means.

D. Estimates of N^*

Table I shows the values of N^* for the three main runway configurations under VMC, that were used during the field tests based on the ASDE-X data analysis. For each runway configuration, we use plots similar to Figure 5 to determine the expected throughput. For example, if the runway configuration is 22L, 27 | 22L, 22R, 11 jets are taxiing out, and the expected arrival rate is 9 aircraft in the next 15 minutes, the expected departure throughput is 10 aircraft in the next 15 minutes.

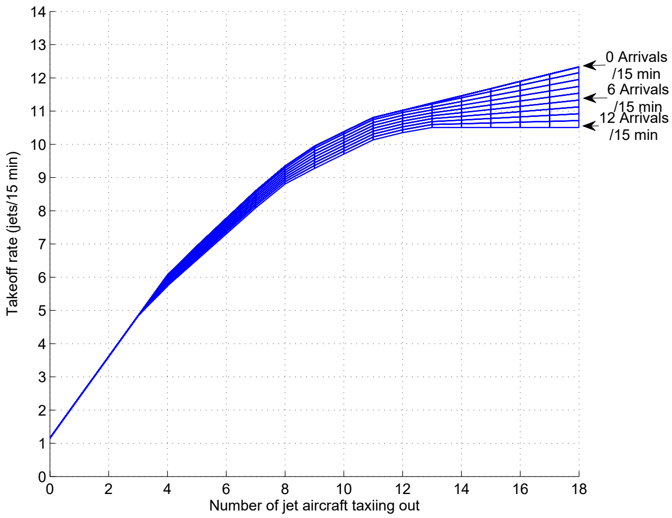


Fig. 5: Regression of the takeoff rate as a function of the number of jets taxiing out, parameterized by the number of arrivals, using ASDE-X data, for the 22L, 27 | 22L, 22R configuration.

III. Implementation of Pushback Rate Control

The pushback rate was determined so as to keep the number of jets taxiing out near a suitable value (N_{ctrl}), where N_{ctrl} is greater than N^*, in order to mitigate risks such as under-utilizing the runway, facing many gate conflicts, or being unable to meet target departure times. Off-nominal events such as gate-use conflicts and target departure times were carefully monitored and addressed. Figure 6 shows a schematic of the decision process to determine the suggested pushback rate.

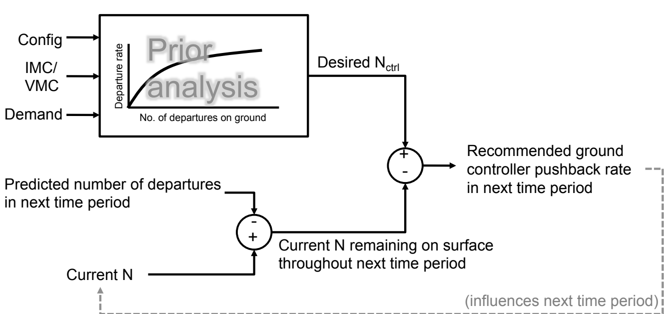


Fig. 6: A schematic of the pushback rate calculation.

The determination of the pushback rate is conducted as follows. Prior to the start of each 15-minute period, we:

1) Observe the operating configuration, VMC/IMC, and the predicted number of arrivals in the next 15 minutes (from ETMS) and using these as inputs into the appropriate departure throughput saturation curves (such as Figure 5), determine the expected jet departure throughput.
2) Using visual observations, count the number of departing jets currently active on the surface. We counted a departure as active once the pushback tug was attached to the aircraft and it was in the process of pushing back.
3) Calculate the difference between the current number of active jet departures and the expected jet departure throughput. This difference is the number of currently active jets that are expected to remain on the ground through the next 15 min.
4) The difference between N_{ctrl} and the result of the previous step provides us with the additional number of pushbacks to recommend in next 15 minutes.
5) Translate the suggested number of pushbacks in the next 15 minutes to an approximate pushback rate in a shorter time interval more appropriate for operational implementation (for example, 10 aircraft in the next 15 minutes would translate to a rate of "2 per 3 minutes.").

TABLE I
Values of N^* estimated from the analysis of ASDE-X data.

Configuration	N^*
22L, 27 | 22L, 22R	12
27, 32 | 33L	12
4L, 4R | 4L, 4R, 9	15

A. Communication of recommended pushback rates and gate-hold times

During the demo, we used color-coded cards to communicate suggested pushback rates to the air traffic controllers, thereby eliminating the need for verbal communications. We used one of eight 5 in × 7.5 in cards, with pushback rate suggestions that ranged from "1 per 3 minutes" (5 in 15 minutes) to "1 aircraft per minute" (15 in 15 minutes), in addition to "Stop" (zero rate) and "No restriction" cards, as shown in Figure 7 (left). The setup of the suggested rate card in the Boston Gate controllers position is shown in Figure 7 (right).

Fig. 7: (Left) Color-coded cards that were used to communicate the suggested pushback rates. (Right) Display of the color-coded card in the Boston Gate controller's position.

The standard format of the gate-hold instruction communicated by the Boston Gate controller to the pilots included both the current time, the length of the gate-hold, and the time at which the pilot could expect to be cleared. For example:
Boston Gate: "AAL123, please hold push for 3 min. Time is now 2332, expect clearance at 2335. Remain on my frequency, I will contact you."

In this manner, pilots were made aware of the expected gate-holds, and could inform the controller of constraints such as gate conflicts due to incoming aircraft. In addition, ground crews could be informed of the expected gate-hold time, so that they could be ready when push clearance was given. The post-analysis of the tapes of controller-pilot communications showed that the controllers cleared aircraft for push at the times they had initially stated (i.e., an aircraft told to expect to push at 2335 would indeed be cleared to push at 2335), and that they also accurately implemented the push rates suggested by the cards.

B. Handling of off-nominal events

The implementation plan also called for careful monitoring of off-nominal events and system constraints. Of particular concern were gate conflicts (for example, an arriving aircraft is assigned a gate at which a departure is being held), and the ability to meet controlled departure times (Expected Departure Clearance Times or EDCTs) and other constraints from Traffic Management Initiatives. After discussions with the Tower and airlines prior to the field tests, the following decisions were made:

1) Flights with EDCTs would be handled as usual and released First-Come-First-Served. Long delays would continue to be absorbed in the standard holding areas. Flights with EDCTs did not count toward the count of active jets when they pushed back; they counted toward the 15-minute interval in which their departure time fell. An analysis of EDCTs from flight strips showed that the ability to meet the EDCTs was not impacted during the field tests.
2) Pushbacks would be expedited to allow arrivals to use the gate if needed. Simulations conducted prior to the field tests predicted that gate-conflicts would be relatively infrequent at BOS; there were only two reported cases of potential gate-conflicts during the field tests, and in both cases, the departures were immediately released from the gate-hold and allowed to pushback.

C. Determination of the time period for the field trials

The pushback rate control protocol was tested in select evening departure push periods (4-8PM) at BOS between August 23 and September 24, 2010. Figure 8 shows the average number of departures on the ground in each 15-minute interval using ASPM data. There are two main departure pushes each day. The evening departure push differs from the morning one because of the larger arrival demand in the evenings. The morning departure push presents different challenges, such as a large number of flights with controlled departure times, and a large number of tow-ins for the first flights of the day.

IV. RESULTS OF FIELD TESTS

Although the pushback rate control strategy was tested at BOS during 16 demo periods, there was very little need to control pushbacks when the airport operated in its most efficient configuration (4L, 4R | 4L, 4R, 9), and in only eight of the demo periods was there enough congestion for gate-holds to be experienced. There was insufficient congestion for recommending restricted pushback rates on August 23, September 16, 19, 23, and 24. In addition, on September 3 and 12, there were no gate-holds (although departure demand was high, traffic did not build up, and no aircraft needed to be held at the gate). For the same reason, only one aircraft received a gate-hold of 2 min on September 17. The airport operated in the 4L, 4R | 4L, 4R, 9 configuration on all three of these days. In total, pushback rate control was in effect during the field tests for over 37 hours, with about 24 hours of test periods with significant gate-holds.

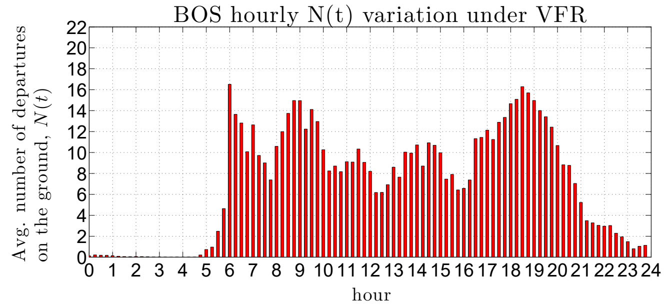


Fig. 8: Variation of departure demand (average number of active departures on the ground) as a function of the time of day.

A. Data analysis examples

In this section, we examine three days with significant gate-holds (August 26, September 2 and 10) in order to describe the basic features of the pushback rate control strategy.

Figure 9 shows taxi-out times from one of the test periods, September 2. Each green bar in Figure 9 represents the actual taxi-out time of a flight (measured using ASDE-X as the duration between the time when the transponder was turned on and the wheels-off time). The red bar represents the gate-hold time of the flight (shown as a negative number). In practice, there is a delay between the time the tug pushes them from the gate and the time their transponder is turned on, but statistical analysis showed that this delay was random, similarly distributed for flights with and without gate-holds, and typically about 4 minutes. We note in Figure 9 that as flights start incurring gate-holds (corresponding to flights departing at around 1900 hours), there is a corresponding decrease in the active taxi-out times, i.e., the green lines. Visually, we notice that as the length of the gate-hold (red bar) increases, the length of the taxi-out time (green bar) proportionately decreases. There are still a few flights with large taxi-out times, but these typically correspond to flights with EDCTs. These delays were handled as in normal operations (i.e., their gate-hold times were not increased), as was agreed with the tower and airlines. Finally, there are also a few flights with no gate-holds and very short taxi-out times, typically corresponding to props.

The impact of the pushback rate control strategy can be further visualized by using ASDE-X data, as can be seen in

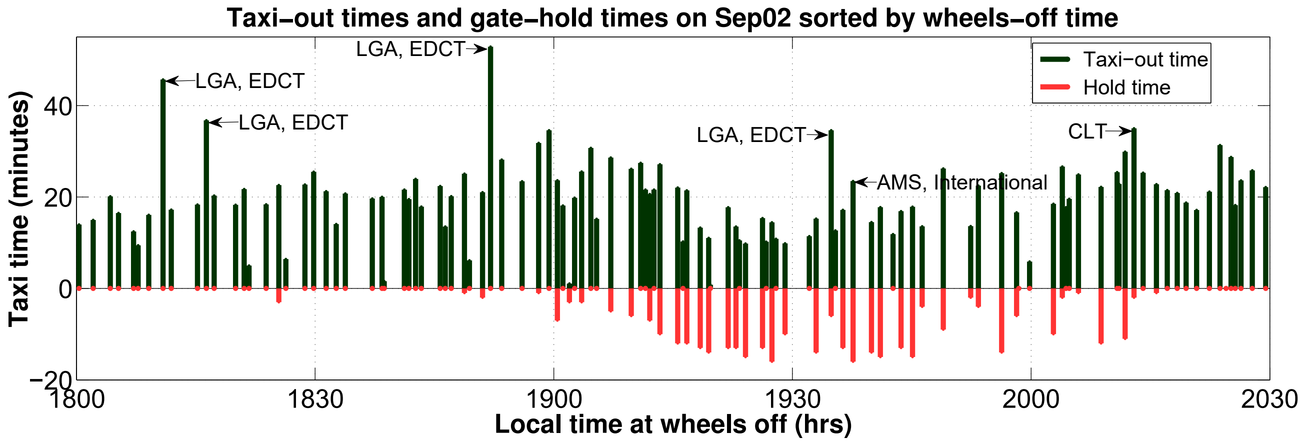


Fig. 9: Taxi-out and gate-hold times from the field test on September 2, 2010.

Fig. 10: Snapshots of the airport surface, (left) before gate-holds started, and (right) during gate-holding. Departing aircraft are shown in green, and arrivals in red. We note that the line of 15 departures between the ramp area and the departure runway prior to commencement of pushback rate control reduces to 8 departures with gate-holds. The white area on the taxiway near the top of the images indicates the closed portion of taxiway "November".

the Figure 10, which shows snapshots of the airport surface at two instants of time, the first before the gate-holds started, and the second during the gate-holds. We notice the significant decrease in taxiway congestion, in particular the long line of aircraft between the ramp area and the departure runway, due to the activation of the pushback rate control strategy.

Looking at another day of trials with a different runway configuration, Figure 11 shows taxi-out times from the test period of September 10. In this plot, the flights are sorted by pushback time. We note that as flights start incurring gate-holds, their taxi time stabilizes at around 20 minutes. This is especially evident during the primary departure push between 1830 and 1930 hours. The gate-hold times fluctuate from 1-2 minutes up to 9 minutes, but the taxi-times stabilize as the number of aircraft on the ground stabilizes to the specified N_{ctrl} value. Finally, the flights that pushback between 1930 and 2000 hours are at the end of the departure push and derive the most benefit from the pushback rate control strategy: they have longer gate holds, waiting for the queue to drain and then taxi to the runway facing a gradually diminishing queue.

Figure 12 further illustrates the benefits of the pushback rate control protocol, by comparing operations from a day with pushback rate control (shown in blue) and a day without it (shown in red), under similar demand and configuration. The upper plot shows the average number of jets taxiing-out, and the lower plot the corresponding average taxi-out time, per 15-minute interval. We note that after 1815 hours on September 10, the number of jets taxiing out stabilized at around 15. As a result, the taxi-out times stabilized at about 16 minutes. Pushback rate control smooths the rate of the pushbacks so as to bring the airport state to the specified state, N_{ctrl}, in a controlled manner. Both features of pushback rate control, namely, smoothing of demand and prevention of congestion can be observed by comparing the evenings of September 10 and September 15. We see that on September 15, in the absence of pushback rate control, as traffic started accumulating at 1745 hours, the average taxi-out time grew to over 20 minutes. During the main departure push (1830 to

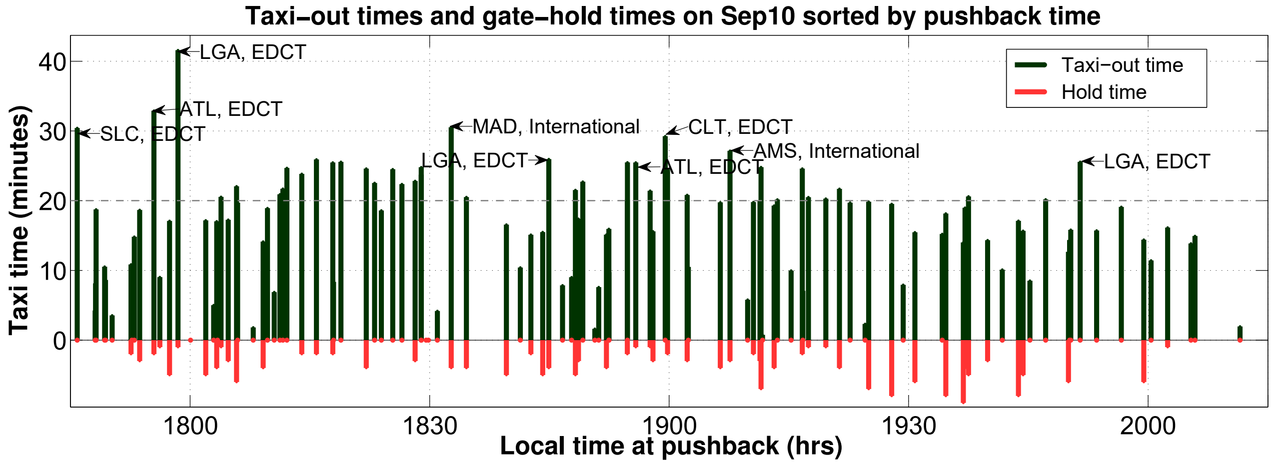


Fig. 11: Taxi-out and gate-hold times from the field test on September 10, 2010.

1930), the average number of jets taxiing out stayed close to 20 and the average taxi-out time was about 25 minutes.

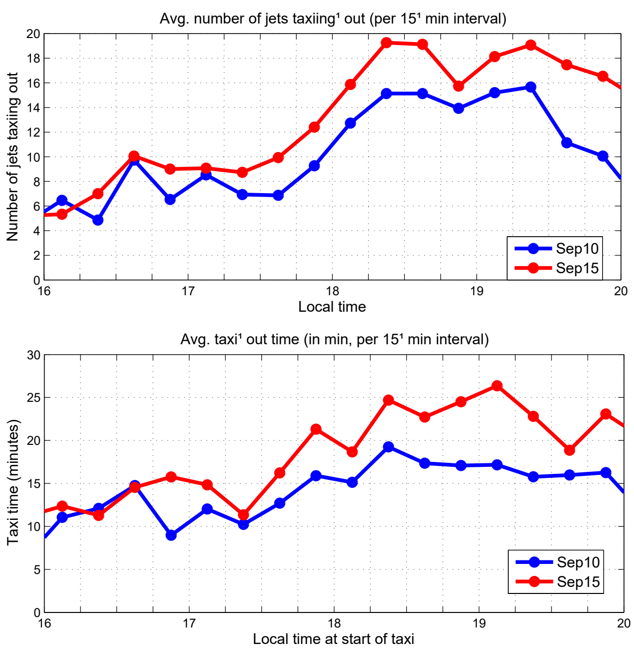


Fig. 12: Surface congestion (top) and average taxi-out times (bottom) per 15-minutes, for (blue) a day with pushback rate control, and (red) a day with similar demand, same runway configuration and visual weather conditions, but without pushback rate control. Delay attributed to EDCTs has been removed from the taxi-out time averages.

Similarly, Figure 13 compares the results of a characteristic pushback rate control day in runway configuration 27, 22L | 22L, 22R, August 26, to a similar day without pushback rate control. We observe that for on August 26, the number of jets taxiing out during the departure push between 1830 and 1930 hours stabilized at 15 with an average taxi-out time of about 20 minutes. On August 17, when pushback rate control was not in effect, the number of aircraft reached 20 at the peak of the push and the average taxi-out times were higher than those of August 26.

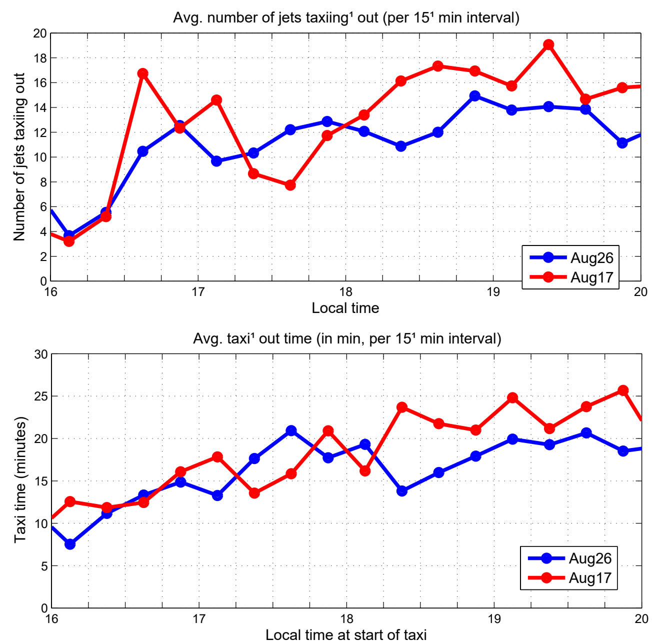


Fig. 13: Ground congestion (top) and average taxi-out times (bottom) per 15-minutes, for (blue) a day with pushback rate control, and (red) a day with similar demand, same runway configuration and weather conditions, but without pushback rate control. Delay attributed to EDCTs has been removed from the taxi-out time averages.

B. Runway utilization

The overall objective of the field test was to maintain pressure on the departure runways, while limiting surface congestion. By maintaining runway utilization, it is reasonable to expect that gate-hold times translate to taxi-out time reduction, as suggested by Figure 9. We therefore also carefully analyze runway utilization (top) and departure queue sizes (bottom) during periods of pushback rate control, as illustrated in Figure 14.

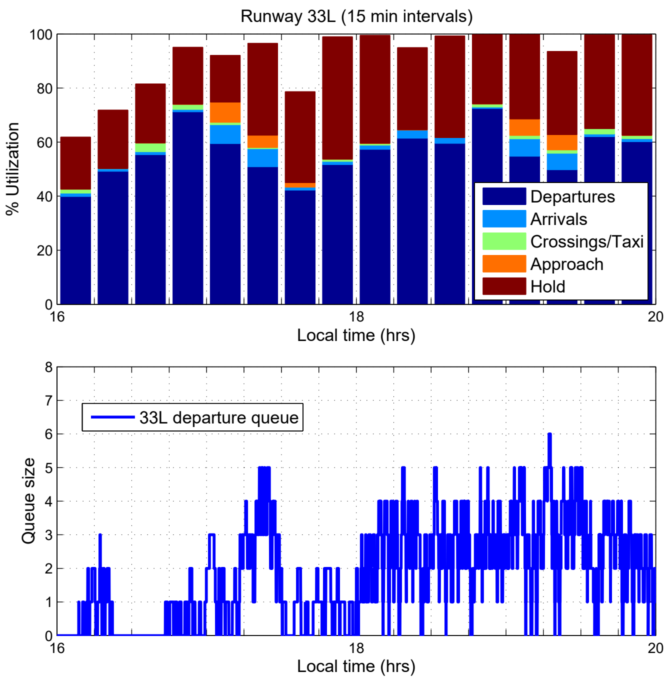


Fig. 14: Runway utilization plots (top) and queue sizes (bottom) for the primary departure runway (33L) during the field test on September 10, 2010. These metrics are evaluated through the analysis of ASDE-X data.

In estimating the runway utilization, we determine (using ASDE-X data) what percentage of each 15-min interval corresponded to a departure on takeoff roll, to aircraft crossing the runway, arrivals (that requested landing on the departure runway) on final approach, departures holding for takeoff clearance, etc. We note that between 1745 and 2000 hours, when gate-holds were experienced, the runway utilization was kept at or close to 100%, with a persistent departure queue as well.

Runway utilization was maintained consistently during the demo periods, with the exception of a three-minute interval on the third day of pushback rate control. On this instance, three flights were expected to be at the departure runway, ready for takeoff. Two of these flights received EDCTs as they taxied (and so were not able to takeoff at the originally predicted time), and the third flight was an international departure that had longer than expected pre-taxi procedures. Learning from this experience, we were diligent in ensuring that EDCTs were gathered as soon as they were available, preferably while the aircraft were still at the gate. In addition, we incorporated the longer taxi-out times of international departures into our predictions. As a result of these measures, we ensured that runway utilization was maintained over the remaining duration of the trial. It is worth noting that the runway was "starved" in this manner for only 3 minutes in over 37 hours of pushback rate control, demonstrating the ability of the approach to adapt to the uncertainties in the system.

V. Benefits analysis

Table II presents a summary of the gate-holds on the eight demo periods with sufficient congestion for controlling pushback rates. As mentioned earlier, we had no significant congestion when the airport was operating in its most efficient configuration (4L, 4R | 4L, 4R, 9).

TABLE II
SUMMARY OF GATE-HOLD TIMES FOR THE EIGHT DEMO PERIODS WITH SIGNIFICANT GATE-HOLDS.

	Date	Period	Configuration	No. of gate-holds	Average gate-hold (min)	Total gate-hold (min)
1	8/26	4.45-8PM	27,22L | 22L,22R	63	4.06	256
2	8/29	4.45-8PM	27,32 | 33L	34	3.24	110
3	8/30	5-8PM	27,32 | 33L	8	4.75	38
4	9/02	4.45-8PM	27,22L | 22L,22R	45	8.33	375
5	9/06	5-8PM	27,22L | 22L,22R	19	2.21	42
6	9/07	5-7.45PM	27,22L | 22L,22R	11	2.09	23
7	9/09	5-8PM	27,32 | 33L	11	2.18	24
8	9/10	5-8PM	27,32 | 33L	56	3.7	207
Total				247	4.35	1075

A total of 247 flights were held, with an average gate-hold of 4.3 min. During the most congested periods, up to 44% of flights experienced gate-holds. By maintaining runway utilization, we traded taxi-out time for time spent at the gate with engines off, as illustrated in Figures 9 and 11.

A. *Translating gate-hold times to taxi-out time reduction*

Intuitively, it is reasonable to use the gate-hold times as a surrogate for the taxi-out time reduction, since runway utilization was maintained during the demonstration of the control strategy. We confirm this hypothesis through a simple "what-if" simulation of operations with and without pushback rate control. The simulation shows that the total taxi-out time savings equaled the total gate-hold time, and that the taxi time saving of each flight was equal, in expectation, to its gate holding time. The total taxi-out time reduction can therefore be approximated by the total gate-hold time, or 1077 minutes (18 hours).

In reality, there are also second-order benefits due to the faster travel times to the runway due to reduced congestion, but these effects are neglected in the preliminary analysis.

B. *Fuel burn savings*

Supported by the analysis presented in Section V-A, we conduct a preliminary benefits analysis of the field tests by using the gate-hold times as a first-order estimate of taxi-out time savings. This assumption is also supported by the taxi-out time data from the tests, such as the plot shown in Figure 9. Using the tail number of the gate-held flights, we determine the aircraft and engine type and hence its ICAO taxi fuel burn index [12]. The product of the fuel burn rate index, the number of engines, and the gate-hold time gives us an estimate of the fuel burn savings from the pushback rate control strategy. We can also account for the use of Auxiliary Power Units (APUs) at the gate by using the appropriate fuel burn rates

[13]. This analysis (not accounting for benefits from reduced congestion) indicates that the total taxi-time savings were about 17.9 hours, which resulted in fuel savings of 12,000-15,000 kg, or 3,900-4,900 US gallons (depending on whether APUs were on or off at the gate). This translates to average fuel savings per gate-held flight of between 50-60 kg or 16-20 US gallons, which suggests that there are significant benefits to be gained from implementing control strategies during periods of congestion. It is worth noting that the per-flight benefits of the pushback rate control strategy are of the same order-of-magnitude as those of Continuous Descent Approaches in the presence of congestion [14], but do not require the same degree of automation, or modifications to arrival procedures.

C. *Fairness of the pushback rate control strategy*

Equity is an important factor in evaluating potential congestion management or metering strategies. The pushback rate control approach, as implemented in these field tests, invoked a First-Come-First-Serve policy in clearing flights for pushback. As such, we would expect that there would be no bias toward any airline with regard to gate-holds incurred, and that the number of flights of a particular airline that were held would be commensurate with the contribution of that airline to the total departure traffic during demo periods. We confirm this hypothesis through a comparison of gate-hold share and total departure traffic share for different airlines, as shown in Figure 15. Each data-point in the figure corresponds to one airline, and we note that all the points lie close to the 45-degree line, thereby showing no bias toward any particular airline.

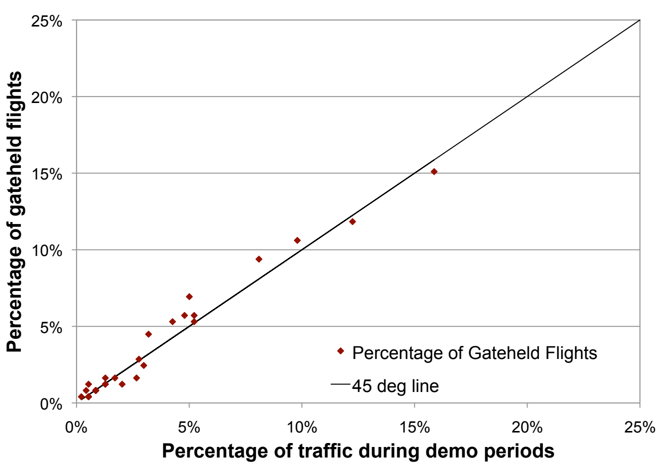


Fig. 15: Comparison of gate-hold share and total departure traffic share for different airlines.

We note, however, that while the number of gate-holds that an airline receives is proportional to the number of its flights, the actual fuel burn benefit also depends on its fleet mix. Figure 16 shows that while the taxi-out time reductions are similar to the gate-holds, some airlines (for example, Airlines 3, 4, 5, 19 and 20) benefit from a greater proportion of fuel savings. These airlines are typically ones with several heavy jet departures during the evening push.

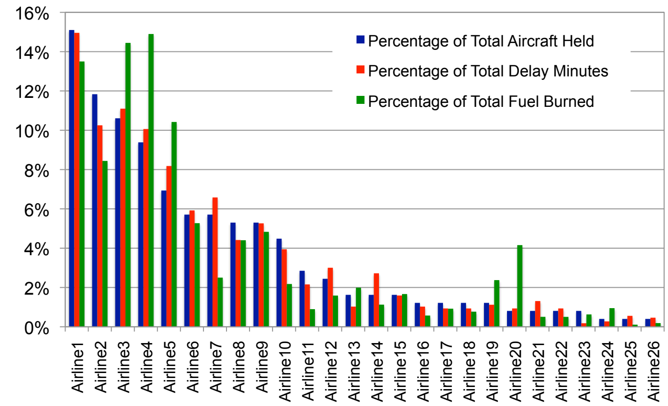


Fig. 16: Percentage of gate-held flights, taxi-out time reduction and fuel burn savings incurred by each airline.

VI. Observations and Lessons Learned

We learned many important lessons from the field tests of the pushback rate control strategy at BOS, and also confirmed several hypotheses through the analysis of surveillance data and qualitative observations. Firstly, as one would expect, the proposed control approach is an aggregate one, and requires a minimum level of traffic to be effective. This hypothesis is further borne by the observation that there was very little control of pushback rates in the most efficient configuration (4L, 4R | 4L, 4R, 9). The field tests also showed that the proposed technique is capable of handling target departure times (e.g., EDCTs), but that it is preferable to get EDCTs while still at gate. While many factors drive airport throughput, the field tests showed that the pushback rate control approach could adapt to variability. In particular, the approach was robust to several perturbations to runway throughput, caused by heavy weight category landings on departure runway, controllers' choice of runway crossing strategies, birds on runway, etc. We also observed that when presented with a suggested pushback rate, controllers had different strategies to implement the suggested rate. For example, for a suggested rate of 2 aircraft per 3 minutes, some controllers would release a flight every 1.5 minutes, while others would release two flights in quick succession every three minutes. We also noted the need to consider factors such as ground crew constraints, gate-use conflicts, and different taxi procedures for international flights. By accounting for these factors, the pushback rate control approach was shown to have significant benefits in terms of taxi-out times and fuel burn.

VII. Summary

This paper presented the results of the demonstration of a pushback rate control strategy at Boston Logan International Airport. Sixteen demonstration periods between August 23 and September 24, 2010 were conducted in the initial field trial phase, resulting in over 37 hours of research time in the BOS tower. Results show that during eight demonstration periods (about 24 hours) of controlling pushback rates, over 1077 minutes (nearly 18 hours) of gate holds were experienced during the demonstration period across 247 flights, at an average of 4.3 minutes of gate hold per flight (which correlated well to the observed decreases in taxi-out time). Preliminary fuel burn savings from gate-holds with engines off were estimated to be between 12,000-15,000 kg (depending on whether APUs were on or off at the gate).

Acknowledgments

We would like to acknowledge the cooperation and support of the following individuals who made the demo at BOS possible: Deborah James, Pat Hennessy, John Ingaharro, John Melecio, Michael Nelson and Chris Quigley at the BOS Facility; Vincent Cardillo, Flavio Leo and Robert Lynch at Massport; and George Ingram and other airline representatives at the ATA. Alex Nakahara provided assistance in computing the preliminary fuel burn savings from the gate-hold data, and Regina Clewlow, Alex Donaldson and Diana Michalek Pfeil helped with tower observations before and during the trials. We are also grateful to Lourdes Maurice (FAA) and Ian Waitz (MIT) for insightful feedback on the research, and James Kuchar, Jim Eggert and Daniel Herring of MIT Lincoln Laboratory for their support and help with the ASDE-X data.

References

[1] I. Simaiakis and H. Balakrishnan, "Analysis and control of airport departure processes to mitigate congestion impacts," *Transportation Research Record: Journal of the Transportation Research Board*, pp. 22–30, 2010.

[2] C. Cros and C. Frings, "Alternative taxiing means – Engines stopped," Presented at the Airbus workshop on Alternative taxiing means – Engines stopped, 2008.

[3] E. R. Feron, R. J. Hansman, A. R. Odoni, R. B. Cots, B. Delcaire, W. D. Hall, H. R. Idris, A. Muharremoglu, and N. Pujet, "The Departure Planner: A conceptual discussion," Massachusetts Institute of Technology, Tech. Rep., 1997.

[4] N. Pujet, B. Delcaire, and E. Feron, "Input-output modeling and control of the departure process of congested airports," *AIAA Guidance, Navigation, and Control Conference and Exhibit, Portland, OR*, pp. 1835–1852, 1999.

[5] F. Carr, "Stochastic modeling and control of airport surface traffic," Master's thesis, Massachusetts Institute of Technology, 2001.

[6] P. Burgain, E. Feron, J. Clarke, and A. Darrasse, "Collaborative Virtual Queue: Fair Management of Congested Departure Operations and Benefit Analysis," *Arxiv preprint arXiv:0807.0661*, 2008.

[7] P. Burgain, "On the control of airport departure processes," Ph.D. dissertation, Georgia Institute of Technology, 2010.

[8] I. Simaiakis and H. Balakrishnan, "Queuing Models of Airport Departure Processes for Emissions Reduction," in *AIAA Guidance, Navigation and Control Conference and Exhibit*, 2009.

[9] ——, "Departure throughput study for Boston Logan International Airport," Massachusetts Institute of Technology, Tech. Rep., 2011, No. ICAT-2011-1.

[10] I. Simaiakis, "Modeling and control of airport departure processes for emissions reduction," Master's thesis, Massachusetts Institute of Technology, 2009.

[11] Federal Aviation Administration, "Fact Sheet Airport Surface Detection Equipment, Model X (ASDE-X)," October 2010.

[12] International Civil Aviation Organization, "ICAO Engine Emissions Databank," July 2010.

[13] Energy and Environmental Analysis, Inc., "Technical data to support FAA's circular on reducing emissions for commercial aviation," September 1995.

[14] S. Shresta, D. Neskovic, and S. Williams, "Analysis of continuous descent benefits and impacts during daytime operations," in *8th USA/Europe Air Traffic Management Research and Development Seminar (ATM2009)*, Napa, CA, June 2009.

Author Biographies

Ioannis Simaiakis is a PhD candidate in the Department of Aeronautics and Astronautics at MIT. He received his BS in Electrical Engineering from the National Technical University of Athens, Greece and his MS in Aeronautics and Astronautics from MIT. His research focuses on modeling and predicting taxi-out times and airport operations planning under uncertainty.

Harshad Khadilkar is a graduate student in the Department of Aeronautics and Astronautics at the Massachusetts Institute of Technology. He received his Bachelors degree in Aerospace Engineering from the Indian Institute of Technology, Bombay. His research interests include algorithms for optimizing air traffic operations, and stochastic estimation and control.

Hamsa Balakrishnan is an Assistant Professor of Aeronautics and Astronautics at the Massachusetts Institute of Technology. She received her PhD in Aeronautics and Astronautics from Stanford University. Her research interests include ATM algorithms, techniques for the collection and processing of air traffic data, and mechanisms for the allocation of airport and airspace resources.

Tom Reynolds has joint research appointments with MIT's Department of Aeronautics & Astronautics and Lincoln Laboratory. He obtained his Ph.D. in Aerospace Systems from the Massachusetts Institute of Technology. His research interests span air transportation systems engineering, with particular focus on air traffic control system evolution and strategies for reducing environmental impacts of aviation.

R. John Hansman is the T. Wilson Professor of Aeronautics and Astronautics at the Massachusetts Institute of Technology where he is the Director of the MIT International Center for Air Transportation.

Brendan Reilly is currently the Operations Manager at Boston Airport Traffic Control Tower. He is responsible for the day to day operations of the facility as well as customer service. He has been involved in aviation throughout New England for over twenty years as both an Air Traffic Controller and a Pilot.

Steve Urlass is an environmental specialist and a national resource for airports in the FAA's Office of Environment and Energy. He is responsible for research projects and developing environmental policy for the Agency. He has been involved with a variety of environmental, airport development, and system performance monitoring for the FAA. He received his degree in Air Commerce from Florida Tech.

This Page Intentionally Left Blank.