ENVIRONMENTAL ASSESSMENT

Terminal E Renovation and Enhancements at Boston-Logan International Airport

EAST BOSTON, MASSACHUSETTS

PREPARED FOR

massport

Massachusetts Port Authority

PREPARED BY vhb

IN ASSOCIATION WITH AECOM

DATE July 2015

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Terminal E Renovation and Enhancements at Boston-Logan International Airport

East Boston,
Massachusetts

Prepared for **Massachusetts Port Authority**

Prepared by

In association with **AECOM**
HMMH, Inc.
KB Environmental, Inc.

July 2015

This environmental assessment becomes a Federal document when evaluated, signed, and dated by the Responsible FAA Official.

Responsible FAA Official

July 29, 2015
Date

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DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINSTRATION
FINDING OF NO SIGNIFICANT IMPACT

Terminal E Renovation and Enhancements Project
Boston - Logan International Airport

Proposed Action

The Massachusetts Port Authority (Massport) is the sponsor of the **Terminal E Renovation and Enhancements Project** at Boston-Logan International Airport. The purpose of the project is to:

- Accommodate the current and future aircraft fleet mix of the international commercial airline carriers serving Logan Airport, including larger aircraft such as the Airbus A380, the Boeing 747-8 and other Group VI aircraft;
- Improve terminal and airfield safety and efficiency; and
- Enhance passenger service and convenience.

The project includes interior and exterior improvements at Terminal E to accommodate regular service by wider and longer aircraft, as well as airfield improvements to allow safe and efficient operations of Group VI aircraft. The project does not propose any new gates, however, Massport proposes to reconfigure three existing gates at Terminal E to accommodate these larger aircraft types. An approximately 94,000 square-foot addition to the west side of Terminal E will allow passenger holdrooms to be reconfigured to accommodate the passenger loads associated with the larger aircraft. Interior renovations throughout the terminal will enhance overall passenger service. The project also includes modifications to the airfield to meet required Federal Aviation Administration (FAA) safety and design standards for these operations. Modifications include the stabilizing of selected runway shoulders and taxiway turning areas (fillets) to accommodate the larger aircraft.

Up to four Group VI aircraft per day will serve Terminal E during the peak hours. Three A380s are projected to replace three Boeing 747-400 operations, one B747-8 aircraft is expected to replace one B777 aircraft operation. The newer larger aircraft are cleaner and quieter than older aircraft currently in operation; for example, the A380 is the quietest wide-body jetliner flying today

The revisions to the Airport Layout Plan require FAA approval. Massport and FAA prepared an Environmental Assessment (EA) to assess the Proposed Action. The Proposed Action will require a Construction General Permit under the National Pollutant Discharge Elimination System, but is not likely to require any other federal or state approvals. Review of the project for consistency with the Massachusetts Endangered Species Act regulations by the MA Natural Heritage and Endangered Species Program (NHESP) is complete; with the proposed airfield mitigation, NHESP has determined that a Conservation and Management Permit is not required.

Alternatives Considered

The EA includes a review of alternatives to the Proposed Action, including a No-Action Alternative. Several alternatives were considered for both the terminal and gate improvements and the airfield modifications. The key differences among the terminal alternatives relate to number of gate modifications, the size of the addition, the layout, the ability to accommodate passengers, and the cost. Each of the building alternatives includes internal renovation as well as external construction that converts airside pavement/apron area to the terminal footprint. The terminal improvements will all take place within paved areas currently used for aircraft operations. To accommodate the larger aircraft, three existing gates will be upsized and new upsized

passenger holdrooms will be constructed. Passenger amenities would include improved concessions, passenger seating, airline club space, improvements at the baggage claim, and enhanced way-finding throughout the terminal.

Changes to the airfield are required to allow regular operations by larger aircraft such as the Airbus A380 and Boeing 747-8. The larger wingspan, fuselage length and the position of the wing-undermounted engine of these aircraft require more space than smaller commercial aircraft for ground movements. The minimal airfield improvements will facilitate safe landings and taxiing without the need to disrupt operations on adjacent areas of the airfield. The engine position of these aircraft requires stabilized shoulders because jet blasts may potentially dislodge grass or signage adjacent to the paved surfaces of the runways. Airfield improvement alternatives were developed to optimize operational efficiency while minimizing runway and taxiway modifications. Alternatives include widening runway pavement and variations of taxiway fillet improvements along several routes between the runways and Terminal E. The Proposed Action for the airfield modifications consists of stabilizing Runway 15R-33L shoulders from 30 to 50 feet,west of Runway 4L-22R intersection and adjusting fillets for portions of taxiways that would be used by Group VI aircaft.

Assessment and Mitigation

EA Chapter 5.0 *Environmental Consequences and Mitigation* evaluated the environmental consequences of the Proposed Action. Together with the proposed mitigation, all impacts to resource categories are anticipated to less than significant, based on the significance thresholds defined in FAA Order 1050.1E.

The Proposed Action will unavoidably alter airfield areas that have been identified as habitat for state-protected grassland bird species. The Proposed Action includes removing excess airfield pavement to offset loss of grassland. The Massachusetts Division of Fisheries and Wildlife, NHESP issued a "no take" determination on July 9, 2015 based on the proposed pavement removal, the commitment to no airfield construction during the nesting and breeding season (May 1-July 31), and ongoing consultation with NHESP.

All other impacts discussed in the EA are minor construction related impacts that are temporary in nature, including noise, air and construction related traffic. Massport commits to follow appropriate construction best management practices to minimize minor temporary construction related impacts.

Some of the proposed airfield improvements require an FAA Modification of Standard. If that process requires implementation of measures not assessed here, we will revisit that prior to construction. Also, the FAA is now in the process of identifying problematic taxiway geometry at airports nationwide, to minimize runway incursions. That process may result in other airfield improvements a Boston-Logan. We will await the results of that analysis, and take appropriate action.

Finding of No Significant Impact

I have carefully and thoroughly considered the facts contained in the EA. Based on that information, I find the proposed Federal action is consistent with the existing national environmental policies and objectives of Section 101(a) of the National Environmental Policy Act of 1969 (NEPA) and other applicable environmental requirements. I also find the proposed federal action will not significantly affect the quality of the human environmental or include any condition requiring consultation pursuant to Section 102(2)(C) of NEPA. As a result, FAA will not prepare an EIS for this action.

APPROVED: R Doucette

Richard Doucette,
Environmental Program Manager, FAA New England Region

7/29/15
Date

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Acronyms

747-800	Boeing 747-800
A380	Airbus A380
ADG	Aircraft Design Group
AIP	Airport Improvement Program
ALP	Airport Layout Plan
APU	auxiliary power unit
CAA	Clean Air Act
CO	carbon monoxide
CBP	Customs and Border Protection
dB	decibel
DHS	Department of Homeland Security
DNL	Day-night average sound level
EA	Environmental Assessment
EEA	Executive Office of Energy and Environmental Affairs
EDR	Environmental Data Report
EMS	Environmental Management System
EPA	U.S. Environmental Protection Agency
ESPR	Environmental Status and Planning Report
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIS	Federal Inspection Services
FOD	Foreign Object Debris
FONSI	Finding Of No Significant Impact
FY	Fiscal Year
GHG	Greenhouse Gas
GSE	Ground Service Equipment
GTU	Ground Transportation Unit
HOV	high occupancy vehicle
Hz	hertz
INS	Immigration and Naturalization Services
kWh	kilowatt-hour
LCC	low cost carrier
LEED®	Leadership in Energy and Environmental Design

LOS	Level of Service
MassDEP	Massachusetts Department of Environmental Protection
MCP	Massachusetts Contingency Plan
MEPA	Massachusetts Environmental Policy Act
MOS	Modification to Standard
MWh	megawatt hour
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHESP	Massachusetts Natural Heritage and Endangered Species Program
NO_2	Nitrogen Dioxide
NPDES	National Pollutant Discharge Elimination System
NOx	nitrogen oxides
O_3	Ozone
Pb	Lead
PBB	passenger boarding bridges
PH	peak hour
PM	Particulate Matter
SPCC	Spill Prevention Control and Countermeasure Plan
SO_2	Sulfur Dioxide
SWPPP	Stormwater Pollution Prevention Plan
SWSA	Southwest Service Area
TAF	Terminal Area Forecast
tpy	Tons per year
TSA	Transportation Security Administration
µm	micrometers
µg	migrograms
VOC	Volatile Organic Compounds

1 Project Overview and Background

1.1 Introduction

Market demands and airline restructuring have led to the incorporation of larger aircraft, such as the Airbus A380 and the Boeing 747-8, into the international commercial airline fleets. The Terminal E Renovation and Enhancements Project at Boston-Logan International Airport was developed by the Massachusetts Port Authority (Massport) in response to recent international airline requests to use new Group VI aircraft including the Airbus A380 (A380) for international travel from Europe, the Middle-East, and Asia. These aircraft hold more passengers than ever before and require more space for operations on the airfield and at the terminal. In addition, the newer larger aircraft are cleaner and quieter than older aircraft currently in operation; for example, the A380 is the quietest wide-body jetliner flying today.

The Airbus A380 superjumbo jet is larger than any other commercial aircraft, with a length of 240 feet and a wingspan of 262 feet. The aircraft is 79 feet high, with two passenger decks carrying up to 853 passengers. The Boeing 747-8 is the longest passenger aircraft in the world. The A380 and the Boeing 747-8 require two or three jet-bridge connections to serve the multiple passenger levels and efficiently de-board the aircraft. The current configuration of Terminal E at Boston-Logan International Airport (Logan Airport or Airport) does not provide gate, terminal holdrooms, or airside facilities that can accommodate A380 aircraft and other Group VI aircraft. The existing passenger processing and amenities areas within the terminal are currently inadequate to handle the number of passengers, as well as the anticipated number of passengers in the future peak hours.

In addition to the current terminal configuration, the airfield cannot accommodate regularly scheduled service by the A380 and other Group VI aircraft. Changes to the airfield are required in order to allow regular operations by larger aircraft such as the Airbus A380 and Boeing 747-8. The larger wingspan, fuselage length and the position of the wing under-mounted engine of these aircraft require more space for ground movements than smaller commercial aircraft. Airfield improvements are needed to facilitate safe landings and taxiing without disrupting operations on adjacent areas of the airfield. The engine position of these aircraft requires stabilized shoulders because jet blasts may potentially dislodge grass or signage adjacent to the paved surfaces of the runways.

In an ongoing effort to adjust to changing air carrier business models, Massport continues to respond by modifying and upgrading facilities to meet the air carriers' needs while providing facilities that improve and simplify passengers' traveling experience. As part of this ongoing process, Massport is proposing to renovate and enhance Terminal E by upgrading three existing gates to accommodate larger aircraft, and to configure the interior space needed for passengers to efficiently move through the terminal and correct current space

deficiencies at the terminal. The Proposed Project/Proposed Action includes a total of approximately 94,000 square feet of new construction and 121,000 square feet of renovated space, including upgraded passenger holdroom facilities, an enhanced concourse, upgraded concessions, and improved airline club facilities. The Proposed Action also includes modifications to the airfield to meet required Federal Aviation Administration (FAA) safety and design standards for regular scheduled operations. Modifications include stabilizing selected runway shoulders and taxiway turning areas (fillets) to accommodate the larger aircraft.

The Proposed Project does not propose any changes to runway lengths or widths. The proposed improvements will not increase aircraft operations, passenger activity levels, or ground transportation volumes. Aviation forecasts project that international passenger levels will increase independent of this project. There will be no increase in the number of gates, although three existing gates will be upgraded. The Project will not have a long-term adverse effect on ground access, noise, or air quality.

1.1.1 Logan Airport Overview

Logan Airport, New England's primary domestic and international airport, plays a key role in the metropolitan Boston and New England passenger and freight transportation networks and is a significant contributor to the regional economy. The Airport employs over 12,000 people and, including airport-related activities, contributes $13.4 billion annually into the local economy.[1] In 2013, Logan Airport was the 19th busiest commercial airport in North America as ranked by aircraft operations, and the 20th busiest in North America ranked by number of passengers.[2]

As shown in **Figure 1.1**, Logan Airport is one of the most land-constrained airports in the nation and is surrounded by water on three sides. The Airport boundary encompasses approximately 2,400 acres in East Boston and Winthrop, including 700 acres underwater in Boston Harbor. Logan Airport is close to downtown Boston and is accessible by public transit and a well-connected roadway system.

Logan Airport has four passenger terminals (Terminal A, B, C, and E), each with its own ticketing, baggage claim, and ground transportation facilities. Terminal E serves as the international terminal for the Airport. The airfield comprises six runways, approximately 15 miles of taxiway, and approximately 240 acres of concrete and asphalt apron. 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.

1 *Massachusetts Statewide Airport Economic Impact Study Update,* MassDOT Aeronautics Division, 2014.
2 ACI-NA Airport Traffic Reports 2013 at www.aci-na.org/stats/stats_traffic accessed March 2015.

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Source(s): ArcGIS Online

Figure 1.1

Logan Airport

1.1.2 Terminal E Overview

Terminal E (**Figure 1.2**), is the international terminal for Logan Airport. The original terminal was completed in 1974. Massport constructed the Terminal E Modifications project in 1997, which enhanced passenger facilities. In 2002, Massport began work construction on the International Gateway Project, which expanded and upgraded the Terminal to provide better service to international passengers. The project was completed in phases. Phase 1, completed in 2004, included a weather-protected airside bus portico linking the ground floor with the second floor to accommodate passengers arriving from remotely parked aircraft. Phase II, completed in 2007, expanded the Federal Inspection Services (FIS) Facility for U.S. Customs, and improved the meeter/greeter lobby and the ticketing area to maximize passenger convenience and reduce processing times. The baggage handling facilities were upgraded as part of an Airport-wide in-line baggage screening project in 2004.

Unlike the domestic terminals, where the upper level is used for departures while the lower level is used for arrivals, at Terminal E, the third level is used for departures while the ground level is used for arrivals and Customs. The second level is used for passport control. Parking for Terminal E is provided in the central parking complex, connected to the terminals via passenger bridges, and in two surface parking lots situated near the Terminal E entrance.

1.2 NEPA Compliance

The Federal Aviation Administration (FAA) has determined that the proposed renovation and enhancements identified by Massport require an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA) due to changes to the Airport Layout Plan that would result from project implementation. This EA describes the Proposed Action, identifies alternatives considered, and documents the potential environmental effects associated with constructing and operating the proposed Terminal E renovation and enhancements at Logan Airport. The Project is not expected to result in significant environmental impacts, such as increased vehicle traffic, noise, or air emissions. Impacts to airfield natural resources will be mitigated. The FAA is expected to issue a Finding of No Significant Impact (FONSI) for the Proposed Action. The Project does not exceed thresholds for size or environmental impacts that would trigger a review under the Massachusetts Environmental Policy Act (MEPA).

This EA provides the following information for the Project: Project Purpose and Need, detailing the deficiencies that the Project is designed to address; Alternatives Analysis, describing the alternative designs that were considered during design development; Affected Environment, providing background on existing natural and built conditions within the Project Area; Environmental Consequences, describing the anticipated environmental effects of the Proposed Action; and Mitigation, describing the measures proposed to offset any impacts. This EA also includes a distribution list of all parties that received the EA document. This Chapter, Chapter 1, *Project Overview and Background*, provides a summary and overview of the Airport and Project and a discussion of public involvement.

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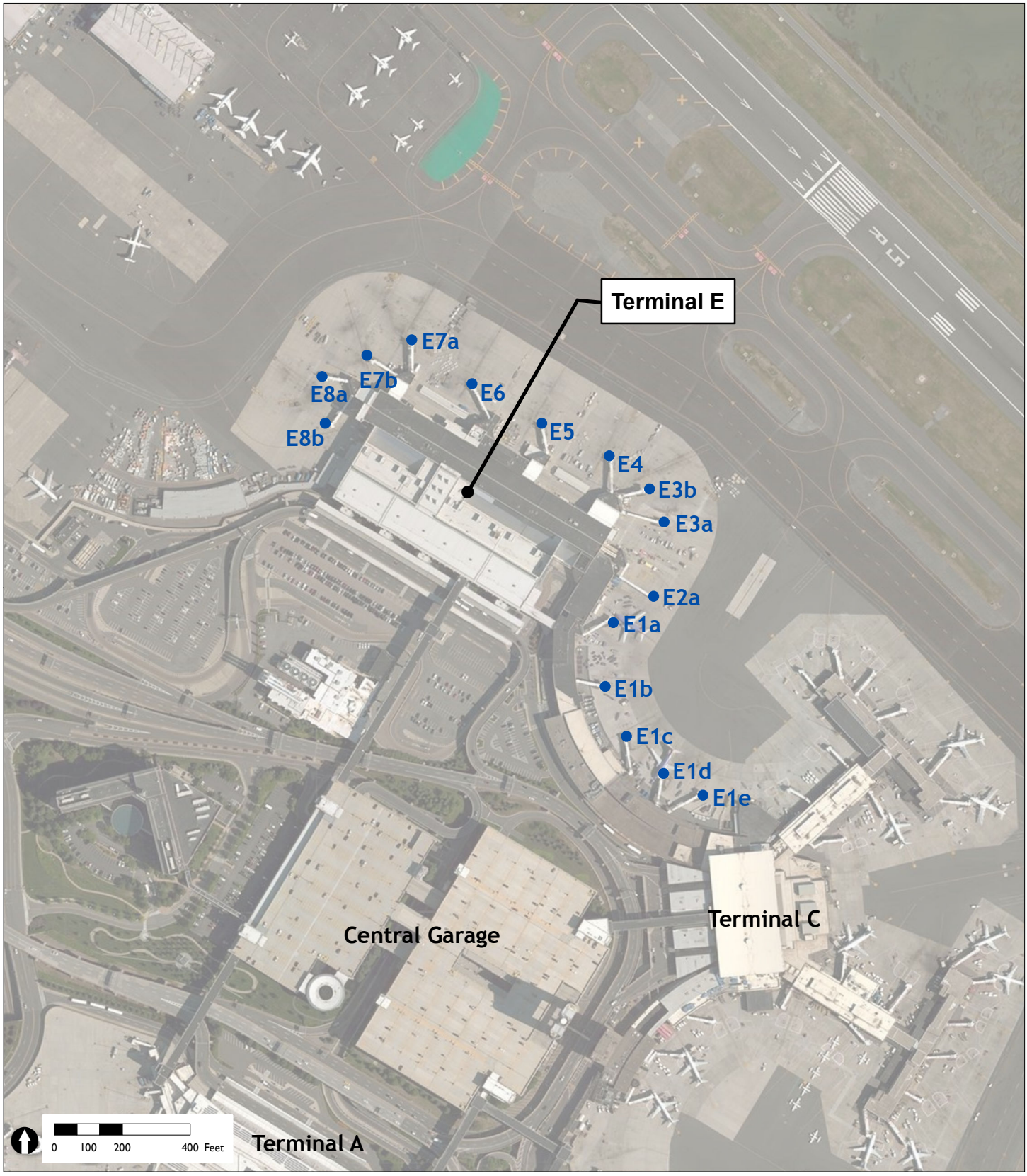

Source(s): MassGIS 2008 15cm Aerial

Figure 1.2

Terminal E Existing Conditions

TERMINAL E RENOVATION AND ENHANCEMENTS PROJECT
Boston-Logan International Airport
East Boston, Massachusetts

1.3 Project Goals and Objectives

Massport must continue to provide safe, secure, and convenient facilities for its users and tenants. To respond to the changing airline industry markets, the Terminal E gates and configuration need to be flexible and provide adequate space for the airlines' fleet mix, scheduling requirements and expected passenger loads.

The Project's purpose is to safely and efficiently accommodate the current and near term aircraft fleet mix of the international commercial airline carriers, including Group VI aircraft such as the A380 and Boeing 747-8, and to enhance terminal operations, passenger service, and convenience.

1.4 Proposed Project

The Proposed Project includes three key elements; Terminal E interior improvements, Terminal E exterior improvements, and airfield improvements.

1.4.1 Terminal E Interior Improvements

Passenger loads from Group VI arrivals during the peak period cannot be accommodated by the existing terminal space and facilities. To meet this demand, Terminal E will be expanded by approximately 94,000 square feet. Within the Terminal, approximately 121,000 square feet of existing space will be renovated to improve the efficiency and amenities of the Terminal. The Project will upgrade three existing gates (E7B, E8A, and E8B) to accommodate Group VI aircraft. To simplify nomenclature for future use, the gates at Terminal E will be renumbered E1-E12. New gate numbers are used throughout this document and, where needed for clarity, old gate numbers are provided in parentheses. No additional gates are proposed as part of this project.

The three upgraded gates would be provided with a sterile corridor connecting to the sterile corridor at E9 (former E7A). Three new holdrooms would be located at each of the newly reconfigured gates with the concourse located in a crescent configuration. The new holdrooms would be designed to accommodate one A380 at Gate E11 (8A), one 747-8 at Gate E10 (7B), and one 747-400 at Gate E12 (8B). Three new airline clubs would be located above the Gate E10 (7B), E11 (8A), and E12 (8B) holdrooms (each would be approximately 8,000 square feet). Retail shops and concessions would also be improved throughout the Terminal. **Figure 1.3A** show the proposed terminal improvements.

1.4.2 Terminal E Exterior Improvements

To provide flexibility for peak period needs, three existing Terminal E gates would be reconfigured. The Terminal E gates currently do not have the multilevel access points that are needed for loading and unloading passengers from Group VI type aircraft. Group VI aircraft also require more space on the apron area than smaller aircraft. Reconfiguring aircraft apron parking areas, repositioning of fueling locations relative to aircraft positions, and modification to taxiways are also needed to meet FAA minimums for safety areas for aircraft operational areas (AOA) in the vicinity of the Terminal E gates.

1.4.3 Airfield Improvements

The current configuration of taxiways, particularly fillet dimensions, do not meet minimum FAA requirements for Group VI aircraft to be accommodated under Taxiway Design Group 7. The wingtip clearances for these aircraft are larger and require reconfiguration of certain elements of the airfield to allow for safe operations. Airfield modifications will include stabilizing selected runway shoulders, taxiway shoulders, and taxiway turning areas (fillets). No runway extensions are required to meet the Group VI requirements. **Figure 1.3B** shows the proposed airfield improvements, and **Figure 1.3C** shows the Terminal E gate and apron configuration.

1.5 Public Involvement

As requested by FAA, an informational meeting on the Project was hosted by Massport during the NEPA review process with invited participation by regulatory agencies, organized community groups interested in airport activity, and local residents. While this public meeting is not mandatory as part of the NEPA process, Massport and the FAA are committed to reaching out to interested parties. Massport has also consulted directly with resource agencies regarding potential impacts, avoidance, and minimization of these impacts, and mitigation strategies.

The public information session was held on June 30, 2015 at 6:30 at the Logan Airport Rental Car Center Noddle Room. The goal of this meeting was to acquaint the nearby community with the Project, including construction schedule/activities, and to solicit input regarding potential neighborhood issues. FAA attended the meeting to provide an overview of the NEPA process and to listen to the public discussion on the project as part of the NEPA consultation process.

Massport posts information about key regulatory filings on its website. Massport also publishes annual Environmental Data Reports and Environmental Status and Planning Reports on its website. The most recent environmental filings, including this EA and all supporting documentation are available on its website at the following URL: www.massport.com/environment/environmental-reporting/environmental-filings/. The public was notified of the meeting via notification in the June 11, 2015 cover letter to the EA and publication in the local East Boston Times-Free Press on June 24, 2015.

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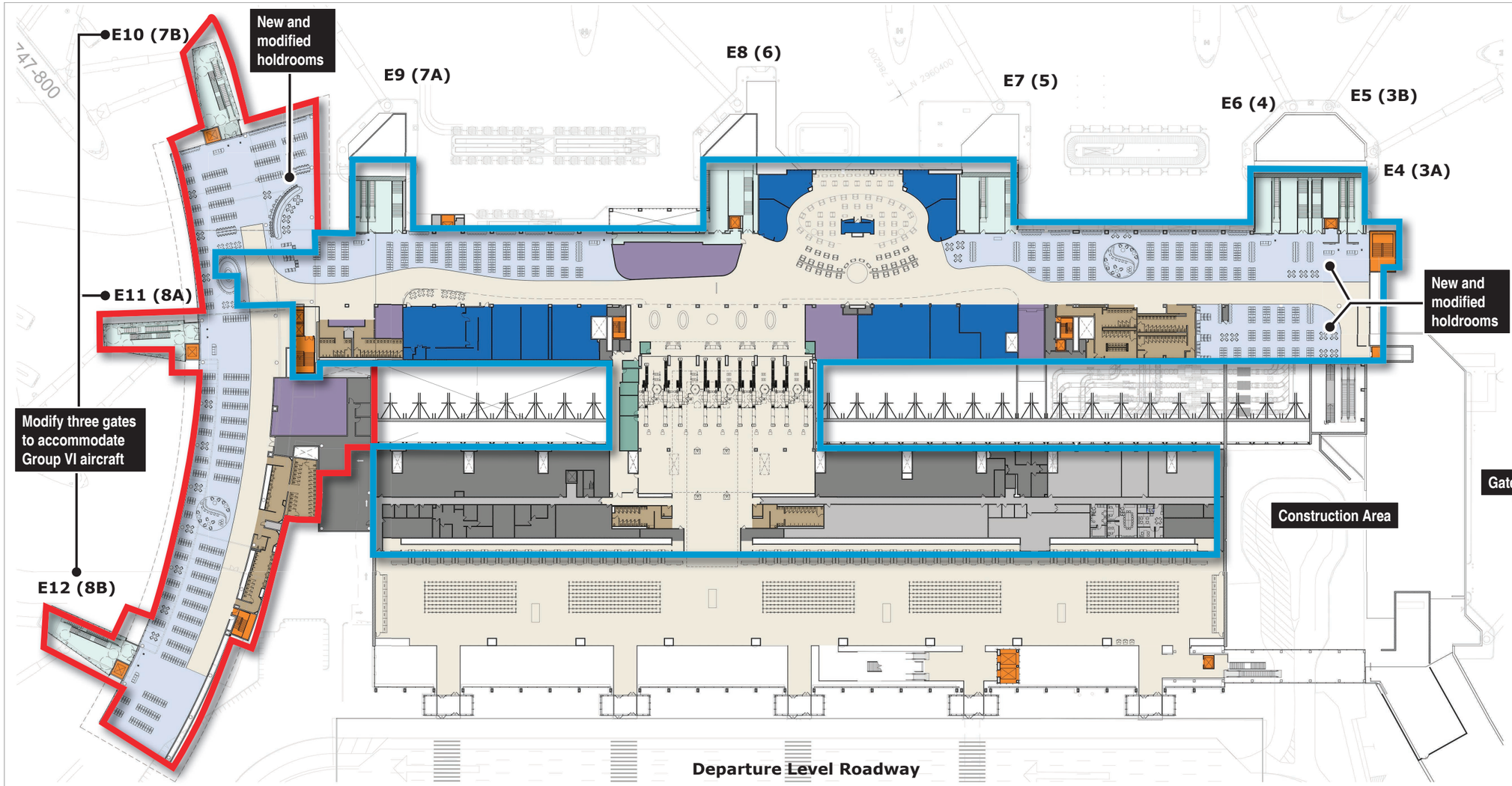


Terminal Alternative C
(Level 3, Departures)

- Modify three gates to accommodate A380 aircraft and other Group VI aircraft
- Construct three new holdrooms
- Construct three new 8,000 square foot airline clubs on Level 4
- Enhance concession/retail throughout Terminal E
- Modify hydrant fueling system

Total New Building Area (all levels): 93,563 sf

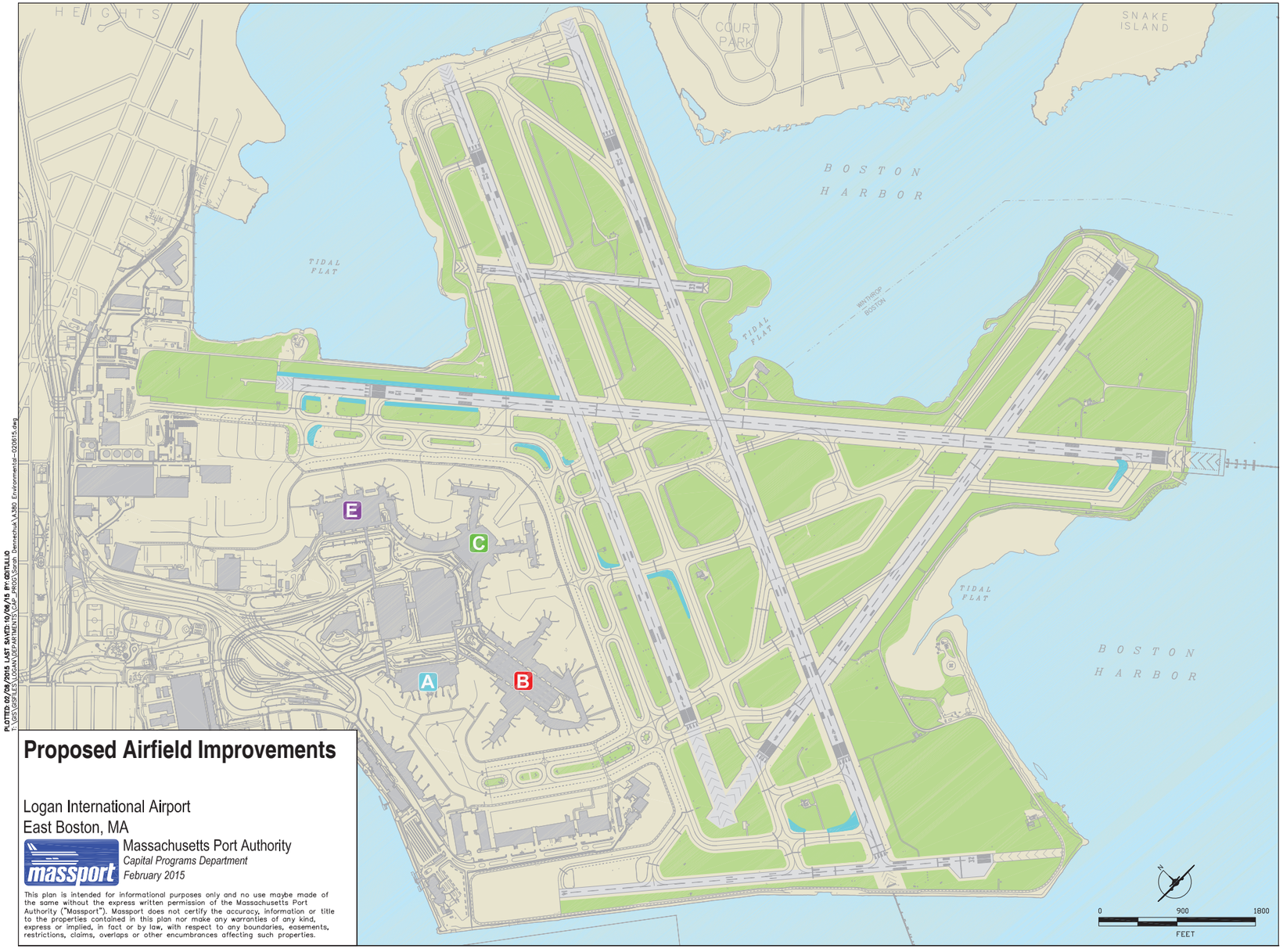
Source: AECOM

Note: Gates have been renumbered as part of the Proposed Action

Figure 1.3A

Proposed Action - Terminal E

TERMINAL E RENOVATION AND ENHANCEMENTS PROJECT
Boston-Logan International Airport
East Boston, Massachusetts



Proposed Airfield Improvements

Logan International Airport
East Boston, MA

Massachusetts Port Authority
Capital Programs Department
February 2015

Airfield Alternative 3 (Proposed Action)

- No runway widening
- Stabilize runway shoulder runway 15R-33L to 50-feet west of the runway 4L-22R intersection only
- Modify pavement fillets along 6 select taxiways

New Pavement

Not to Scale

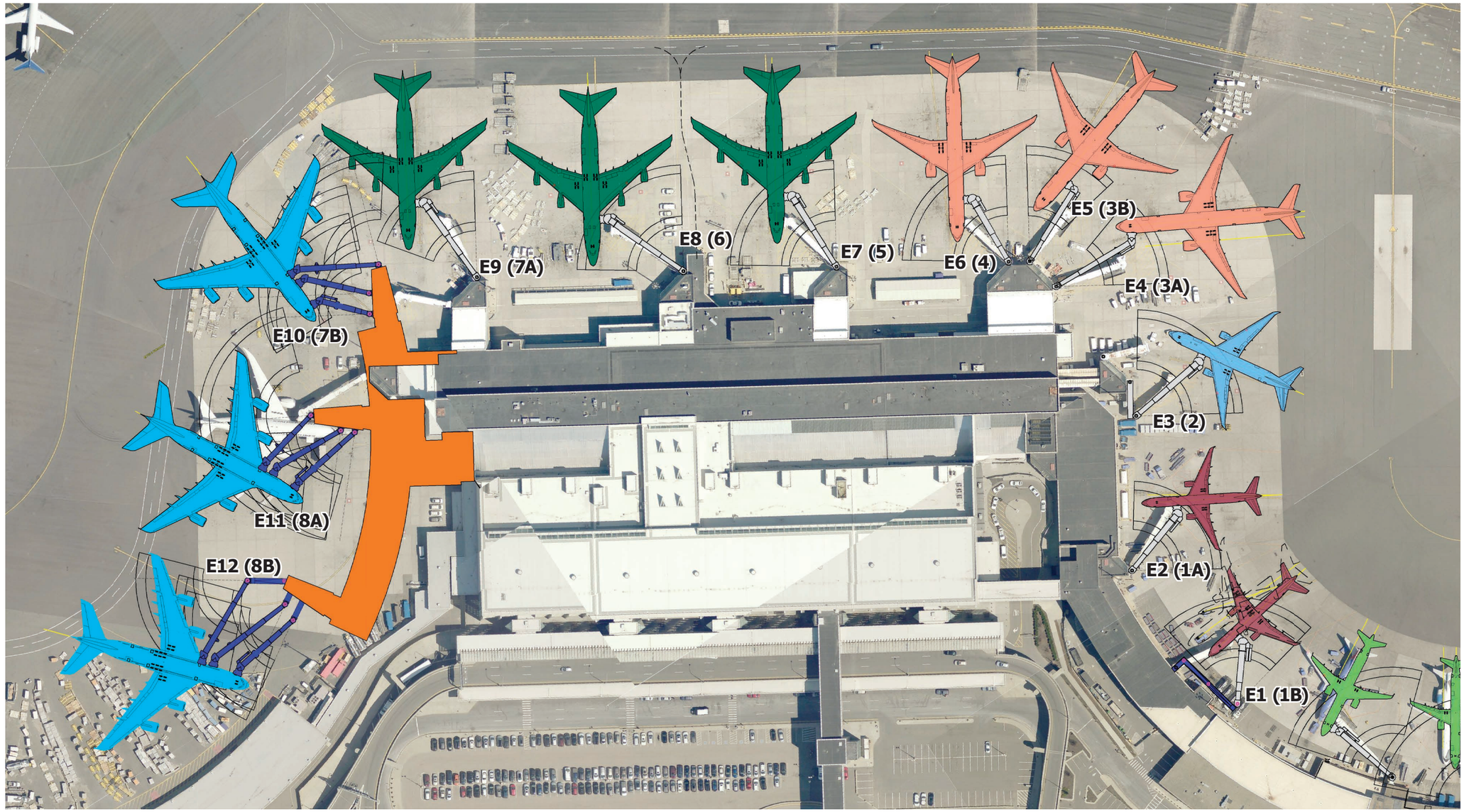
Source: AECOM

Note: Does not show pavement removal

Figure 1.3B

Proposed Action - Airfield Improvements

TERMINAL E RENOVATION AND ENHANCEMENTS PROJECT
Boston-Logan International Airport
East Boston, Massachusetts



Source: AECOM

Figure 1.3c

Proposed Terminal E Gate and Aircraft Configuration

TERMINAL E RENOVATION AND ENHANCEMENTS PROJECT
Boston-Logan International Airport
East Boston, Massachusetts

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1.6 Contents of the Environmental Assessment

The remainder of this Environmental Assessment includes:

- **Chapter 2, *Purpose and Need*,** presents the purpose of the Project and existing deficiencies at the Airport that need to be addressed by the Project in order to meet the purpose and need.
- **Chapter 3, *Alternatives*,** provides an overview of design requirements for each element of the Project and compares the alternatives developed to address the Project purpose and need, and provides a description of the Proposed Action.
- **Chapter 4, *Affected Environment*,** describes the existing environmental conditions at the Airport, particularly at Terminal E.
- **Chapter 5, *Environmental Consquences and Mitigation,*** presents the anticipated impacts to existing environmental resources from the Proposed Action, and details mitigation measures, as appropriate.
- **Chapter 6, *Regulatory Compliance,*** outlines the required environmental permits anticipated to construct the Proposed Action.
- **Chapter 7, *Distribution List,*** provides a comprehensive list of agencies and individuals that will receive a copy of the Environmental Assessment.

Supporting appendices include:

- Appendix A – Terminal Area Forecast
- Appendix B – Traffic Data Analysis
- Appendix C – Noise Data Analysis
- Appendix D – Agency Correspondence

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2 Purpose and Need

2.1 Introduction

This chapter describes the purpose and need for the Terminal E Renovation and Enhancements Project (the Project) at Logan Airport. As described in Chapter 1, *Project Overview and Background*, some international airlines are responding to changing market demands by up-gauging their fleets to include Airport Design Group VI aircraft, including the Airbus A380 (A380), and the Boeing 747-8. These aircraft carry larger passenger loads and have passenger accommodations, boarding, and airfield requirements that are not fully met by the current configuration of Logan Airport. As a result, Massport needs to enhance both terminal and airfield facilities to accommodate Group VI aircraft, while improving passenger convenience within Terminal E.

The Project includes all actions required to enable Logan Airport to accommodate A380 and other Group VI aircraft safely and efficiently. However, this project is not intended to remedy all deficiencies within the Terminal complex. Any additional projects or actions that are proposed by Massport to enhance or facilitate the future operation of the A380 and other Group VI aircraft at the Airport, or to improve passenger processing will be assessed as independent projects, separate from the Proposed Action. Each project, including the Terminal E Renovation and Enhancements Project, has been determined to be able to proceed and achieve its' project purpose independent of other actions taken previously or simultaneously.

2.2 Purpose of the Project

The overall purpose of the Project is to:

- Accommodate the current and near term aircraft fleet mix of the international commercial airline carriers serving Logan Airport, including larger aircraft such as the Airbus A380, the Boeing 747-8 and other Group VI aircraft;
- Improve terminal and airfield safety and efficiency; and
- Enhance passenger service and convenience.

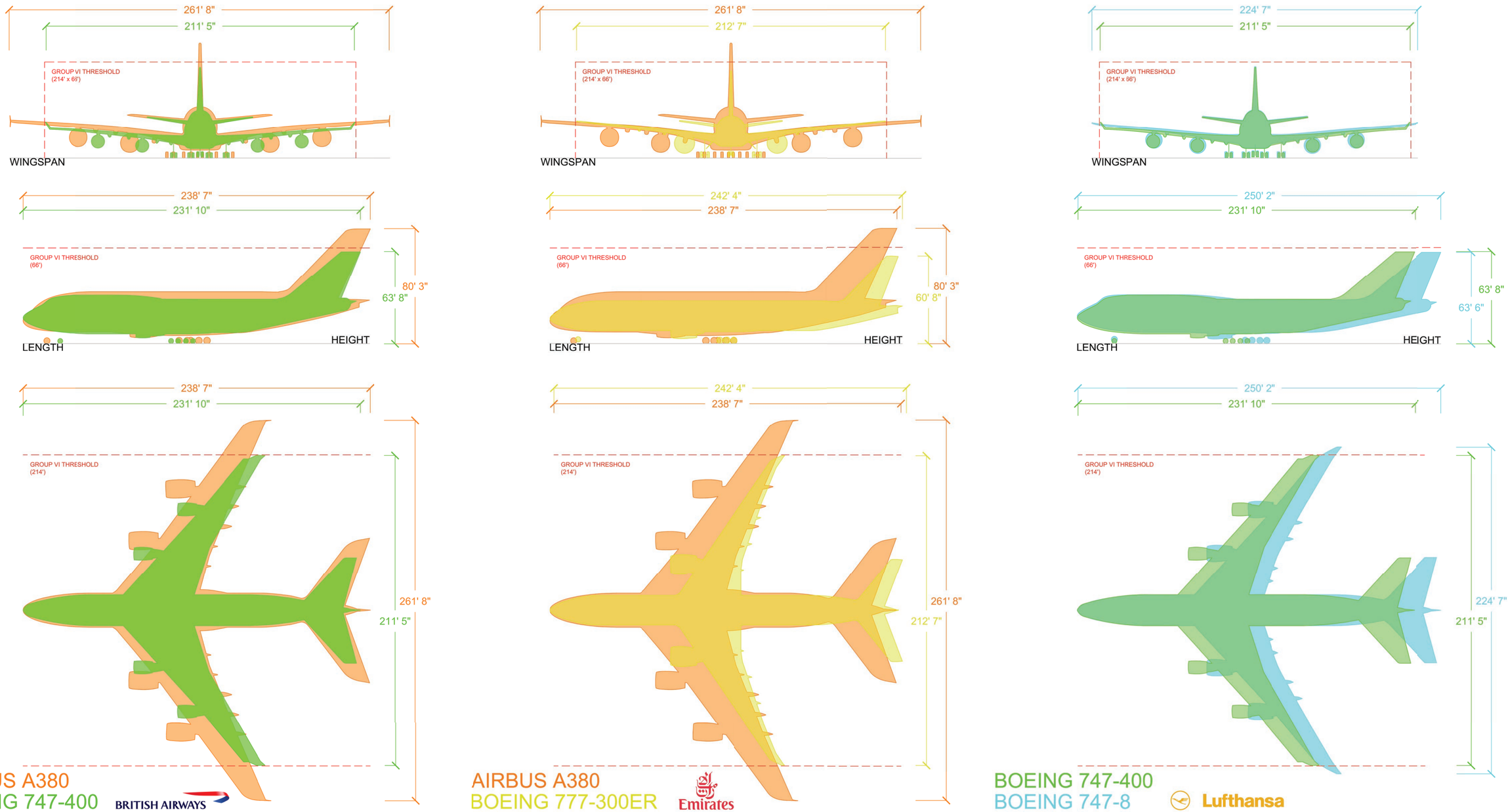
The Project will address three key elements:

- Terminal E interior Renovations;
- Terminal E exterior Improvements; and
- Airfield improvements.

Refer to **Figures 1.3A** and **1.3B** for the location of the Project components in the terminal area and airfield. Chapter 3, *Alternatives and Proposed Action*, provides a detailed description of the Proposed Action.

2.3 Airline Industry Trends

The airline industry, including international air carriers, is in a state of flux with new entrants, new travel markets, and different service models. Over the past seven years the international fleet mix has moved to larger sized aircraft including more Boeing 747s, Boeing 777s, and Boeing 787s. Massport's recent discussions with airlines indicate that British Airways and Emirates are adding A380s to their fleets, and Lufthansa has incorporated the Boeing 747-8 in its fleet. The A380 superjumbo jet is larger than any other commercial aircraft, with a length of 240 feet and a wingspan of 262 feet. The aircraft is 80 feet high, with two passenger decks. It requires at least two jetbridges and up to three connections to serve the dual passenger levels. **Figure 2.1** illustrates the size differential between aircraft currently in the fleet and larger aircraft to be added. Massport's goal is to provide airfield and Terminal E facilities that are flexible enough to accommodate these changes and market demands safely and efficiently. The Project was proposed by Massport in response to recent international airline requests to use new A380 aircraft for international travel from Europe, the Middle East, and Asia. The following section describes the existing and forecasted international operations and passenger levels as a context for understanding the current and anticipated changes that will need to be accommodated by Massport at Logan International Airport.



Source: VHB

Figure 2.1

Aircraft Size Differential

TERMINAL E RENOVATION
AND ENHANCEMENTS PROJECT
Boston-Logan International Airport
East Boston, Massachusetts

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2.4 Projected Passenger and Operational Levels

For over two decades, Massport has tracked and reported on historical passenger and aircraft operation activity levels on an Airport-wide basis in the annual Logan Airport *Environmental Data Reports* (EDRs) and *Environmental Status and Planning Reports* (ESPRs) which are prepared approximately every five years and provided to FAA. The EDRs and ESPRs are prepared in accordance with the Massachusetts Environmental Policy Act (MEPA) and scopes included in the Certificates of the Secretary of the Executive Office of Energy and Environmental Affairs (EEA). The EDRs and ESPRs assess the impact(s) of passenger activity levels and aircraft operations on ground access, noise, air quality, and water quality conditions at Logan Airport. In addition, Massport plans for future Airport activities by developing passenger and operations forecasts which are presented and assessed in the ESPRs. Massport assesses terminal-specific conditions for internal planning purposes to ensure that the Airport and its facilities are functioning efficiently and effectively. The annual EDRs and ESPRs provide updates to forecasts and describe the status of planning concepts and projects at the Airport. The following sections summarize data from these reports to describe the historical passenger levels and operations at Logan Airport in general and at Terminal E.

2.4.1 Airport-wide Passenger and Operational Levels

The *Logan Airport 2012/2013 EDR* reported on annual activity at Logan Airport in 2012 and 2013, including air passengers, aircraft operations, and cargo volumes compared to prior-year levels.[1] In 2012/2013, improvements in economic conditions from the 2008/2009 recession, both domestic and international, led to a modest recovery in passenger levels at Logan Airport. jetBlue Airways' expanding service, new international services, and capture of market share from some regional airports has offset service reductions by recently merged legacy carriers. Growth of jetBlue Airways has contributed the most to overall passenger traffic growth at Logan Airport. While passenger activity levels have increased, aircraft operations, have decreased dramatically since 2000 because of legacy air carriers improving load factors and using larger, more fuel-efficient aircraft.

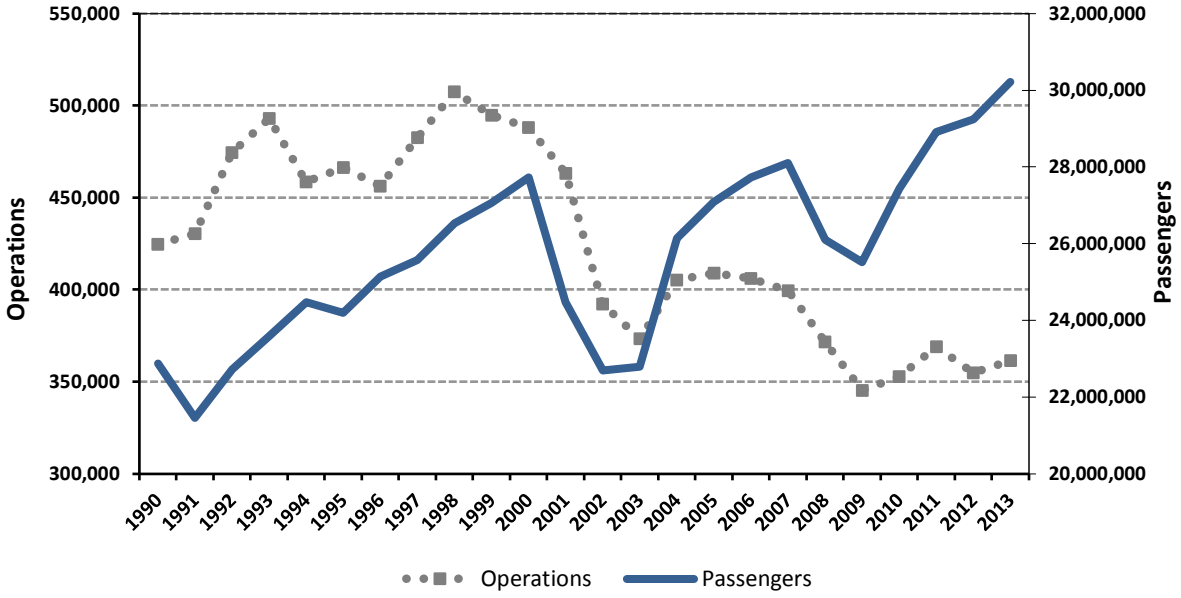
Figure 2.2 illustrates the historical passenger and aircraft operations activity levels at Logan Airport from 2000 to 2013. The following section provides 2014 updates where available. Notable changes in passenger, operations, and cargo activity at Logan Airport over the past few years include:

- The total number of air passengers at Logan Airport increased by 4.7 percent to 31.6 million in 2014, compared to 30.2 million in 2013, and increased 16.6 percent from 27.1 million in 2005. The 2014 passenger level represents a new record high for Logan Airport.
- The total number of aircraft operations[2] totaled 363,797 in 2014, an increase of 0.7 percent from 2013. This is well below the historic peak of 507,449 operations set in 1998.
- Airline efficiency continued to increase as the average number of passengers per aircraft operation grew from 83.6 in 2013 to 86.9 in 2014. At Logan Airport, the increasing number of passengers per flight reflects both a shift away from smaller aircraft as well as rising load factors as airlines have reduced or restricted capacity growth after several airline mergers.

1 Massachusetts Port Authority, *2012/13 Environmental Data Report (EDR) Boston-Logan International Airport* (EEA # 3247), December 2014.
2 An aircraft operation is defined as one arrival or one departure.

- In 2014, international passenger operations grew by nearly 10 percent. Logan Airport saw a significant increase in foreign carrier service and international operations.
- In 2014, combined air cargo volumes increased compared to 2013 by 8.8 percent to 585 million pounds.

Figure 2.2 Logan Airport Historical Passengers and Aircraft Operations, 1990-2013



Source Massport *2012/2013 Environmental Data Report (EDR) Boston-Logan International Airport* (EEA # 3247)

Notes: 2011 Passenger numbers revised to reflect changes in carrier reported figures.
Total annual passengers changed from 28,907,938 to 28,909,267.

2.4.2 International Passenger and Operations Activity Levels

The following sections describe the international passenger and operations activity levels at Logan Airport. Most international passengers arrive at Terminal E and clear customs and immigration through the Federal Inspections Services (FIS) facility[3], while some international passengers using air carriers such as Air Canada may depart from other terminals.

2.4.2.1 International Passenger Activity Levels

Logan Airport experienced robust growth in international passenger activity levels in 2013 and 2014 as airlines introduced new air services. In 2013, total international passengers increased by 3.7 percent over the prior year to 4.5 million, slightly exceeding the previous high level achieved in 2000. The number of international air passengers accelerated in 2014, growing by 9.8 percent to 4.9 million. **Table 2.1** illustrates these trends.

3 International passengers originating in Canada may pre-clear immigration prior to departure.

Table 2.1 Air Passengers by Market Segment, 1990, 2000, and 2009-2014

	1990	2000	2009	2010	2011	2012	2013	2014	Percent Change (2012-2013)	Percent Change (2013-2014)
Domestic	19,519,247	23,100,645	21,767,086	23,688,471	24,579,780	24,743,008	25,977,960	26,545,978	3.4%	3.8%
International	3,358,944	4,513,192	3,696,336	3,681,739	4,215,071	4,383,501	4545,799	4,992,225	3.7%	9.8%
Europe/ Middle East	n/a	2,948,542	2,605,825	2,672,635	2,939,226	2,896,002	2,901,529	2,943,698	0.2%	1.4%
Bermuda/ Caribbean	n/a	693,620	636,719	486,911	700,267	793,953	863,842	887,301	8.8%	2.7%
Canada	n/a	833,669	453,430	518,088	573,660	614,879	643,987	669,546	4.7%	3.9%
Asia/Pacific	n/a	37,451	0	0	0	78,484	104,235	170,867	32.8%	63.9%
Central/South America	n/a	0	362	4,105	1,918	627	32,425	70,402	5,071.5%	117.1%
General Aviation	n/a	112,996	48,664	58,752	114,416	109,134	94,872	96,242	(13.1%)	1.4%
Total Passengers	22,878,191	27,726,833	25,512,086	27,428,962	28,909,267	29,235,643	30,218,631	31,634,445	3.4%	4.7%

Sources: Massport *2012/2013 Environmental Data Report (EDR) Boston-Logan International Airport* (EEA # 3247), December 2014.
Massport Logan Statistics For 2014, https://www.massport.com/logan-airport/about-logan/airport-statistics/, 2015. Accessed March 24, 2015.
1 Averaged

International traffic accounted for 15.8 percent of total Logan Airport passengers in 2014. Europe and the Middle East was the dominant international destination market, accounting for 58.9 percent of international traffic in 2014. Passenger traffic to Europe/Middle East was up 1.4 percent in 2014, compared to an increase of only 0.2 percent between 2012 and 2013. The Bermuda/Caribbean region represented the second largest international market, accounting for 17.7 percent of international passengers in 2014. Air traffic within the Bermuda/Caribbean market increased by 2.7 percent in 2014, following an 8.8 percent increase in 2013. Canada accounted for 13.4 percent of international passengers in 2014. Other international traffic included Asia/Pacific traffic and Central/South America traffic. The Asia/Pacific and Central/South America regions accounted for 3.4 percent and 1.4 percent of total Logan Airport international passengers respectively in 2014.

2.4.2.2 International Passenger Operations and Service

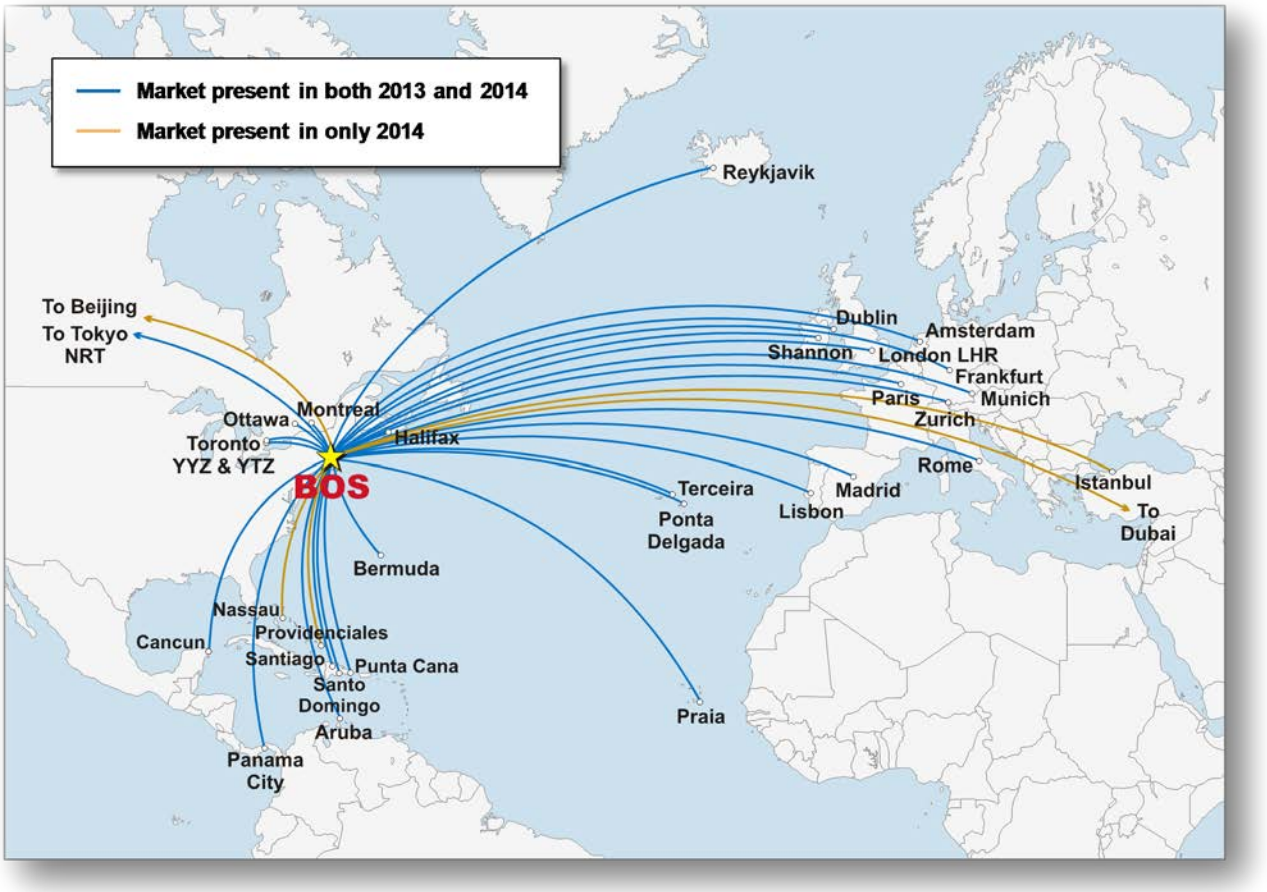
Total scheduled international passenger operations at Logan Airport decreased by a slight 0.6 percent in 2013 followed by a significant 6.0 percent increase in 2014. There were approximately 40,000 annual international passenger aircraft operations at Logan Airport in 2014, as summarized in **Table 2.2**. The Canadian market, Logan Airport's largest international destination region in terms of aircraft operations, decreased through 2013 and 2014 by 3.9 percent and 1.2 percent respectively. Passenger operations to the Europe/Middle East market decreased 2.6 percent in 2013, but rose 2.3 percent in 2014. The Europe/Middle East market remains the second largest international market in terms of operations and the largest in passengers. Operations to the Bermuda/Caribbean market increased significantly by 4.1 percent in 2013 and again by 5.9 percent in 2014. Logan Airport's scheduled international air service markets are shown in **Figure 2.3**.

Table 2.2 International Passenger Aircraft Operations by Market Segment, 2000, and 2009-2014

Category	2000	2009	2010	2011	2012	2013	2014	Percent Change 2012-2013	Percent Change 2013-2014
Scheduled	43,021	33,878	33,265	37,126	37,903	37,679	39,966	(0.6%)[2]	6.0%
Canada	26,067	14,815	16,399	16,290	16,787	16,125	15,920	(3.9%)	(1.2%)
Europe/Middle East	13,435	12,960	12,750	14,782	13,890	13,530	13,843	(2.6%)	2.3%
Bermuda/Caribbean[1]	3,205	6,103	4,116	6,054	6,752	7,031	7,450	4.1%	5.9%
Asia	0	0	0	0	474	646	1,002	36.3%	55.1%
Central/South America	314	0	0	0	0	347	688	n/a	98.2%
Total Scheduled International	43,021	33,878	33,265	37,126	37,903	37,679	39,966	(0.6%)	6.0%

Sources: Massport *2012/2013 Environmental Data Report (EDR)* Boston-Logan International Airport (EEA # 3247), December 2014.
Massport Logan Statistics For 2014, https://www.massport.com/logan-airport/about-logan/airport-statistics/, 2015. Accessed March 24, 2015.
1 Includes Puerto Rico and U.S. Virgin Islands.
2 Numbers in parenthesis ( ) indicate negative number.

Figure 2.3 International Non-stop Markets Served from Logan Airport, August 2013 and 2014



Source: Official Airline Guide Market Files/ Massport 2012/2013 Environmental Data Report (EDR) Boston-Logan International Airport (EEA # 3247), December 2014.

Changes to international passenger service at Logan Airport in 2013 and 2014 included the following:

- In 2012, jetBlue Airways expanded its service offering to the Caribbean adding new nonstop seasonal service to Grand Cayman (Cayman Islands) and increasing service frequencies to Providenciales (Turks and Caicos Islands), Punta Cana (Dominican Republic), St. Maarten, Santiago (Dominican Republic), and Santo Domingo (Dominican Republic). jetBlue Airways did not add any new Caribbean destinations from Boston in 2013. In 2014, jetBlue Airways expanded its service offering to the Caribbean and Central America, adding new nonstop service to Liberia (Costa Rica), Puerto Plata (Dominican Republic), and Saint Lucia, and increasing service frequencies to Santo Domingo.
- Japan Airlines' nonstop service to Tokyo Narita operated with the Boeing 787 Dreamliner, Logan Airport's first nonstop service to Asia and the first U.S. airport to receive regularly scheduled service with Boeing 787-Dreamliner aircraft.
- In 2013, Aer Lingus switched Shannon flight from Airbus A330-200 to recently acquired Boeing 757-200W aircraft. In 2014, Aer Lingus increased its Shannon service from five times weekly to daily service and also introduced some aircraft up-gauging on its Dublin service.
- Air Canada reduced nonstop service to Montreal from seven daily flights in 2012 to six daily flights in 2013.
- American Airlines discontinued three daily departures from Logan Airport to London Heathrow in 2013, and now only serves its five major hubs (JFK, ORD, MIA, DFW, LAX) with 32 daily flights. Seasonal non-stop service to Paris Charles De Gaulle is also offered in the summer with one daily flight.
- British Airways, a Oneworld Alliance partner with American Airlines, increased nonstop services to London Heathrow from three daily flights in 2012 to four daily in 2013.
- Copa Airlines introduced new nonstop service to its Panama City connecting hub in July 2013.
- Delta Air Lines reinstated summer season service to Paris Charles De Gaulle for the summer 2013 season. Delta Air Lines also has flights to London-Heathrow, as well as Amsterdam providing connections throughout Europe and the Middle East with its partner KLM. In 2014, Delta expanded its service offering to the Caribbean, adding new nonstop seasonal service to Nassau (Bahamas) and Providenciales (Turks and Caicos). However, some aircraft down-gauging on Delta's Bermuda route resulted in an overall decline in international seat capacity from the previous year.
- Icelandair increased its peak season services to Reykjavik from 14 weekly flights in 2012 to 18 weekly flights in 2013.
- Porter Airlines increased its service to Toronto from five daily departures during the 2012 summer season to seven daily peak season departures in 2013. In 2014, Porter Airlines increased its Q400 turboprop service to Toronto Island Airport by 7 to 10 weekly flights.
- Emirates Airlines introduced new daily non-stop service to Dubai in March 2014.
- Turkish Airlines introduced new daily non-stop service to Istanbul in May 2014.
- Hainan Airlines introduced new non-stop service to Beijing in June 2014.

2.4.2.3 Terminal E Historical Passengers and Operations Activity Levels and Gate Configurations

International operations at Logan Airport had reached a high of 4.5 million passengers in 2000, but the events of September 11, 2001 resulted in greatly reduced passenger volumes, with slow growth through 2012. Year 2000 international passenger levels were exceeded for the first time in 2013 with 4,546,018 passengers, with growth continuing into 2014 with 4,992,225 international passengers. Since 2000, Terminal E passengers have been accommodated with greatly increased efficiency with the construction of the new Terminal E Ticketing, Customs, and Arrivals Halls. Even as air passengers have increased, the number of flights has decreased due to the use of larger aircraft and more efficient passenger handling techniques. As shown in **Table 2.3**, in 2000, at Terminal E there were approximately 118 passengers per flight during the peak month of August; this increased to 139 passengers per operation for the same period in 2013 reflecting higher aircraft load factors, larger aircraft, and improved airline efficiencies. In 2013, over 4.5 million passengers were served at Terminal E.

Table 2.3 International Passengers and Operations

	Peak Month, August			Annual		
Year	Passengers	Operations	Passengers/ Operation	Passengers	Operations	Passengers/ Operation
2000	477,979	4,080	118	4,513,192	45,183	100
2012	495,394	3,696	135	4,350,597	37,994	115
2013	513,087	3,700	139	4,545,799	37,958	120

Source: Massport
Note: This data includes Air Canada/Air Canada Express flights that arrive and depart from Domestic Terminal B, Delta Airlines departures from Terminal A, American Airlines/US Airways departures from Terminal B, and JetBlue Airways departures from Terminal C. Delta, American, US Airways and JetBlue international arrivals deplane at Terminal E.

2.4.3 Airport-wide Forecast Passenger and Operations Activity Levels

As part of an ongoing strategic planning effort, Massport updated its passenger and operations forecast for two forecast horizons – 2022 and 2030. Massport has developed three forecast scenarios. Demand for passenger service, however, is determined by many external factors including economic growth, cost of travel, and demographic shifts. According to the medium-term scenario, Logan Airport's passenger traffic is forecast to reach 35 million annual passengers by the end of 2022 and nearly 40 million annual passengers by 2030. These forecasts are substantially lower than those developed in 1990, when it was anticipated that by 2010 Logan Airport would be serving between 37.5 million and 45.0 million air passengers.

For the purposes of this EA, the medium term scenario for Logan Airport is assumed, which will serve a projected 35 million annual passengers by 2022. The forecast demand of 35 million annual passengers by 2022 reflects an assumption that aircraft operations will increase, but will remain below historic highs as airlines will deploy larger Group VI aircraft rather than adding additional standard aircraft.

Massport's overall passenger forecast is consistent with the FAA's Terminal Area Forecast (TAF). The recently released TAF (released on February 2, 2015, and included in Appendix A) predicts that annual passengers using Logan Airport in 2022 would be 36.2 million and up to 42.9 million in 2030. Massport's forecasts for both those years are within 5 percent of the 2022 TAF and 10 percent of the 2030 TAF.

On the international passenger side, the rise in international travel among Boston's business and leisure passengers has helped fuel passenger growth at Logan Airport. This is consistent with Logan Airport's role of accommodating international and long-haul passenger service demand for the New England region and domestic passenger demand for greater Boston and Massachusetts. International traffic is growing at a faster rate than domestic traffic at Logan Airport with new non-stop service since spring of 2012 to Beijing, Tokyo, Dubai, Istanbul, Israel, and Panama City. As of March 2015, Logan Airport provides nonstop service to 44 international destinations. These routes have opened New England and Boston to hubs in Asia, the Middle East, and Latin America and are expected to bring an additional $735 million in annual economic impact to Massachusetts.

As part of planning for the growth of international travel into and out of Logan Airport, and proposed use of A380 aircraft and other Group VI aircraft by the airlines for the Boston market, Massport developed future passenger forecasts for Terminal E for the near-term (2017) as a basis for programming analysis. The following section outlines the passenger and operations assumptions used for determining future space needs and anticipated passenger and operations activity levels at Terminal E.

Based upon flight schedules of international carriers for 2013, anticipated new international carrier activity, and discussions with the airlines concerning their future operations, Massport prepared a future flight schedule to assist in establishing a basis for programming terminal functions for 2017. This flight schedule represents passenger airline flight activity for an average day in the peak month, and the resulting passenger numbers were further distilled to represent peak hour passenger activities. This schedule contains all of the existing and anticipated daily flights for the individual international airlines, including use of aircraft anticipated, aircraft seating, load factors, and arrivals and departures times.

From a planning and facility sizing perspective, the key timeframe to consider is the peak period, and particularly the peak hour for space programming of passenger throughput and processing requirements. Based on these data, a corresponding peak demand period was generated. These numbers represent the maximum number of people that would travel through Terminal E during the Airport's average peak (busiest) period, and serve as the basis for the detailed terminal facility requirements. The peak period demands for the future milestone years were applied to various terminal functions in order to assess the need for additional space within Terminal E, particularly in all of the passenger and baggage processing areas, for example, ticketing, passenger check point, outbound baggage screening and processing, Immigration and Naturalization Services processing, baggage claim, and Customs and Border Protection. This analysis also identified new terminal spaces needed for holdrooms, passenger circulation concourse, airline clubs, retail, sterile corridor, and other required spaces. To account for future growth beyond 2017, an anticipated growth rate of 1.5 percent per year, consistent with the FAA TAF, is extended out to a design year of 2022.

Table 2.4 shows existing (2013) and anticipated peak and annual passenger and operations for the Project for the planning years 2017 and 2022.

Table 2.4 International Forecast Passengers and Operations

	Daily Passenger / Peak Month, August			Annual		
Year	Passengers	Operations	Passengers/ Operation	Passengers	Operations	Passengers/ Operation
2013	16,551	119	139	4,545,799	37,958	120
2017	24,255	158	154	6,938,911	47,863	145
2022	39,102	224	162	11,342,966	69,709	163

Source: Massport
Notes: Forecasts for 2017 and 2022 derived from 2013 peak day schedule. Several international flights arriving at Terminal E will depart from other terminals. These data include Air Canada/Air Canada Express flights that arrive and depart from Domestic Terminal B, Delta Airlines departures from Terminal A, American Airlines/US Airways departures from Terminal B, and jetBlue Airways departures from Terminal C. Delta, American, US Airways and jetBlue international arrivals deplane at Terminal E.

Table 2.4 shows the actual 2013 daily passengers during the peak month of August and annual passengers and operations levels for 2013; also anticipated passenger levels for the planning year 2017 and 2022. During the peak month of August, there is predicted passenger growth and aircraft operations in 2017, with an increase of 7,703 daily passengers and 38 additional aircraft operations. **Table 2.4** also shows an increase in passengers per operation, indicating a trend to larger aircraft, such as the A380 and other Group VI aircraft.

2.5 Project Need

Massport must continue to provide flexible and convenient facilities for its passengers, tenants, and other Airport users. Based on an understanding of the changing airline industry and specific terminal configurations at Logan Airport, the following section describes the need for the Project. The Terminal E Renovation and Enhancements Project planning began with an airfield and terminal analysis undertaken to explore opportunities for accommodating Group VI aircraft in response to increased and anticipated use by international air carriers. Terminal E gates are not currently configured to efficiently deplane larger aircraft and holdrooms are not large enough to accommodate passengers waiting to board. This arrangement is an impediment to flexibility of gate allocation, a flexibility required by the commercial airlines in today's aviation market. Consideration was also given to space requirements and deficiencies of the existing terminal. Based on an understanding of the changing airline industry, requests from international air carriers, and the specific Terminal E configuration, the following sections describe the need for the Project.

2.5.1 Need for Terminal E Interior Area Improvements

Space requirements for Terminal E are a function of variables unique to Logan Airport as an active international destination. Generally, Terminal E has heavy peaking activities during the early to late evening period. Summer is typically the heaviest travel period for this terminal. Airline schedules and operating characteristics, peaking characteristics, and airport supporting activities are all important factors used to determine space requirements. Peak hour passenger activities, however, play the key role in determining most of the minimum space requirements.

Departure peaks affect the needed size of critical passenger processing areas such as ticketing, checkpoints, outbound bag rooms, passenger hold rooms, Federal Immigration Service (FIS) processing, and most

concessions areas – especially secure-side concessions. Arrival peaks determine the needed size of baggage claim areas, and even impact toilet room fixture counts. In addition to accommodating the anticipated Group VI aircraft, the Project will need to address the facilities within Terminal E that are currently outdated and already cannot handle current peak passenger volumes efficiently.

2.5.1.1 Passenger Holdrooms

Passenger waiting areas, or holdrooms, are sized based on the different aircraft types at the terminal gates and average seating capacity of aircraft serving each gate. The passenger holdroom area was calculated for planning purposes based on airline load factors (85 percent) at Terminal E. For the Project, it was assumed that 60 percent of the passengers are provided with seating, with 20 percent standing room assuming that the remaining 20 percent will be elsewhere in the terminal, typically at a food court or concessions, or in an airline club adjacent to the holdroom.

Currently the holdrooms in the terminal are inadequate. In the summer of 2014, the terminal was 1,100 seats short in the holdrooms, and by the summer of 2015, shortages are predicted to rise to 1,400 seats throughout the terminal. **Table 2.5** summarizes the key aircraft gate and passenger terminal area facility program requirements for the Terminal E Renovation and Enhancements Project to address current deficiencies as well as meet the needs for large aircraft accommodations.

Table 2.5 Terminal E Renovation and Enhancements Project - Space Program Facility Requirements[1]

Building Use	Existing Terminal E	Future Required Program[1]
Aircraft Gates	12 Gates	12 Gates, incl. VI capable
Holdrooms	36,870 sf	59,908 sf
Concessions / Retail	31,240 sf	38,000 sf
Airline Passenger Clubs	24,600 sf	54,600 sf
Toilet Facilities	8,625 sf	14,000 sf
Circulation – Secure Concourse	35,000 sf	62,000 sf
Circulation – Sterile Corridor	13,500 sf	30,000 sf
Circulation – Aircraft Boarding Cores	NA	22,300 sf
Mechanical / Support	NA	10,000 sf

sf Square Feet
1 Based on industry standards and Massport Requirements.

2.5.1.2 Additional Passenger Amenities: Airline Ticketing/Baggage Handling, Airline Clubs, Baggage Claim, Passenger Security Checkpoint, Baggage Screening, Public Space, Concessions

Four major passenger processing areas are contained within Terminal E; outbound passenger processing areas include Passenger Ticketing and Passenger Security Check Point; inbound passenger processing includes two customs and immigration service areas. Each of these facilities is already currently insufficient to handle peak passenger volumes efficiently, and outdated terminal technology further diminishes the efficiency of terminal operations and passenger experience.

Terminal E has a ticketing hall with 108 ticket counter positions, 92 of which are passenger-oriented contact counters for customer-service and check-in. These ticket counters are designed to be "Common Use Terminal Equipment" so that they can be used by any international airline carrier; this provides flexible efficient use of the ticketing positions, eliminating redundancy and inefficient use of space in the ticketing hall. Streamlining and efficiency trends in ticketing administration and processing technology have improved passenger processing; consequently, the projected demand in 2017 is 74 ticketing positions. There are adequate ticket positions for processing passengers, but only if Common Use provisions are utilized throughout the existing ticketing positions. An increase in agent staffing will contribute to a more efficient ticketing process.

The existing Passenger Security Screening Checkpoint consists of seven lanes, with approximately 3,170 square feet of queue space. With the existing seven lanes, the current average maximum passenger processing wait time is 24 minutes. International Air Transport Association target wait times are 10 minutes. With a greater number of passengers carried by large aircraft departing during the peak period, there is a need for greater throughput requiring eight lanes for an 11-minute average wait time, or nine lanes for a seven-minute wait time, assuming 150 passengers per hour per lane throughput, with all lanes open at the beginning of the peak period.

With the proposed increase in use of larger aircraft, there is also a need to provide more facilities on the post-security side of Terminal E to improve passenger convenience. Currently there are inadequate concessions for international customers within Terminal E. With larger volumes associated with Group VI aircraft there will also be increased peak demand for airline clubs, retail/concessions as well as passenger processing facilities such as baggage claim and a sterile corridor to INS.

Currently the terminal technology and systems are outdated, baggage handling systems are over capacity, and CBP facilities need improvements to accommodate new technology and processing. Transportation Security Administration (TSA) baggage screening areas are required to be designed in accordance with Department of Homeland Security (DHS) guidelines and design standards, including *Recommended Security Guidelines for Airport Planning, Design, and Construction* and *Security Checkpoint Layout Design/Reconfiguration Guide*.[4],[5]

2.5.2 Need for Terminal E External Area Modifications

Currently the gates at Terminal E cannot accommodate enplaning or deplaning the A380 aircraft and other Group VI aircraft because of the configuration of jet bridges associated with this type of aircraft. The upsizing of the international fleet also creates space conflicts within the existing apron and ramp areas at Terminal E. Parking Group VI aircraft requires more wingtip clearance areas and jet blast setbacks than with the existing fleet regularly serving Logan Airport. The ramp space at Terminal E is not currently configured to safely maneuver an A380 to the gate area.

2.5.2.1 Gates

The largest existing gates at Terminal E currently accommodate Group V aircraft, the largest being the Boeing 747-400 aircraft, which came into sevice in 1988. Now there is a demand to provide gates for Group VI aircraft, the largest being the Airbus A380 and the Boeing 747-8. The geometry, jet bridge placement, and adjacent apron areas of the existing gates will not accommodate these Group VI aircraft.

4 Transportation Security Administration, *Recommended Security Guidelines for Airport Planning, Design, and Construction*, May 1, 2011.
5 Transportation Security Administration, *Security Checkpoint Layout Design/Reconfiguration Guide*, March 10, 2011.

The A380 superjumbo jet is larger than any other commercial aircraft, with a length of 240 feet and a wingspan of 262 feet. The aircraft is 80 feet high, with two passenger decks. It requires at least two jetbridges and up to three connections to serve the dual passenger levels. The A380 can carry a maximum of 853 passengers, but is more commonly configured to carry 555. It is currently flown by several international carriers, including Air France, British Airways, Emirates, Lufthansa, Qantas, Singapore Airlines, and Thai Airlines. British Airways and Emirates have A380s in their fleet and have expressed interest in providing A380 service at Logan Airport once the facilities and airfield can safely and efficiently serve Group VI aircraft. The current configuration of the gates at Terminal E is not designed to have two passenger bridges and cannot accommodate the dual bridges associated with A380 configurations. Massport has identified three gates at the west end of Terminal E, gates E7B, E8A, and E8B that would be most suitable to convert to be compatible with the A380 and other wide-body aircraft.

2.5.2.2 Aircraft Apron and Ramp

The apron needs to be restriped so that the A380 and other Group VI aircraft can be accommodated at existing gates E7B, E8A, and E8B. Accommodating the diagonal placement of an A380 at Gate E7B (with the advantage of greater apron depth within the existing service road) would interfere with the simultaneous occupancy by an aircraft at Gate E7A, typically occupied by a B747-400. This placement would force the aircraft occupying Gate E8A further south, eliminating use of Gate E8B, except by a Group III or much smaller aircraft. To modify Gate E8A to accommodate A380 would result in the aircraft interfering with the service road alignment, but the wingtip clearances would have less impact on an aircraft parked at Gate E7B. However, with an A380 in this position, the use of Gate E8B would be eliminated. Thus to accommodate improvements at gates E7B, E8A, and E8B, restriping of the aircraft apron depth would be required.

2.5.3 Need for Airfield Improvements

Logan Airport is also constrained by airfield conditions that do not meet current FAA standards for Group VI aircraft, primarily due to the aircraft's larger wingspan. In 2011, Massport undertook an airfield analysis to identify existing conditions of runways and taxiways that do not meet FAA standards to accommodate the new A380 aircraft. The study determined that Runway 4R-22L is long enough to accommodate the A380s and due to its instrument landing system rating, was recommended as the primary runway for A380 operations.

Runway 15R-33L is also long enough to accommodate A380s, although does not fully meet design guidelines for runway and stabilized shoulder width set forth in FAA Engineering Brief 65A. The primary taxiways used to access Runways 4R-22L and 15R-33L have centerline radii and fillets that do not meet standards for this size aircraft. Currently FAA has approved restricted access for diversionary landings only for A380s at Logan Airport. Takeoff weight can be restricted due to runway length and accounting for weather and distance to destination, but landing weight is unrestricted. The airfield runway lengths are expected to be adequate to handle Group VI aircraft with these operational restrictions, while selected runway shoulder and taxiway widths will have to be modified. Additional airfield elements, including electrical equipment, signs, pavement markings, and existing lighting would need to be reconfigured. In addition, aircraft ground movements accessing Terminal E are challenged today due to the compact nature of Logan Airport's airfield, and will become more constrained as operations increase and with the anticipated accommodation of new large aircraft such as the A380 or the 747-8. Modifications including stablizing of runway shoulders, and taxiway fillets will

be required to address these restrictions. Regularly scheduled service of the A380 aircraft will not be possible without physical improvements to the airfield.

Tables 2.6 and **2.7** compare existing dimensions of airfield elements to design standards required to accommodate Group VI aircraft for landing, takeoff, and taxiing.

Table 2.6 Runway Requirements for Aircraft Design Group VI Operations (feet)

Runway	ADG VI Design Standard (feet)	4R	22L	4L	22R	15R	33L
Runway Length[1]	10,990	10,005[1]		7,864		10,083[1]	
Runway Width	200	150		150		150	
Shoulder Width	40	75	55[2]	50	50	35[3]	75
Total Runway Width	280	300	260	250	250	220	300
Landing Distance Available	7,000[1]	8,851	8,806	7,861	7,046	9,202	10,083
Blast Pad Length	400	400	200	1,250	200[4]	193	660
Blast Pad Width	280	300	220	220	170[4]	220	300
Distance to Holding Position	280	280	280	250	240	280	280
Distance to Parallel Taxiway	500/550	935	1,000	400	500	400	500
Distance to Aircraft Parking Area	500	n/a	n/a	800	n/a	1,750	n/a

1 Operational requirement – dimensions of runway lengths meet the requirements for the expected service.
2 Shoulder width between Runway 22L end and Runway 33R intersection is 55 feet and the remainder is 75 feet.
3 Shoulder width west of Runway 4R-22L intersection is only 35 feet.
4 Runways with Visibility minimums of <1/2SM require 550 feet of separation.
5 Runway 22R has EMAS and an 820-ft displacement.
Notes: Conditions that are deficient are shown in bold text. The airfield study determined that Runway 4R-22L is long enough to accommodate the A380s and due to its instrument landing system rating, was recommended as the primary runway for A380 operations. Runway 15R-33L is also long enough to accommodate A380s, although it does not fully meet design guidelines for runway and shoulder width set forth in FAA Engineering Brief 65A.

Table 2.7 Taxiway Requirements for Aircraft Design Group VI Operations (feet)

Component	Group VI Design Standard	Existing Taxiways									
		B	C	D	E	F	N3	N	M	P	R
Taxiway Width	82	100	100	100	100	100	100	100	100	100	100
Shoulder Width	40	35	35	35	35	35	35	35	35	35	35
Centerline Separation between Runway and Taxiway	324	249	547	547	NA	382	NA	NA	NA	NA	NA

1 Potential Taxiways used for A-380 operations

2.6 Summary

The Project is intended to provide accommodations for larger aircraft in response to aviation industry trends and market demand. Massport's intent is to provide greater flexibility in gate and terminal facility usage while enhancing passenger experience and accommodating current and near term changes in the airline industry. The introduction of regularly scheduled Group VI operations at Logan Airport would require reconfiguring interior and exterior areas of Terminal E and improvements to the airfield.

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3 Alternatives and Proposed Action

3.1 Introduction

As required by the National Environmental Policy Act (NEPA), this chapter describes the alternatives considered for the Terminal E Renovation and Enhancements Project. Both terminal and airfield alternatives are summarized including the No-Action Alternative.

As discussed in Chapter 2, *Purpose and Need*, the purpose of the Terminal E Renovation and Enhancements Project is to:

- Accommodate the current and near term aircraft fleet mix of international airline carriers, including larger aircraft such as the Airbus A380 (A380) and Boeing 747-8;
- Improve terminal and airfield safety and efficiency; and
- Enhance passenger service and convenience.

The Proposed Project includes three key elements; Terminal E (the "Terminal") interior improvements, Terminal E exterior improvements, and airfield improvements. The Project aims to improve airport flexibility and accommodate Group VI use by converting three existing gates at Terminal E to be capable of accommodating A380 or other large aircraft; these gates are E10 (7B), E11 (8A), and E12 (8B). All other gates at Terminal E will also be renumbered. On the airfield, limited runway shoulder and taxiway fillet modifications are planned to accommodate Group VI ground operations. All full-build terminal alternatives studied would provide new passenger holdrooms, an extended public concourse, vertical circulation cores, three new passenger clubs, and new restrooms. The Project would also include a renovated security checkpoint to improve passenger throughput and an enhanced concessions program.

Massport evaluated alternatives according to their ability to meet the Project purpose and need, as well as practical considerations such as program requirements, layout efficiency, total new square footage of building, new impervious surfaces, cost, and constructability.

Over the past seven years, 17 new international destinations have been added at Logan Airport, seven of which were added between 2014 and 2015. The size of the aircraft in the international fleet is increasing, with several airlines moving to Group VI aircraft such as the Airbus A380 or Boeing 747-8. These aircraft carry larger volumes of people and can therefore move passengers more efficiently without increasing the number of operations at the Airport. Use of these larger more efficient aircraft will allow airlines to continue to meet the demand for international travel without increasing overall number of aircraft operations. Accommodating

regular Group VI service at Logan Airport requires modification to several areas of Terminal E and the airfield at Logan Airport including:

- Modifying interior spaces within Terminal E to provide holdrooms and services for larger numbers of passengers departing or arriving at one time;
- Modifying the exterior facilities (including gates) at Terminal E to provide gates that can efficiently de-board larger aircraft (for example, two boarding bridges for upper and lower decks of the A380 aircraft) and apron areas that can accommodate Group VI aircraft parked at the gate;
- Remedying existing interior deficiencies at Terminal E; and
- Modifying the airfield in accordance with FAA standards to allow Group VI aircraft, with considerably larger wingspan clearance requirements, adequate space to maneuver on the ground.

Massport's goal is to provide Terminal E facilities and airfield conditions that are flexible enough to accommodate these changes and market demands. While this project is not intended to remedy all existing and projected needs at the international terminal, it is intended to provide the physical capability of accommodating larger aircraft and their passenger loads at Terminal E in a timely manner. In September 2013, Massport initiated a feasibility study of Terminal E that analyzed existing facilities and building systems, and evaluated several alternative concepts for accommodating two A380 aircraft arrivals at two existing, but reconfigured, gates. Later, as the project evolved and additional airlines expressed interest in using A380s at Logan Airport, the alternatives considered reconfiguring up to three gates to accommodate a Group VI aircraft. The feasibility study found that Terminal E had inadequate holdroom sizing, gate facilities, concessions, and clubs, and that the existing technology and systems at Terminal E are outdated, baggage handling systems are over capacity, and passenger processing facilities are inadequate to handle passenger volumes. Based on projected airline future schedules, during the peak period, two A380 aircraft would be on the ground, with one departing during the peak. Currently, international Terminal E gates cannot accommodate the two boarding bridges required to access the upper and lower decks of the A380, nor can the holdrooms and passenger processing facilities accommodate additional passenger activity levels; the airfield also requires upgrades.

3.2 Planning Metrics, Facility Requirements, and Design Assumptions

The following sections discuss the planning metrics, facility requirements, and design assumptions necessary to accommodate Group VI regularly scheduled service such as the A380 and Boeing 747-8. The planning standards and requirements that have shaped the development of the proposed alternatives followed guidance from Federal Aviation Administration (FAA), Transportation Security Administration (TSA), and Department of Homeland Security (DHS). Massport also considered aviation industry best practices, Massport's internal requirements, airline needs, and Project-specific parameters during the development of the alternatives.

3.2.1 Planning Metrics

As discussed in Chapter 2, *Purpose and Need*, a combined 2014 flight schedule was prepared by Massport from existing international schedules to establish the projected peak August 2017 schedule. The summer 2017 peak represents the highest likely seasonal usage of the international terminal with the anticipated Group VI aircraft operating in the fleet. The future 2017 condition was the basis for determining terminal facility requirements

and sizing for the proposed alternatives. In addition to considering the future schedule, space requirements for Terminal E also considered Logan Airport-specific variables and peaking characteristics. Key passenger processing areas considered in the alternatives analysis included: ticketing, checkpoints, outbound bag rooms, passenger holdrooms, concession areas, baggage claim, and restrooms. The following sections outline the planning metrics used to develop alternative concepts to accommodate regular service by Group VI aircraft at Terminal E.

Each of the alternatives described accommodates the program requirements, but to differing levels of configuration, adjacency, and efficiency. Airfield planning and design standards are described following the terminal considerations.

3.2.2 Sustainability Design Standards and Guidelines

The Project will be built to Leadership in Energy and Environmental Design (LEED®) and Massachusetts LEED Plus standards, to achieve LEED Silver or higher certification for the newly constructed portion of the Terminal. In addition to considering LEED practices, the Project design team consulted Massport's Sustainable Design Standards and Guidelines for projects in Massport's Capital Program.1 The Project will be consistent with Massport's overall sustainability program, which includes diverse sustainability initiatives ranging from facilities maintenance to innovative partnerships and public incentives. The standards are tailored to Massport's operations, facilities, and geography, and are intended to be used by architects, engineers, and planners working on capital projects for Massport. The standards apply to both new construction and rehabilitation projects (building and non-building) of any square footage or monetary value and may also be used on tenant alterations or development projects on Massport property.

3.2.2.1 Terminal Area Requirements

The Terminal E facility must present an efficient layout of required program elements, efficient and intuitive passenger circulation, and conveniently placed passenger amenities. Implementation of the improvements must be conducted in a manner that maintains existing aircraft and Terminal operations, with little disruption to existing passenger processing and movements within the Terminal spaces. Terminal area requirements include:

- Three reconfigured aircraft gates capable of accommodating Group VI aircraft, including the A380 and 747-8. Each reconfigured gate would be equipped with two boarding bridges to access the upper and lower decks of the aircraft;
- Reconfigured apron to provide room for larger aircraft footprints;
- New passenger holdroom (boarding lounge) areas to accommodate seating and gate/podium queues for simultaneous boarding of future Group VI aircraft while maintaining required seating for the mix of aircraft at other existing international gates;
- Reconfigured and expanded passenger checkpoint within the existing Terminal to improve passenger throughput;
- Enhanced concessions and retail spaces to serve arriving and departing passengers;

1 Massachusetts Port Authority. *Logan Airport Sustainable Design Standards and Guidelines – Version 1*, June 2009.

- Three new airline clubs serving the passengers boarding at the three reconfigured gates;
- New toilet facilities; and
- Improved internal circulation and support spaces;

No enhancements are expected to be made to the curb areas as part of this Project. Curb improvements, which consist primarily of operational changes, are currently underway to address existing conditions. These improvements will be in place prior to the opening of the Proposed Project.

Planning Metrics - Terminal E Interior

Massport undertook terminal space programming to establish gross size requirements for various functional components of the Terminal E facilities necessary for efficient future airport operations (see **Table 3.1**). Conceptual layouts undertaken to date have been based on a set of requirements sufficient to assess alternatives.

Over the past several decades, specific planning metrics have evolved within the airline planning community and FAA that define various terminal functions, including: the number of ticketing positions and queuing; throughput rates and passenger screening requirements at security checkpoints; the loading factor of gated aircraft and their impact on holdroom sizing and number of seats provided; and baggage claim frontage and queuing. Airlines have also developed their own specific planning metrics based on their business models. Specifically, the FAA Advisory Circular 150/5360-7, Planning and Design Considerations for Airport Terminal Building Development, provides guidance in the design of airport terminals, specifically for origin and destination (O&D) airports such as Logan Airport.[2] The guidelines for O&D airports are general in nature and the principles apply to terminal development; these guidelines are used for general planning parameters in the proposed alternatives described below.

In 2000, Massport also adopted its own Terminal Improvement Design Guidelines that were used for the design and construction of the then new Terminal A for Delta Airlines, and are intended to guide all future terminal design and improvements. These guidelines, in conjunction with standard industry practices and airline standards, have directed terminal planning at Logan Airport since their adoption. While not prescriptive in every area of terminal programming and planning, they offer qualitative guidelines and metrics for the gate holdrooms.

Table 3.1 summarizes the key aircraft gate and passenger Terminal area facility program requirements for the Terminal E Renovation and Enhancements Project to address current deficiencies as well as meet the needs for Group VI accommodations.

2 Federal Aviation Administration, Advisory Circular 150/5360-7, *Planning and Design Considerations for Airport Terminal Building Development*, April 22, 1988.

Table 3.1 Terminal E Renovation and Enhancements Project - Space Program Facility Requirements[1]

Building Use	Existing Terminal E	Future Required Program[1]
Aircraft Gates	12 Gates	12 Gates, incl.Group VI capable
Holdrooms	36,870 sf	59,908 sf
Concessions / Retail	31,240 sf	38,000 sf
Airline Passenger Clubs	24,600 sf	54,600 sf
Toilet Facilities	8,625 sf	14,000 sf
Circulation – Secure Concourse	35,000 sf	62,000 sf
Circulation – Sterile Corridor	13,500 sf	30,000 sf
Circulation – Aircraft Boarding Cores	NA	22,300 sf
Mechanical / Support	NA	10,000 sf

sf Square Feet
1 Based on industry standards and Massport Guidelines.

Planning Metrics - Terminal E Exterior

Massport analyzed multiple scenarios attempting to optimize aircraft combinations on the available Terminal E apron space and to provide flexibility for future operational conditions. Three existing gates, Gates E10 (7B), E11 (8A), and E12 (8B), were evaluated for their ability to accommodate A380 and other wide body aircraft. Only these gates could accommodate Group VI aircraft without negatively impacting the taxiway system. The reconfigured A380 capable gates would also be capable of accommodating 747-8 and 747-400 aircraft. No new gates are proposed in any of the Action Alternatives.

Alternate layouts for the three reconfigured gates were explored. To determine aircraft gate allocation and parking positions (gate programming), the alternatives analysis considered the future aircraft fleet mix and total number of aircraft that would need to be serviced concurrently. To derive the future fleet mix and total number of parked aircraft, Massport analyzed the combined airline schedule for all current and projected international flights at Terminal E (for the peak demand period). Massport, through discussions with air carriers, evaluated the inclusion of A380 and 747-8 aircraft in the future fleet mix. The peak arrivals period used for the alternatives analysis included flights arriving between 3:00 PM to 5:00 PM and departing between 7:00 PM to 9:00 PM.

Massport used the following assumptions in developing the alternatives:

- The existing number of gates will be retained but upsized to better accommodate Group VI operations;
- The fleet mix would include A380s, A340s, A330s, A320s, 747-8s, 747-400s, 777s, 767s, 757s, and 737s;
- Aircraft nose clearances will be no closer than 40 feet to the Terminal face and wingtips will be positioned no closer than 20 feet;[3]
- All ground service equipment (GSE) was considered for each specific aircraft type; and
- Airside vehicle service roads would be provided for baggage and ground service equipment movement.

3 Massport Design Guideline

In addition to analyzing aircraft parking positions adjacent to the Terminal, the design team evaluated the parking positions in relation to the various FAA surfaces[4] to determine if any aircraft components, specifically the tail height, penetrated these surfaces.

3.2.2.2 Planning Metrics Airfield

During development of project alternatives, consideration was also given to airfield requirements to accommodate Group VI aircraft during landing, taxiing, and take-off. The existing airfield conditions at Logan Airport do not satisfy Group VI design standards per FAA AC 150/5300-13A (Change 1). This guidance sets minimum clearances, landing, and take-off requirements for aircraft on runways and taxiways, classifying A380 aircraft within Aircraft Design Group VI for runways, and Taxiway Design Group 7. The airfield must be capable of routinely, safely, and efficiently accommodating Group VI aircraft, including the A380 and 747-8. According to FAA Engineering Brief 65A, A380 operations are sustainable on a 150-foot wide runway with 35 feet of stabilized shoulders on each side (a total width of 220 feet) if a Foreign Object Debris (FOD) inspection is conducted after each A380 operation. However, if an existing 150-foot wide runway maintains 50 feet of stabilized shoulders on each side (a total width of 250 feet) then no FOD inspection is required. In this instance, the Airport would have to file a Modification to Standard (MOS) request if Airport Improvement Program (AIP) or Passenger Facility Charge (PFC) funding is used.

3.3 Project Alternatives

The following sections describe and evaluate the proposed build alternatives for each Project component and the No-Action Alternative. The alternatives include renovation and enhancements to the interior and exterior Terminal E facility and alternatives for improvements to the airfield. Alternatives were assessed based on their ability to meet the Project purpose and need and the following evaluation criteria: program requirements, layout efficiency, total new square footage of building, impervious surfaces, and constructability.

3.3.1 No-Action Alternative

This section describes the No-Action Alternative for the interior and exterior Terminal area and the airfield. Under the No-Action Alternative, Group VI aircraft would be scheduled as part of future fleet mixes for several airlines. However, there would be no physical improvements to the internal or external Terminal facilities, nor the airfield to accommodate the larger aircraft. Under the No-Action alternative the airfield conditions would not meet FAA operational design standards, and would require use of runways as taxiways, operational procedures limiting aircraft weight, and restrictions of perimeter road usage during taxiing.

Currently, the FAA has approved restricted access for the A380 at Logan Airport, only for diversionary landings. Although A380 aircraft have successfully landed at Logan Airport, procedural requirements negatively impact ground operations. An A380 landing at Logan Airport requires a FOD runway inspection prior to any other aircraft arrival or departure, severely straining ground operations at an already busy Airport. This scenario would prevent efficient and flexible operations would result in delays and would significantly

4 Horizontal, conical, and primary airport imaginary surfaces are established in relation to the airport and each runway per 14 CFR part 77.

diminish the passenger experience at Logan Airport. The FAA will not allow regularly scheduled A380 service without physical improvements to the airfield.

Terminal E, as it currently exists, has inadequate facilities to accommodate the requirements associated with anticipated aircraft fleets (Group VI aircraft), and associated peak passenger volumes and handling. In addition, passenger handling associated with Federal Inspection Services (FIS) and Customs and Border Protection (CBP) have changed, and Terminal E facilities need to be upgraded. The No-Action Alternative is discussed in the following sections, organized by interior Terminal areas, exterior Terminal areas, and the airfield. The No-Action Alternative would include improvements in existing conditions at the curb that are unrelated to the Proposed Action.

The No-Action Alternative would result in low levels of customer service and diminished passenger experience and the facility would not be able to adequately accommodate the future aircraft fleet mix. Terminal E should be a welcoming facility for passengers, as the first point of entry to the United States and the last point before departure. The No-Action Alternative does not satisfy the Project purpose and need.

3.3.1.1 No-Action Alternative: Terminal E Interior Areas

There would be no significant changes to Terminal E interior facilities under the No-Action Alternative, however there may be some cosmetic upgrades to the Terminal or energy-related upgrades as part of Massport's ongoing sustainability initiatives. Internal renovation and modifications may take place as part of ongoing facility upgrades that occur periodically at all terminals. Even with these potential modifications, the Terminal facility would remain inadequate and would not meet the Project purpose and need.

Terminal E interior facilities are inadequate for passenger experience and efficiency, particularly the throughput capability at the security checkpoint, the quantity and quality of concessions, and the availability of adequate holdroom seating. As discussed in Chapter 2, *Purpose and Need*, the existing Terminal technology and systems are outdated, baggage handling systems are over capacity, and CBP facilities need improvements to accommodate new technology and processing. Under the No-Action Alternative, new passenger amenities would not be provided. However, improvements could be made to renovated areas within the existing Terminal, special passenger seating areas could be provided, and way-finding upgrades could be introduced. Certain passenger processing enhancements could be achieved through operational changes. For example, there are currently adequate ticket positions for processing passengers; an increase in agent staffing would contribute to more efficient ticketing in the Terminal, however this is not a critical constraint.

3.3.1.2 No-Action Alternative: Terminal E Exterior Areas

The only modifications that would occur under this alternative are those already planned as part of Airport improvements, including curbside improvements (unrelated to the Proposed Action) as described below.

Separate from the Proposed Project, and prior to commencing construction or prior to 2017 peak conditions, Massport is putting in place improvements to the Terminal E curb and associated short-term parking areas. Improvements include shifting shared vans and private car service vehicles from the second curbside to the Limousine Lot, modifying the Limousine Lot layout to increase capacity, and relocating the Limousine Lot egress. The Limousine Lot layout modification will provide six shared van spaces, three stretch limousine spaces, and 40 limousine spaces. The relocation of the Limousine Lot egress allows lot vehicles to exit

Terminal E via the first curbside roadway. This modifies the existing condition where the limousines currently exit via the second curbside roadway. Massport will also convert Terminal E Lot 1 into short-term parking to help promote parking and decrease the number of recirculating passenger pick-up vehicles. The impact analysis and additional information on curbside improvements are discussed in Chapter 4, *Affected Environment* and Chapter 5*, Environmental Consequences and Mitigation.*

3.3.1.3 No-Action Alternative: Airfield Areas

Under the 2017 No-Action Alternative, no physical changes or enhancements would be made to the Logan Airport airfield, with the exception of an A380 FAA operations accommodation to allow a diversionary A380 landing with operational constraints. After each A380 departure or arrival, a FOD inspection is required before any other aircraft may land or depart, triggered by inadequate runway shoulder width. This inspection adds time between aircraft operations, and burdens airport operations inspection staff. Taxiing operations with an A380 would be additionally constrained by inadequate fillet widths for cockpit over centerline steering.

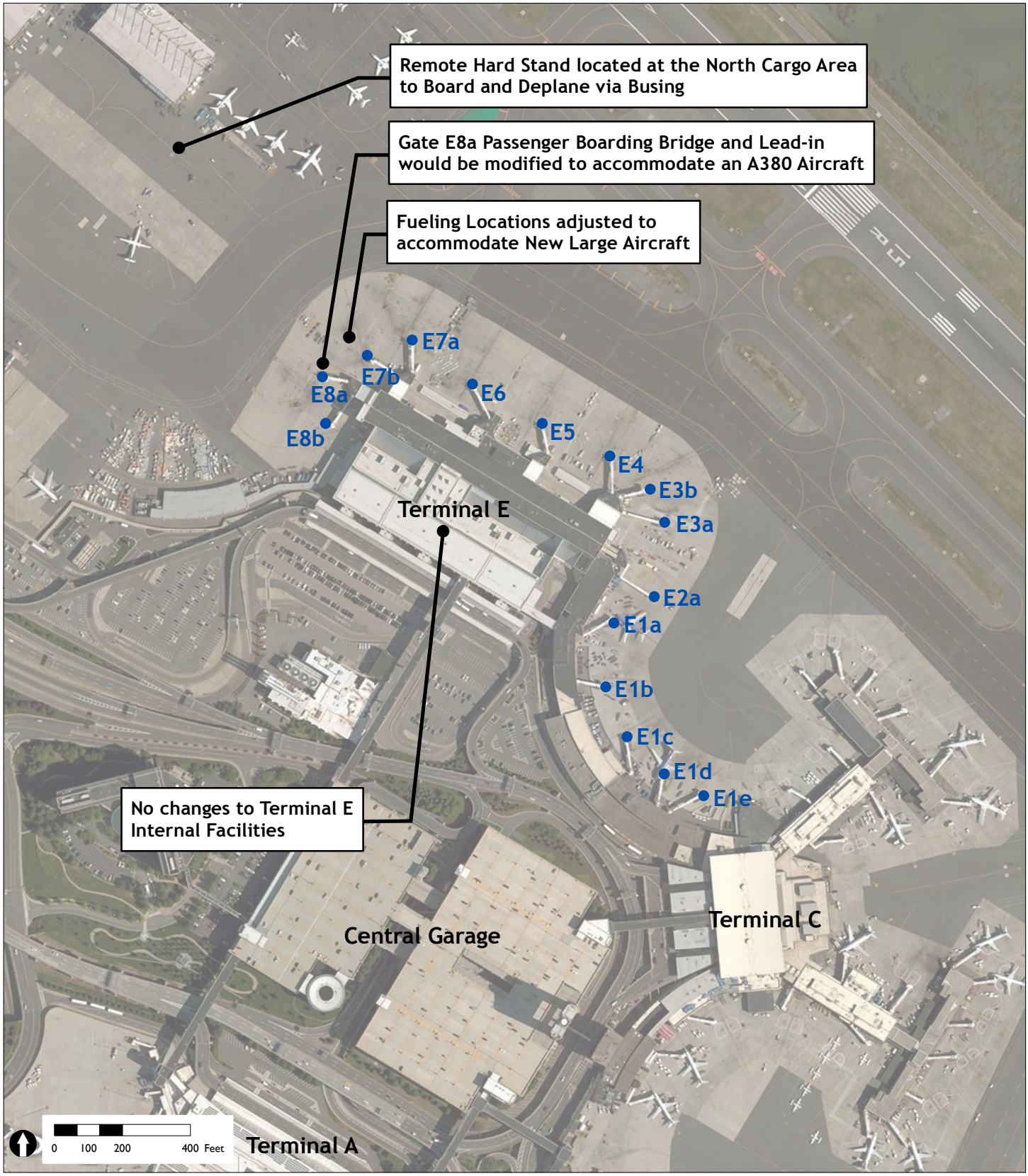
Under the No-Action Alternative, when an A380 is on the airfield, other aircraft operations would be affected due to taxiway closures. These would have to be mitigated through careful coordination with other aircraft for the period that the A380 aircraft is taxiing. Some adjacent taxiways and portions of the perimeter road may become unusable, and general aircraft traffic flow would be greatly affected due to Logan Airport's compact layout. Without widening of the turning radii on taxiways, pilots of the large aircraft would be required to visually estimate the turns (rather than aligning the nose of the aircraft with painted centerlines), increasing the potential for aircraft to taxi off the paved surfaces.

If no modifications are made to the taxiway adjacent to Gate E11 (8A) to accommodate Group VI aircraft, the possibility of remote parking a 747-8 or A380 aircraft, if necessary, would be impossible due to required wingtip clearance needed to pass by another Group VI aircraft. The North Cargo apron would be unusable by these aircraft and other areas of the airfield, farther from Terminal E, would have to be used. Airlines would be restricted from regularly scheduled landings of Group VI aircraft at Logan Airport and would be required to use smaller aircraft, potentially increasing the total number of operations in order to meet increasing international demand. This would negate any benefit that comes from accommodating additional passengers in the same number of aircraft operations. Since operational restrictions do not allow regularly scheduled A380 operations without physical improvements to the airfield, the No-Action Alternative does not meet the purpose and need.

3.3.2 Minimal Action Alternative

This section describes the Minimal Action Alternative which includes improvements to Terminal E exterior areas (i.e., gate, apron, ramp) and airfield. This alternative does not involve any improvements to the interior areas of Terminal E, and would provide only one gate capable of servicing an A380 aircraft. **Figure 3.1** shows the improvements associated with the Minimal Alternative. This Alternative was developed as the least amount of new construction necessary to accommodate large size aircraft.

Path: \\mawatr\EV\12848.00 AECOM-Terminal E\GIS\Project\3.1_No-Action Alternative.mxd



Source(s): MassGIS 2008 15cm Aerial

Figure 3.1

Minimal Action Alternative, Terminal Area

TERMINAL E RENOVATION AND ENHANCEMENTS PROJECT
Boston-Logan International Airport
East Boston, Massachusetts

3.3.2.1 Minimal Action Alternative: Interior Areas

Similar to the No-Action Alternative, the Minimal Action Alternative would not improve interior areas of the Terminal. Passenger holdrooms would not be capable of accommodating the number of passengers boarding an A380 or 747-8 aircraft. In this alternative, one gate would be upgraded to be A380 capable. Since these Group VI aircraft will be using Logan Airport under the Minimal Action Alternative, holdrooms would be severely overcrowded. The existing deficiencies within the Terminal would not be addressed.

3.3.2.2 Minimal Action Alternative: Exterior Areas

This alternative represents the minimal improvements required for making exterior areas of Terminal E capable of accommodating one A380 or 747-8 for direct boarding.

Gates

Only one existing gate, Gate E8A would be modified to be capable of servicing the larger aircraft for direct boarding from the Terminal. The NLA would be accommodated by adding an A380/747-8 lead-in line[5] south of the current Gate E8A line. The passenger boarding bridge would be modified to allow passengers to deplane from the bi-level aircraft exits. Currently at Terminal E, there are 12 gates, and the terminal processes all international arrivals through the Federal Inspections Services facility. As part of the Terminal C to E Connector Project, gates E1C, E1D, and E1E will remain as domestic gates as part of Terminal C. Gates E1A and E1B will remain part of Terminal E for a total of 12 international gates at Terminal E, requiring construction of a sterile corridor to link the converted international gate to the FIS facility for international passenger processing.

Under this condition, however, when Gate E8A is used to service the A380, it will make adjacent gates inoperable due to the A380's wingtips overhanging the lead-in lines for Gate E8B, thus not providing adequate safety spacing for any aircraft size. On the other side of Gate E8A, Gate E7B would also become restricted to smaller aircraft (Boeing 757 or smaller) due to the safety distance from wingtip to wingtip. This scenario would eliminate one gate from operation during occupancy by a Group VI aircraft, and reduce use of other adjacent gates to an aircraft size not commonly used by international air carriers. These limitations would further reduce the efficiency and flexibility of the terminal.

During the summer 2017 peak hour (8:42 to 9:41 PM), two A380 aircraft will be on the ground. One A380 is scheduled to depart Logan Airport during the peak hours at 9:30 PM. The second A380 is scheduled for an 11:15 PM departure. Due to the complex nature of the summer (peak) 2017 flight schedule, the A380 service, and inadequate facilities at Terminal E, the airlines would have to adjust their flight times so that each A380 aircraft could use the sole A380 capable gate at Logan Airport. This scenario will require extremely short turnaround times at the A380 gate with little margin for error in regards to on-time arrivals and departures. In many cases, flights arrive early due to favorable weather conditions and/or "padded" schedule block times. Flights may also depart late due to late arrivals, unavailability of gate space, and/or unforeseen passenger or technical issues.

The Minimal Action Alternative analysis assumes that remote airside busing operations would be required to keep Logan Airport operational with a larger aircraft on the ground, to accommodate those passengers arriving on A380 and other Group VI aircraft, but not accessing the A380 capable gate. Massport would have to bus

5 A lead-in line is a line on the tarmac that aircraft use to align themselves with the passenger boarding bridge.

passengers to a remote hard stand located at the North Cargo area to board and deplane. Remote busing has been considered to and from two locations: Gate E6, where infrastructure already exists, and Gate E8B. Each bus would have the capacity to hold 100 passengers. A380s are most often configured to hold 555 passengers. This would require at least 6 bus trips to board and de-board, significantly increasing the boarding time for passengers. Busing passengers would also create ground traffic conflicts with baggage handling equipment and GSE movements around the aircraft. The hard stand areas where passengers would board buses are not protected from the weather. Passengers arriving and departing at the same time would need to remain segregated. The current configuration of gates would require passengers deboarding and passengers boarding to mix or cross paths. In order to keep the passengers separated, delaying bus level boardings or gate level deplaning would be required; resulting in possible aircraft delays. While this approach is possible, it would not provide an acceptable level of service to the passengers, or meet the needs of airlines already operating at Logan Airport.

Apron/Ramps

There would be no significant changes to the apron or ramps under the Minimal Action Alternative. Under the Minimal Action Alternative, one fueling location would be adjusted in order to accommodate larger aircraft around the modified gate. As described above, use of Group VI aircraft at the apron under the Minimal Action Alternative would result in spatial conflicts on apron areas.

3.3.2.3 Minimal Action Alternative: Airfield Area

The Minimal Action Alternative would provide airfield upgrades to accommodate regular Group VI arrivals and departures. Currently, FAA has approved restricted access for A380s at Logan Airport only for diversionary landings. Runway 15R-33L is long enough to accommodate A380s, although it does not fully meet design guidelines for runway and shoulder width set forth in FAA Engineering Brief 65A, thus requiring an inspection after each take-off and landing The primary taxiways used to access Runways 4R-22L and 15R-33L have centerline radii and fillets that do not meet standards for this size aircraft. Takeoff weight is restricted due to runway length but landing weight is unrestricted. To accommodate scheduled service, runway shoulders and taxiway fillets would have to be modified in a manner consistent with that described in Section 3.3.4, *Airfield Alternatives*.

3.3.3 Proposed Terminal E Action Alternatives (Interior and Exterior Areas)

Three action alternatives were developed, evaluated, and screened for the Terminal E-related renovations and enhancements. The key differences among the Terminal E alternatives relate to gate modifications, the internal and external layout, the ability to accommodate passengers, and the cost. All of the internal and external components of the Terminal E alternatives are located in areas previously developed for Airport purposes and that are fully paved with impervious cover, either by buildings or the apron area. Each of the Terminal E alternatives includes a portion of internal renovation and external construction that converts airside pavement/apron area to the Terminal footprint. All of the Terminal E alternatives retain the existing door locations on the curb and, thus, have the same curbside passenger loading and curbside operations. Massport evaluated preliminary alternatives that have common features and programming, and all of which adequately met the functional needs of accommodating Group VI operations.

Each of the alternatives discussed include reconfiguring three existing gates to serve the unique requirements of the A380 aircraft. These gates are E10 (7B), E11 (8A), and E12 (8B), which were chosen due to the space requirements of Group VI aircraft; the apron area adjacent to these gates has the greatest existing space. The existing gate configurations provide only a single passenger boarding bridge for the aircraft being served, and their locations accommodate a maximum Group V aircraft, such as a 747-400. Gate 8B currently can only serve a Boeing 767 aircraft. The A380s being used by international air carriers, and proposed by these carriers to serve the Boston area market, require at least two passenger boarding bridges per gate to serve the double-decker aircraft. These Group VI aircraft also have a greater wingspan and fuselage length than other aircraft, requiring larger parking positions and greater maneuvering and service requirements.

There are essentially no environmental differences among Terminal Facility Alternatives A, B, and C that would affect the overall environmental consequences of the Project. Each of the alternatives affects previously developed land within the Airport boundary; each alternative accommodates the same number of aircraft operations and passengers as the No-Action Alternative, and all have similar construction phases.

The following section describes the development of the Build Alternatives A, B, and C. **Figures 3.2, 3.3,** and **3.4** provide graphic illustrations of the alternative concepts. **Tables 3.2** and **3.3** compare these three alternatives. **Figure 3.5** illustrates the alternatives screening process.

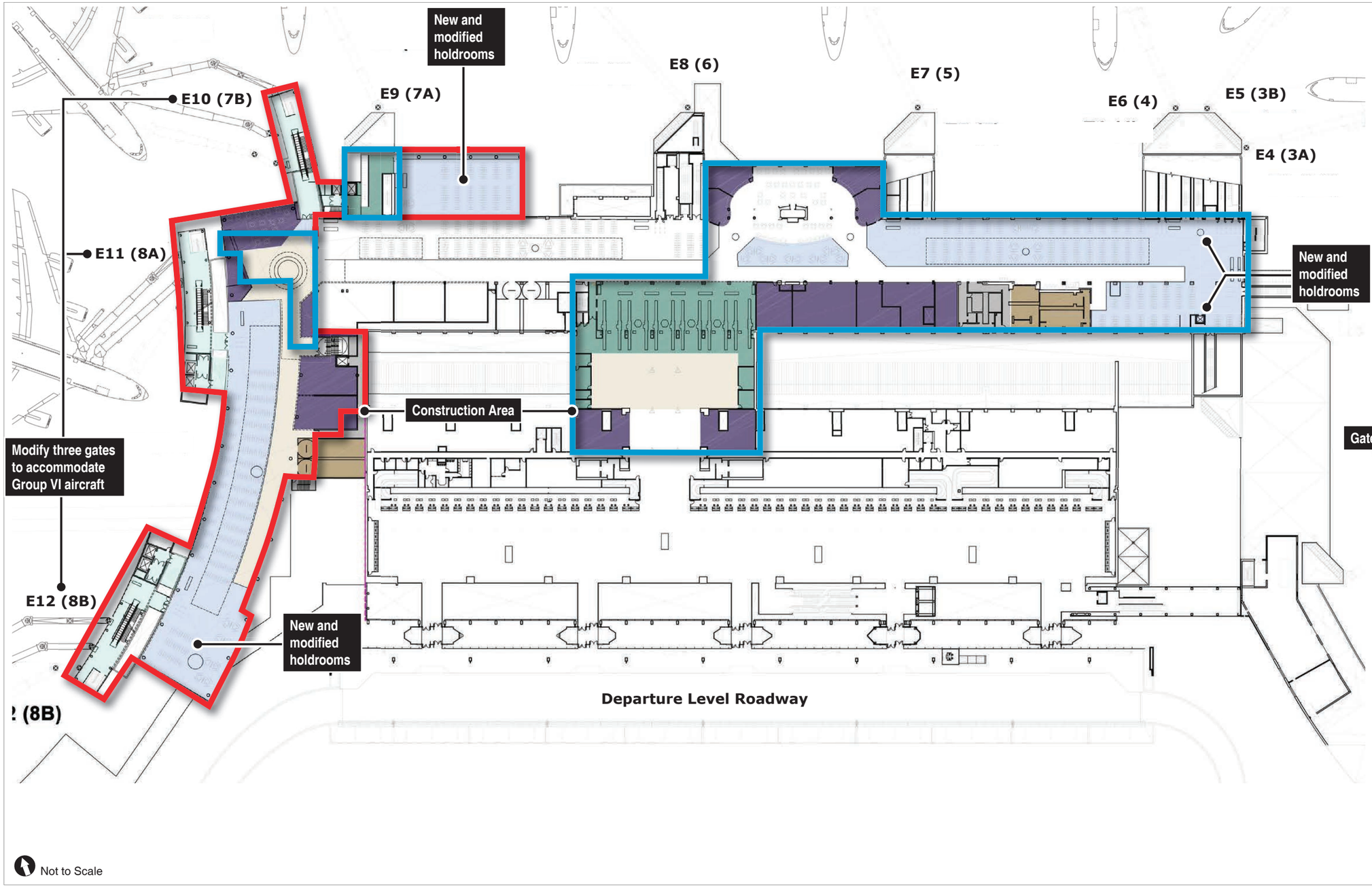
3.3.3.1 Alternative A

Alternative A (**Figure 3.2**) would convert Gates E10 (7B), E11 (8A), and E12 (8B) to be A380 capable. Alternative A was developed as a gate reconfiguration and holdroom addition to simultaneously accommodate three A380 aircraft. Two holdrooms would be located at Gates E11 (8A) and E12 (8B) consisting of a main crescent-shaped building addition on the west. A new, smaller rectangular holdroom would be constructed on the north side of the terminal located adjacent to Gate E9 (7A). Each of the three holdrooms would be designed to have enough space for an A380 aircraft. This alternative also includes three new airline clubs above the holdrooms (7,300 square feet each), and sterile corridor connections to INS processing at the mezzanine level. The passenger boarding bridge portals for Gate E11 (8A) and E12 (8B) would contain gate-required vertical circulation in crescent-shaped enclosures parallel to the holdrooms. The jet-bridge portal for Gate E10 (7B) would be located alongside the existing Gates E9 (7A)/E10 (7B) portal.

A major disadvantage of Alternative A is that one of the three new holdrooms would be located on the north side of the existing terminal, and would not directly serve the reconfigured Gate E10 (7B). This area on the north of the Terminal is a very active airline operations area with service road and five baggage stripping belts for all inbound bags leading to the five existing bag claim devices in the Customs Baggage Claim Hall. Maintaining this critical operation while completing the new holdroom would require complicated construction phasing.

The total new square footage for Alternative A would be 103,144 square feet and the total interior renovation would be 27,266 square feet, for a total of 130,410 square feet. This alternative would cost approximately $120 million.

Alternative A was eliminated because the total club area would be too small to meet program requirements, the Gate E10 (7B) holdroom would not be adjacent to that gate (reducing overall efficiency) and this alternative would have the largest new building footprint (see **Figure 3.2**).



Terminal Alternative A (Level 3, Departures)

- Modify three gates to accommodate A380 aircraft and other Group VI aircraft
- Construct three new holdrooms to accommodate three A380s, two on the west side, one on the north
- Construct three new 7,300 square foot airline clubs above new holdrooms

Total New Building Area (all levels): 103,144 sf

Newly Constructed Space
Renovated Space
BAGGAGE CLAIM
CIRCULATION
CLUB (LEVEL 4)
GATE PIERS
HOLDROOM
MECHANICAL
RESTROOMS
RETAIL
RETAIL SEATING
SECURITY/TSA
SPECIAL DESIGN FEATURES
SUPPORT
TICKETING
VERT CORES

Source: AECOM

Figure 3.2

Terminal Alternative A - Departures, Level 3

TERMINAL E RENOVATION AND ENHANCEMENTS PROJECT
Boston-Logan International Airport
East Boston, Massachusetts

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3.3.3.2 Alternative B

A second design alternative was developed to reduce the amount of new Terminal square footage, reduce cost and simplify construction phasing. Alternative B (**Figure 3.3**) consolidates the new Terminal improvements required for accommodating three upgraded gates, enhances passenger holdrooms only on the west side of the concourse, improves airline clubs, reduces the new building footprint, and reduces costs.

Alternative B was developed to locate all new construction in a single addition on the west side of Terminal E, rather than providing a separate holdroom addition at Gate E9 (7A)/E10 (7B). Alternative B would convert Gates E10 (7B), E11 (8A), and E12 (8B) to be A380 capable. The three new holdrooms would be located at Gates E10 (7B), E11 (8A), and E12 (8B). The new airline clubs would be located above the holdrooms. This alternative provides a lengthened crescent plan, with the holdrooms and concourse on the west side of the Terminal sized for three A380s. The three jetbridges would be oriented perpendicular to the crescent addition, with the three airline clubs above the holdrooms having a central club access core. Each club would retain direct boarding access to the associated gate below, providing efficient and convenient boarding for airline club members.

Alternative B would greatly reduce or eliminate construction to the north of the existing Terminal building, and would restrict construction impacts to the west side only. New construction would be confined to a single area west of the existing Terminal, with all new facilities located within a single building block, providing efficiency, repetitive structural bays, and reducing the duration of construction. However, public circulation and holdroom areas would be somewhat reduced in an effort to reduce costs.

The total new square footage for Alternative B would be 101,000 square feet and the total interior renovation would be 30,000 square feet, for a total of 131,000 square feet. This alternative would cost approximately $100 million.

Since improvements to holdrooms, retail, concessions, and other passenger spaces would be limited to the new building addition, Alternative B would not fully address existing deficiencies, issues, and shortfalls within the remainder of the Terminal. Alternative B would not address all passenger needs throughout the Terminal, which are necessary for improved efficiency and enhanced passenger convenience, and was eliminated from further consideration.

3.3.3.3 Alternative C

The design team developed Alternative C (**Figure 3.4**) in response to comments from Massport planners and air carrier fleet requirements. Concerns were raised that while the new building addition would efficiently accommodate Group VI requirements, remaining gates and passenger holdrooms at the central and east ends of the Terminal were already overcrowded during peak periods. This alternative recognized that Alternatives A and B lacked required retail and passenger amenities and there was a need for more efficient passenger connections to Gates E1 (1B), E2 (1A), and E3 (2) (previously used for Southwest Airlines domestic operations) as these gates would be required for future international operations. Alternative C expands the project's focus from re-configured gates for larger aircraft and passenger accommodations on the west end of the Terminal, to all of Terminal E including all gates and holdrooms, better connections to gates on the east, and improved retail and passenger amenities throughout.

The projected airline schedule changed during the design of the Project alternatives so that the future schedule would only include one A380 (not three) arrival or departure during the peak period, although three gates would be A380 capable. Alternative C responds to revised airline equipment requirements, and also provides improved passenger facilities, including holdrooms and boarding areas, on the east side of Terminal E (not just in proximity to the A380 capable gates on the west side of the concourse). Alternative C reconfigures the new building footprint on the west, providing additional holdroom area for Gates E9 (7A) and E10 (7B) on the north-west corner of the Terminal, improves passenger amenities throughout the Terminal, and refines the plan to be more cost effective.

Alternative C would convert Gates E10 (7B), E11 (8A), and E12 (8B) to be A380 capable. Gates E9 (7A) and E10 (7B) would be reconfigured as new, independent gate portals. New holdrooms would be located at each of the three newly reconfigured gates with the holdrooms located in a crescent configuration on the west side of the concourse. Rather than provide a separate 'bump-out' on the north for a holdroom as in Alternative A, the north end of the crescent would be expanded to provide an additional holdroom to serve an existing shortfall at Gate E9 (7A) in addition to the holdroom for Gate E10 (7B). The new holdrooms would be designed to accommodate one A380 at Gate E11 (8A), one 747-8 at Gate E10 (7B), and one 747-400 at Gate E12 (8B).

Additionally, a new holdroom would be created at Gate E3 (2) within the existing mezzanine level, currently being used as retail space. Three new airline clubs would be located above the Gate E10 (7B), E11 (8A), and E12 (8B) holdrooms (each would be 8,000 square feet). Retail shops and concessions would also be improved throughout Terminal E.

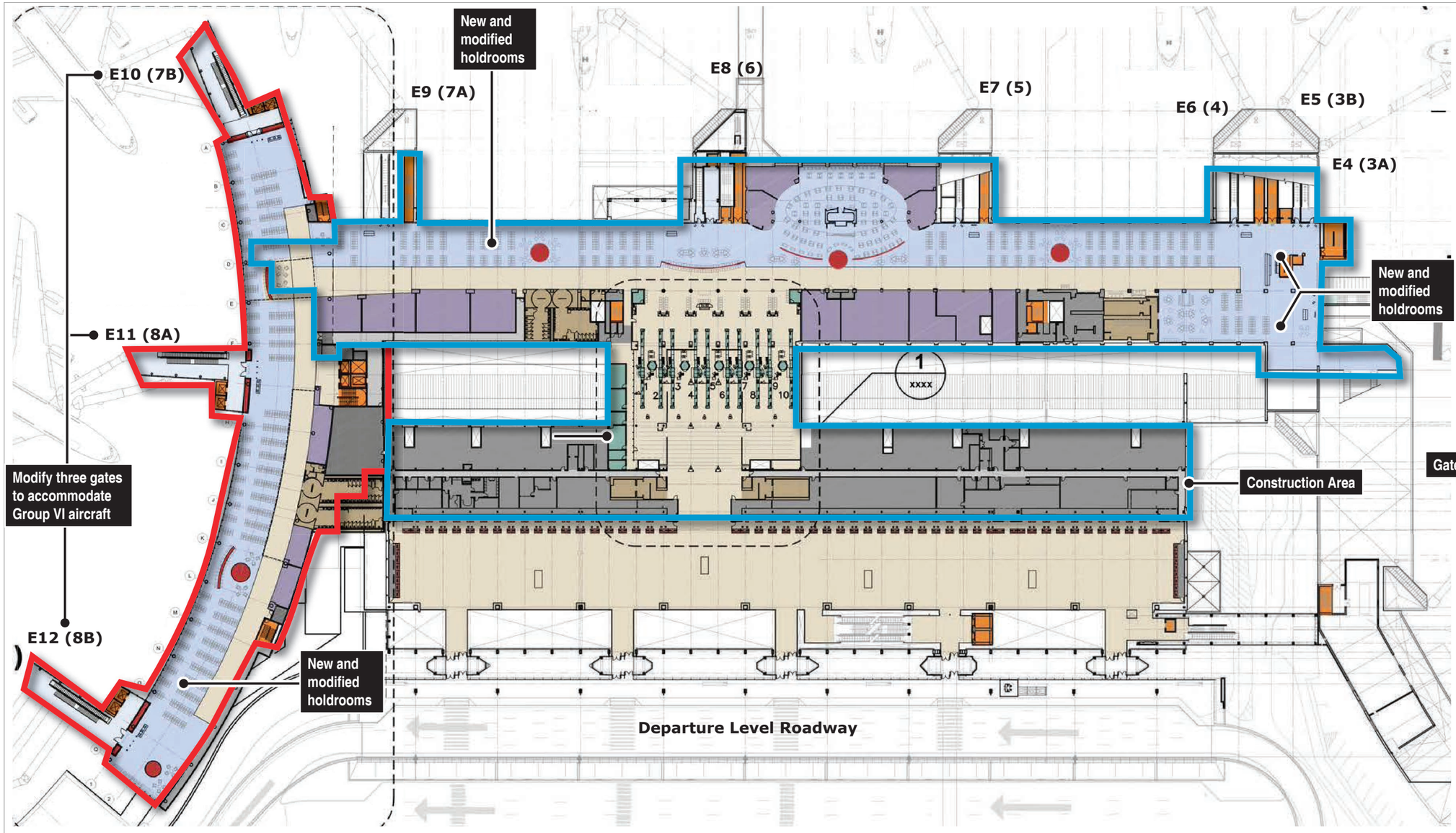
The total new square footage for Alternative C would be 93,563 square feet and the total interior renovation would be 120,707 square feet, for a total of 214,270 square feet. This alternative would cost approximately $135 million.

Alternative C was selected as the Proposed Action because it adequately addresses the Project purpose and need and improves facilities throughout Terminal E. This alternative has the benefits of simplified construction and lower new building square footage as compared to Alternative A. The new holdroom configurations provide the most flexible layout for the future fleet mix and improved facilities throughout Terminal E improve passenger convenience and efficiency.

3.3.3.4 Comparison of Terminal E Alternatives

The No-Action Alternative and Minimal Action Alternative do not meet the purpose and need or Project goals and objectives. They do not improve Terminal flexibility or efficiency, since the existing gate placement and holdroom limitations would simply not accommodate Group VI aircraft or their associated passenger volumes. The No-Action Alternative would not accommodate scheduled A380 or other large aircraft at the terminal or on the airfield. **Figure 3.5** graphically summarizes the terminal alternatives development and selection process.

Alternative A adequately meets most of the program requirements; however, this option would be less efficient than Alternatives B and C with holdrooms separated in two locations, and a similar separation of clubs.



Terminal Alternative B (Level 3, Departures)

- Modify three gates to accommodate A380 aircraft
- Construct single addition with three new upsized holdrooms on the west side only
- Construct three new 10,000 square foot airline clubs

Total New Building Area (all levels): 101,000 sf

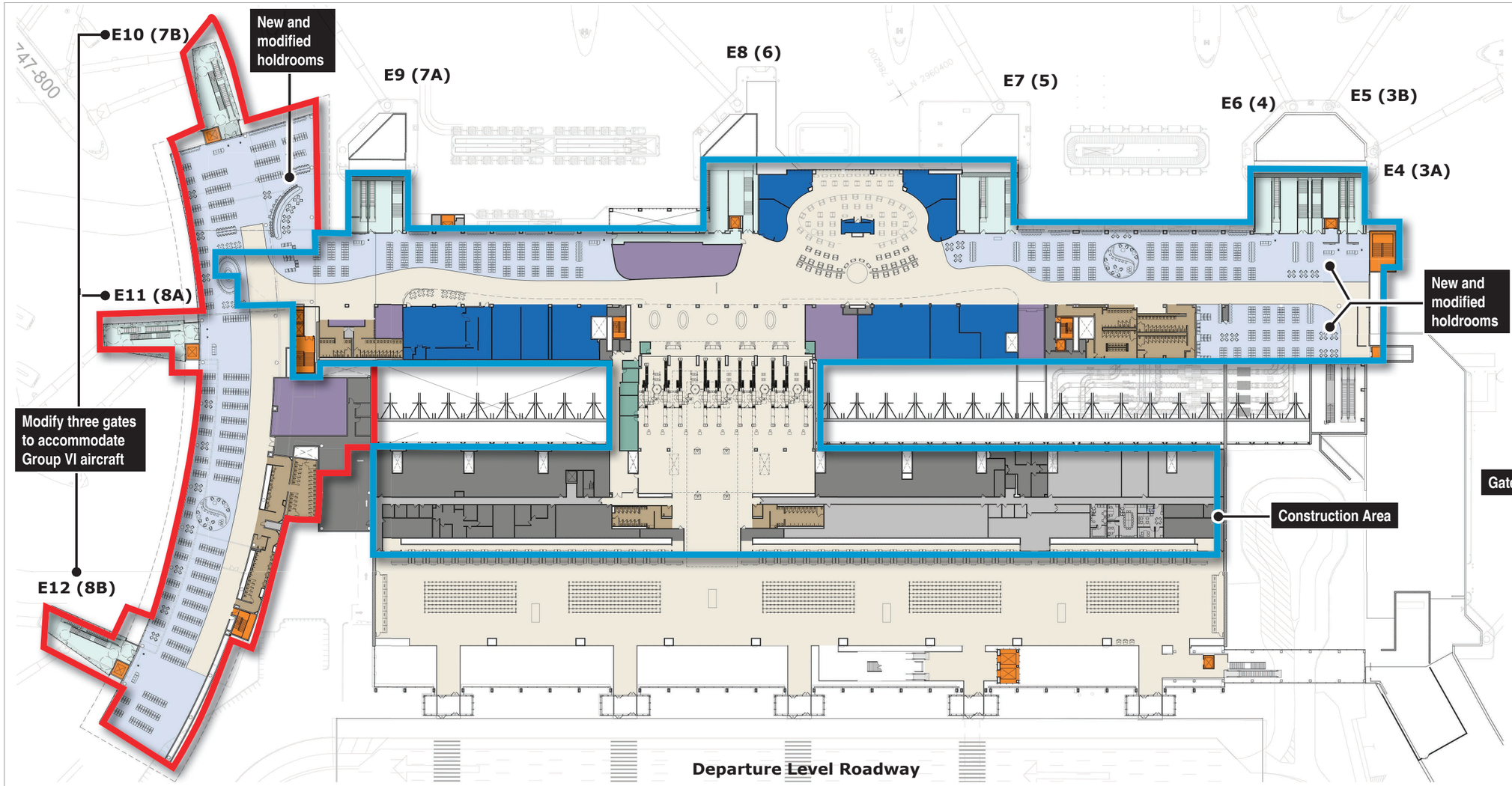
- Newly Constructed Space
- Renovated Space
- BAGGAGE CLAIM
- CIRCULATION
- CLUB (LEVEL 4)
- GATE PIERS
- HOLDROOM
- MECHANICAL
- RESTROOMS
- RETAIL
- RETAIL SEATING
- SECURITY/TSA
- SPECIAL DESIGN FEATURES
- SUPPORT
- TICKETING
- VERT CORES

Source: AECOM

Figure 3.3

Terminal Alternative B - Departures, Level 3

TERMINAL E RENOVATION AND ENHANCEMENTS PROJECT
Boston-Logan International Airport
East Boston, Massachusetts



Terminal Alternative C (Level 3, Departures)

- Modify three gates to accommodate A380 aircraft and other Group VI aircraft
- Construct three new holdrooms
- Construct three new 8,000 square foot airline clubs on Level 4
- Enhance concession/retail throughout Terminal E

Total New Building Area (all levels): 93,563 sf

- Newly Constructed Space
- Renovated Space
- BACK OF HOUSE
- BAGGAGE CLAIM
- CIRCULATION
- CLUB (LEVEL 4)
- EXISTING RETAIL
- GATE PIER
- HOLDROOM
- MECHANICAL
- RESTROOMS
- RETAIL
- RETAIL SEATING
- TSA
- VERTICAL CIRCULATION

Source: AECOM

Figure 3.4

Terminal Alternative C (Proposed Action) - Departures, Level 3

TERMINAL E RENOVATION AND ENHANCEMENTS PROJECT
Boston-Logan International Airport
East Boston, Massachusetts

Alternative B strikes a balance between cost and program requirements as initially defined. It meets planning parameters, efficiently accommodating the requirements of A380 and 747-8 gates, passenger holdrooms, and airline clubs. This scheme provides area requirements for these gates within a single, simple crescent-shaped plan that encloses the maximum amount of required space with the least amount of building enclosure, and with the least public circulation space. Alternative B does not adequately address existing holdroom deficiencies, or international passenger connections to Gates E1 (1B), E2 (1A), or E3 (2), all to be used for future international operations.

Further studies addressing these needs resulted in Alternative C, the Proposed Action. Alternative C expands the project's focus from re-configured gates for larger aircraft and passenger accommodations on the west end of the Terminal, to all of Terminal E including all gates and holdrooms, better connections to gates on the east, and improved retail and passenger amenities throughout. Alternative C has the least amount of new building area, as compared to Alternatives A and B, but has the highest amount of interior renovation. Alternative C is the most costly alternative due to the large amount of renovated space. Holdrooms are sized to accommodate one A380, one 747-8, and one 747-400 during peak hours, which is most representative of the aircraft during peak hours. Alternative C was chosen as the Proposed Action because it best addresses existing issues and shortfalls throughout Terminal E, not just at the new building addition. The Proposed Action will adequately accommodate Group VI aircraft, such as the A380, at three A380 capable gates: E10 (7B), E11 (8A), and E12 (8B).

From an environmental impact perspective, there is very little difference among these alternatives. **Table 3.2** compares the square footage of new construction, interior renovation, and estimated cost of each alternative. Each alternative would include the same number of operations, passenger levels, and curbside configuration. All terminal improvement alternatives would occur on previously developed impervious areas.

Table 3.2 Comparison of Terminal E Gate Accommodation Alternatives

	No-Action Alternative	Minimal Action Alternative	Alternative A	Alternative B	Alternative C
Total Square Footage	—	One gate A380 compatible	130,410 sf	131,000 sf	214,270 sf
New Building Area	—	—	103,144 sf	101,000 sf	93,563 sf
Interior Renovation	—	—	27,266 sf	30,000 sf	120,707 sf
Estimated Construction Cost	NA	NA	$120 Million	$100 Million	$135 Million

Terminal Alternative A

- Modify three gates to accommodate A380s/Group VI aircraft
- Construct three new holdrooms to accommodate three A380s, two on the west side, one on the north of existing terminal
- Construct three new 7,300 square foot airline clubs above new holdrooms

Operational Efficiency: Doesn't address terminal wide need for improved passenger amenities
Square Footage: 103,000 sf new; 27,300 sf renovated
Construction complexity: Most complex and largest alternative

(Dismissed)

Terminal Alternative B

- Modify three gates to accommodate A380s/Group VI aircraft
- Construct single addition with three new upsized holdrooms on the west side only of existing terminal
- Construct three new 10,000 square foot airline clubs

Operational Efficiency: Doesn't address terminal wide need for improved passenger amenities
Square Footage: 101,100 sf new; 30,000 sf renovated
Construction complexity: Simplified with new construction on west side only

(Dismissed)

Terminal Alternative C (Proposed Action)

- Modify three gates to accommodate A380s/Group VI aircraft
- Construct three new holdrooms in a west portion of existing terminal
- Construct three new 8,000 square foot airline clubs
- Enhance concession/retail throughout Terminal E
- Reconfigure Mezzanine to add new holdroom on the east side

Operational Efficiency: Provides upgrades throughout Terminal E
Square Footage: 93,563 sf new; 120,707 sf renovated
Construction complexity: Moderate construction

Source(s):AECOM

Figure 3.5

Terminal Alternatives Development

Table 3.3 Terminal E Renovation and Enhancement: Comparison of Alternatives

	Alternative A [1]	Alternative B [2]	Alternative C [3]
Terminal Configuration	Crescent and Box (at E9 [7A])	Crescent Plan only; holdrooms with clubs above	Crescent; expanded holdrooms and enhancements throughout Terminal E
Size	103,144 square feet of new construction 27,266 square feet of interior renovation	101,000 square feet of new construction 30,000 square feet of interior renovation	93,563 square feet of new construction; 120,707 square feet of interior renovation
Key Design Features/ Differences	Converts Existing Gates E10 (7B), E11 (8A), and E12 (8B) to be A380/ 747-8 Capable; no added gates Two holdrooms at Gates E11 (8A) and E12 (8B); addition located in simple crescent configuration Third holdroom located north of existing Terminal adjacent to Gate E9 (7A) Expanded passenger checkpoint (12-lanes) Third level club spaces: three 7,300-square foot airline clubs above holdrooms for Gates E11 (8A) and E12 (8B) Sterile corridor connects all three gates to existing sterile corridor at Gate E9 (7A)Jetbridge portals for Gates E11 (8A) and E12 (8B) contain gate-required vertical circulation in crescent-shaped enclosures parallel to holdrooms Jetbridge portal for Gate E10 (7B) is located alongside existing E9 (7A)/E10 (7B) portal	Converts Existing Gates E10 (7B), E11 (8A) and E12 (8B) to be A380/747-8 Capable; no added gates Gate E10 (7B) reconfigured as new independent gate portal with separate elevator core Three holdrooms at Gates E10 (7B), E11 (8A) and E12 (8B) with addition located in crescent configuration Expanded passenger checkpoint (10-lanes) Third level club spaces: three 10,000-square foot airline clubs above Gates E10 (7B), E11 (8A), and E12 (8B) holdrooms Sterile corridor connects all three gates to existing sterile corridor at Gate E9 (7A)All jetbridge portals oriented perpendicular to building	Converts Existing Gates E10 (7B), E11 (8A), and E12 (8B) to be A380/747-8 Capable; no added gates Gates E9 (7A) and E10 (7B) reconfigured as new independent gate portals with common elevator core Three hold rooms at Gates E10 (7B), E11 (8A), and E12 (8B) with addition located in crescent configuration Expanded passenger checkpoint (10-lanes) Third level club spaces: three 8,000-square foot airline clubs above hold rooms for Gates E10 (7B), E11 (8A) and E12 (8B) Sterile corridor connects all three gates to existing sterile corridor at Gate E9 (7A) New Gate E3 (2) holdroom within existing mezzanine level, east end of terminal New jet-bridge portals oriented perpendicular to building
Pros	Meets Purpose & Need Provides new holdroom space for three A380s, with three airline clubs above Relatively straight-forward design	Meets Purpose & Need Provides new holdroom space for three A380s, with three airline clubs above, all within a single new structure	Meets Purpose & Need Provides new holdroom space for one A380, one 747-8, and one 747-400 -Addresses holdroom and retail shortfalls and improvements throughout Terminal E
Cons	Holdroom for Gate E9 (7A) is in location separate from main holdroom addition requiring separate construction component	Generates more new construction square footage Does not address space shortages for program within existing terminal	No major disadvantages except greater renovation occurs within east end and throughout terminal, requiring several construction phasing components within the active operating terminal
Rationale for Elimination	Total Club area does not meet requirements; Gate E10 (7B) holdroom not adjacent to gate, inefficient	Meets initial program requirements, but does not address other existing issues and shortfalls in Terminal E	Proposed Action

1 See Figure 3.2
2 See Figure 3.3
3 See Figure 3.4

3.3.4 Airfield Alternatives

In 2011, Massport conducted an airfield analysis to determine if existing conditions at Logan Airport would meet FAA standards to accommodate future Group VI, such as the A380. This analysis included the airfield (runways and taxiways) and the apron. The study determined that Runway 4R-22L is long enough to accommodate Group VI requirements and due to its instrument landing system rating, was recommended as the primary runway for A380 operations. Runway 15R-33L is also long enough to accommodate Group VI aircraft and has an adequate instrument landing system rating, although does not fully meet design guidelines for runway shoulder

width established in FAA guidance documents. Runways are required to either be 200 feet in width, or 150 feet wide with stabilized shoulders without inspection upon take-off and landing. The primary taxiways used to access Runways 4R-22L and 15R-33L have centerline radii and fillets that do not meet standards for large aircraft. FAA has approved restricted access for A380s at Logan Airport. Takeoff weight is restricted due to runway length but landing weight is unrestricted. The airfield runway lengths and widths are expected to be adequate to handle Group VI requirements with these operational restrictions, while specific runway shoulders and taxiways will have to be modified.

The deficiencies identified in this analysis were used as the basis for developing the airfield alternatives described below. Airfield alternatives were created consisting of different combinations of runway and taxiway improvements along potential A380 routes. Operational impacts for the A380 such as jet blast impacts, taxiway fillet improvements, engine clearances, and fixed object clearances were considered as part of the alternatives analysis. Considerations also included costs, operational requirements, capacity, and adjacent taxiways. Below is a summary of the airfield alternatives identified in the study.

Current FAA guidance requires an inspection of 150-foot wide runways with 35-foot stabilized shoulders after a takeoff or landing of an A380. Operationally, this could create a delay for the next arriving or departing aircraft. Runways that are 150 feet wide with 50-foot shoulders, or greater, do not have this requirement.

Airfield components of the Terminal E Renovation and Enhancements Project would take place within the existing operating airfield. A key criterion for selecting the Proposed Action airfield component is the ability to limit the total area of disturbance caused by installing new impervious surfaces, and offsetting any new pavement with pavement removal elsewhere on the airfield. Limiting disturbances is necessary to minimize impacts to grassland habitat present on the Airport.

Tables 3.4 and **3.5** list existing conditions for potential runways and taxiways serving the A380. Certain existing runway and taxiway conditions do not meet the FAA's Group VI design standards, shown in bold. Runways and taxiways that provide a combined runway and shoulder width that meets or exceeds the combined width of Group VI Design Standards comply with the Group VI Design Standards (**Table 3.4,** Total Runway Width; **Table 3.5,** Total Taxiway Width). Meeting the combined width ensures adequate pavement coverage to protect unpaved land from engine overhang, jetblast, and pathway deviations. To meet these requirements, Massport developed initial alternatives that either widen runways and stabilize taxiways, or require operational restrictions, such as limiting other aircraft on certain taxiways while an A380 is on the ground. These alternatives are described in the following sections.

Table 3.4 Existing Runway Conditions

	Group VI Design Standard (feet)	Runway					
		4R	22L	4L	22R	15R	33L
Runway Length[1]	– [1]	10,005		7,864		10,083[1]	
Runway Width	200 or 150 (+ stabilized shoulders)	150		150		150	
Shoulder Width	40	75	55[2]	50	50	35[3]	75
Total Runway Width	280	300	260	250	250	220	300
Landing Distance Available	7,000[1]	8,851	8,806	7,861	7,046	9,202	10,083
Distance to Holding Position	280	280	280	250	240	280	280
Distance to Parallel Taxiway	500/550	935	1,000	400	500	400	500
Distance to Aircraft Parking Area	500	n/a	n/a	800	n/a	1,750	n/a

1 Operational requirement – existing dimensions of runway lengths meet the requirements for the expected service
2 Shoulder width between Runway 22L end and Runway 33R intersection is 55 feet and the remainder is 75 feet
3 Shoulder width west of Runway 4R-22L intersection is only 35 feet
4 Runways with Visibility minimums of <1/2SM require 550 feet of separation
5 Runway 22R has EMAS and a 820-ft displacement
Notes: Conditions that are deficient are shown in bold text. The airfield study determined that Runway 4R-22L is long enough to accommodate the A380s and due to its instrument landing system rating, was recommended as the primary runway for A380 operations. Runway 15R-33L is also long enough to accommodate A380s, although it does not fully meet design guidelines for runway and shoulder width set forth in FAA Engineering Brief 65A

Table 3.5 Existing Taxiway Conditions

		Taxiway[1]									
Group VI Design Standard (feet)		B	C	D	E	F	N-3	N	M	P	R
Taxiway Width	82	100	100	100	100	100	100	100	100	100	100
Shoulder Width	40	35	35	35	35	35	35	35	35	35	35
Total Taxiway Width	162	170	170	170	170	170	170	170	170	170	170
Centerline Separation[2]	324	249	547	547	-	382	-	-	-	-	-

1 Potential taxiways used for A380 operations
2 Parallel taxiway does not exist for E, N-3, N, M, P, and R
Notes: Conditions that are deficient are shown in bold text.

3.3.4.1 Airfield Enhancements, Runway Widening (Alternative 1)

Airfield Alternative 1 (**Figure 3.6)** was developed to accommodate Group VI aircraft, such as the A380, and would widen both Runway 4R-22L and Runway 15R-33L. This alternative would also involve shoulder pavement modifications to both runways. The improvements on the airfield, include stabilizing shoulders on Runway 15R-33L and expanding taxiway fillets to accommodate the increased turning requirements of the A380. All of these improvements would be adjacent to existing pavement in areas that are frequently maintained by mowing due to their proximity to the runway and taxiways. Modifications to the pavement fillets would occur along portions of Taxiways B, C, D, E, L, M, N3, N, P, and R. This alternative would fully meet design requirements for Group VI aircraft for each element of the airfield and provide the greatest number of taxiway improvements to give the greatest degree of flexibility for aircraft ground movements.

Under Alternative 1, total new runway pavement would be 1,044,000 square feet and total new taxiway pavement would be 193,500 square feet for a combined total of 1,237,500 square feet (**Table 3.6)**. The runway widening alternative was dropped from consideration due to the environmental impacts, operational impacts due to construction and cost ($49.2 million).

3.3.4.2 Airfield Enhancements, Maintain Runway Widths (Alternative 2)

Airfield Alternative 2 (**Figure 3.7)** includes fewer runway design improvements than Alternative 1, while still meeting the Project purpose and need. Alternative 2 includes no shoulder modifications to Runway 4R-22L and maintains the existing 150-foot width for both Runways 4R-22L and 15R-33L. The shoulder pavement for Runway 15R-33L would be increased to 50 feet west of the Runway 4L-22R intersection (from the existing 35 feet). Modifications to the pavement fillets would occur along portions of Taxiways B, C, D, E, F, L, M, N, N3, P and R. Alternative 2 would use Taxiways M and F for Runway 4R-22L arrivals and departures.

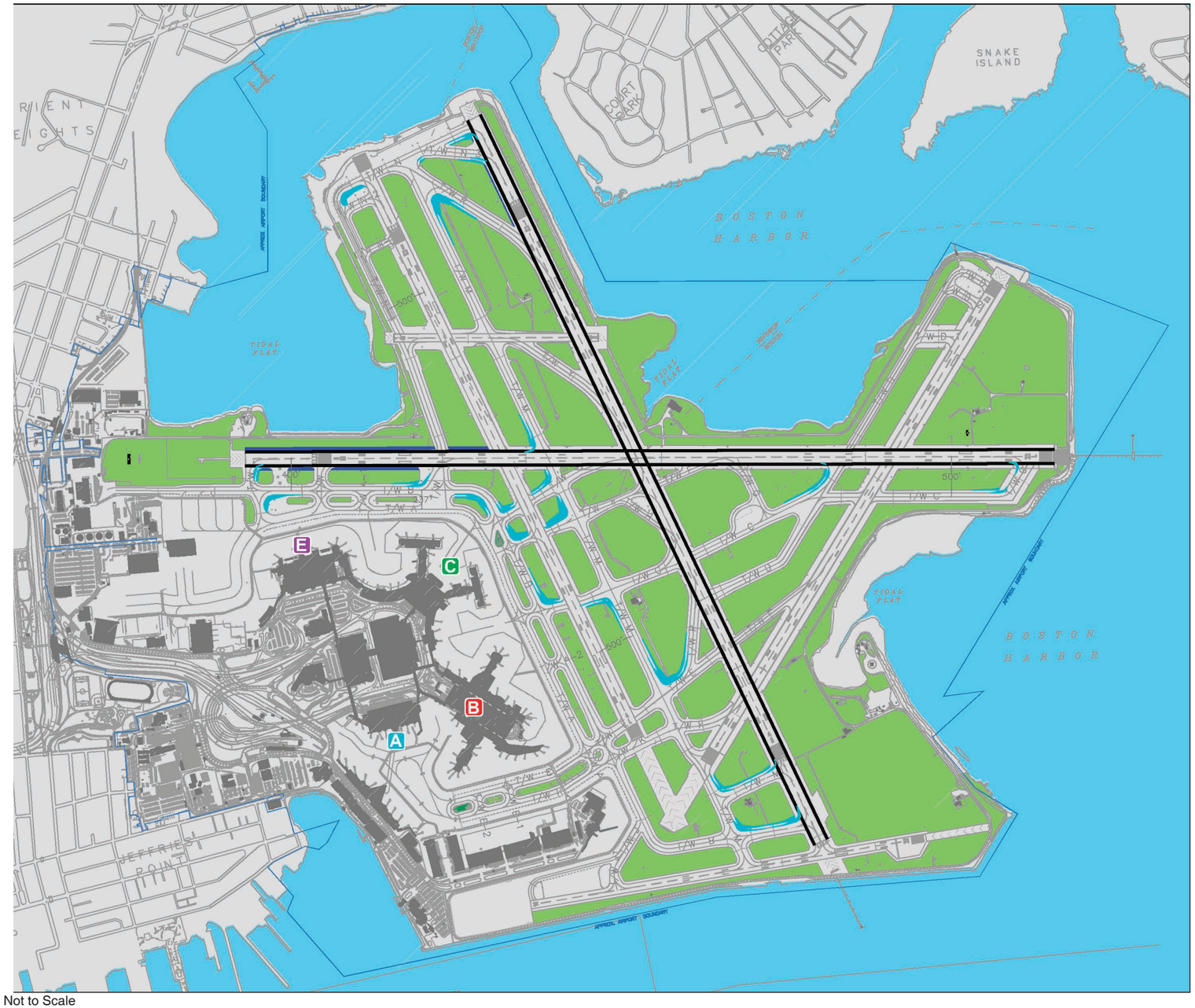
Under Alternative 2, total new runway pavement would be 62,100 square feet and total new taxiway pavement would be 261,000 square feet for a combined total of 323,100 square feet (**Table 3.6)**. New pavement would be offset by pavement removal elsewhere on the airfield. Alternative 2 was eliminated due to environmental impacts and cost ($13.4M).

3.3.4.3 Alternative 3 (Proposed Action)

Alternative 3 (**Figure 3.8**) meets cost and operational requirements, improves efficiency, and further reduces grassland impacts as compared to the other alternatives.

Similar to Alternative 2, Alternative 3 would maintain the existing width of 150 feet for both Runways 4R-22L and 15R-33L and would stabilize the shoulder from 35 to 50 feet on Runway 15R-33L, west of Runway 4L-22R. Alternative 3 would use Taxiways M and F and would modify the fillets for portions of Taxiways B, C, D, E, L, and M, and N. The modifications to Taxiways F, N3, P, and R would not occur under Alternative 3. These modifications were dropped in order to further minimize impacts to grassland. Although this alternative limits the taxiway routes when compared to other alternatives, the proposed routes would be the same as taxiway routes already in use and would not interfere with operations on the perimeter road while an A380 is taxiing to or from the Terminal. Compared to the other airfield alternatives, operational safety is greatest with the selected taxiway route of the Proposed Action.

Under Alternative 3, total new runway pavement would be 76,000 square feet and total new taxiway pavement would be 131,250 square feet for a combined total of 207,250 square feet (Table 3.6). New pavement would be offset by pavement removal elsewhere on the airfield. Alternative 3 meets cost ($12.3M) and operational requirements and included fewer modifications to runways and taxiways and the least overall environmental impact compared with Alternatives 1 and 2. This Alternative considers reasonable and practicable avoidance and minimization designs to for the constrained airfield while maintaining operational flexibility and safety. Massport is working with FAA to develop operational requirements to implement Alternative 3.



Airfield Alternative 1 (Dismissed)

- Widen runway 4R-22L and runway 15R-33L from 150 feet to 200 feet
- Stabilize runway shoulders
- Modify pavement fillets along 10 select taxiways

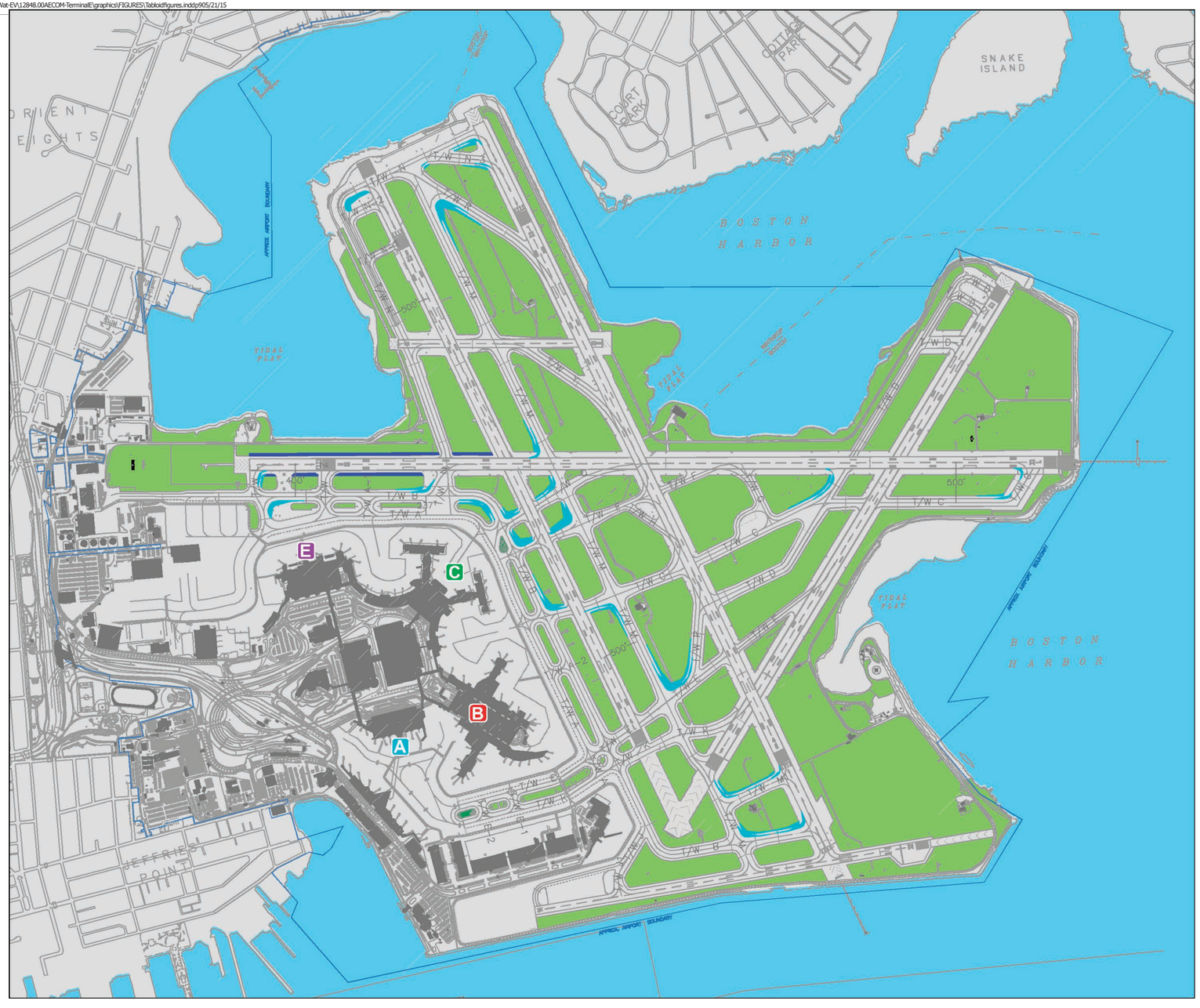
Source: AECOM

Note: Does not show pavement removal

Figure 3.6

Airfield Alternative 1 - Stabilize Runways, Shoulders, and Modify Taxiways

TERMINAL E RENOVATION AND ENHANCEMENTS PROJECT
Boston-Logan International Airport
East Boston, Massachusetts



Not to Scale

Airfield Alternative 2 (Dismissed)

- No runway widening
- Stabilize runway shoulder runway 15R-33L to 50-feet west of the runway 4L-22R intersection only
- Modify pavement fillets along 11 select taxiways

New Pavement
Fillet Pavement

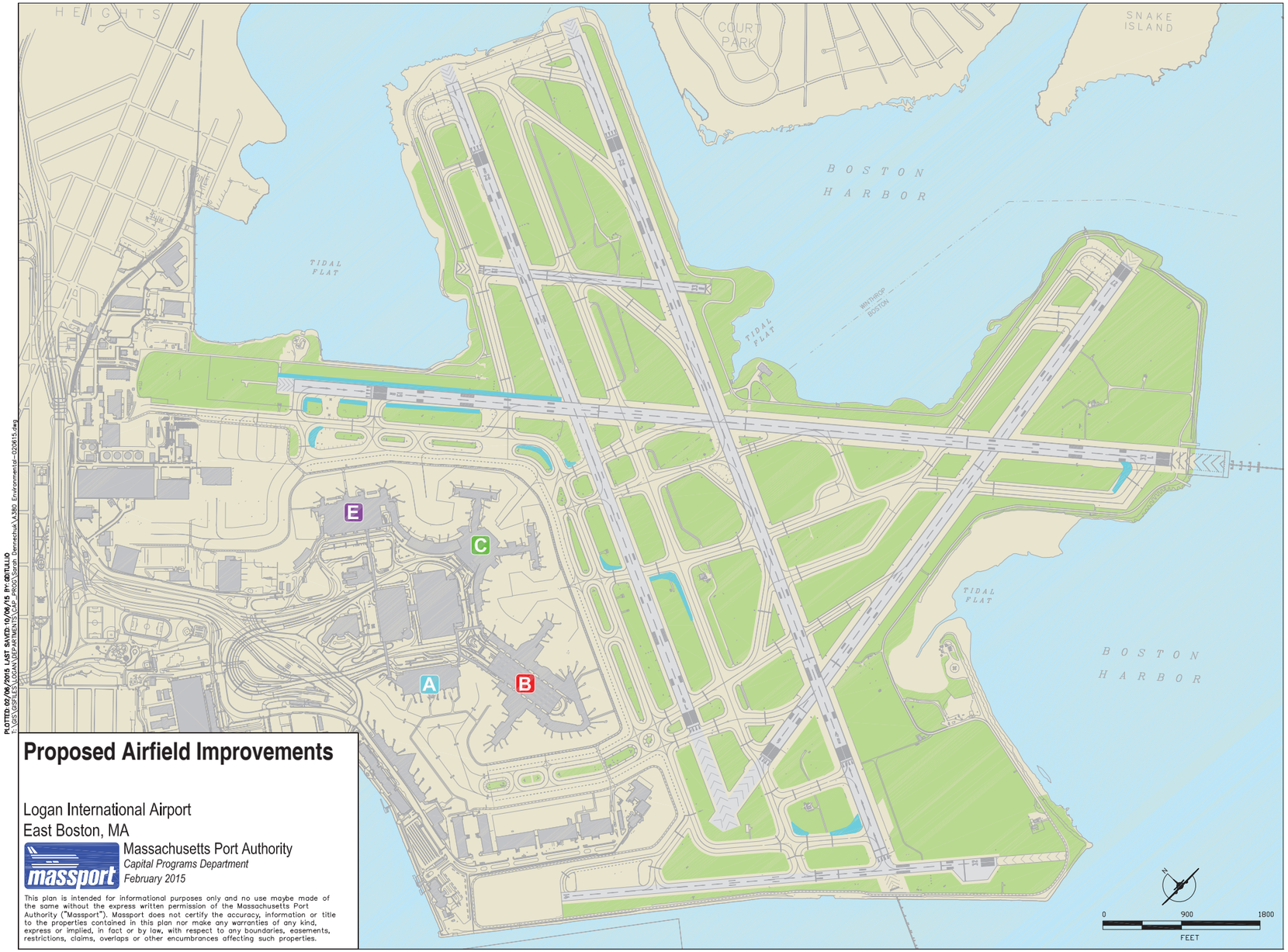
Source: AECOM

Note: Does not show pavement removal

Figure 3.7

Airfield Alternative 2 - Stabilize Runway Shoulders and Modify Taxiways

TERMINAL E RENOVATION AND ENHANCEMENTS PROJECT
Boston-Logan International Airport
East Boston, Massachusetts



Proposed Airfield Improvements

Logan International Airport
East Boston, MA

Massachusetts Port Authority
Capital Programs Department
February 2015

Not to Scale

Airfield Alternative 3 (Proposed Action)

- No runway widening
- Stabilize runway shoulder runway 15R-33L to 50-feet west of the runway 4L-22R intersection only
- Modify pavement fillets along 6 select taxiways

New Pavement

Source: AECOM

Note: Does not show pavement removal

Figure 3.8

Airfield Alternative 3 (Proposed Action) - Reduced Pavement

TERMINAL E RENOVATION AND ENHANCEMENTS PROJECT
Boston-Logan International Airport
East Boston, Massachusetts

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Table 3.6 Airfield Improvements: Comparison of Alternatives

		Alternative 1[1]	Alternative 2	Alternative 3 (Proposed)
Runway Improvements	Runway 4R-22L	200-ft wide runway	150-ft wide runway	150-ft wide runway
	Runway 15R-33L	200-ft wide runway	150-ft wide runway	150-ft wide runway
Shoulder Improvements	Runway 4R-22L	30-ft & 50-ft shoulders	55-ft & 75-ft shoulders	55-ft & 75-ft shoulders
	Runway 15R-33L	40-ft & 50-ft shoulders	50-ft & 75-ft shoulders	50-ft & 75-ft shoulders
Taxiway Improvements		Taxiway Fillet Improvements for Taxiways B, C, D, E, L, M, N3, N, P, R	Taxiway Fillet Improvements for Taxiways B, C, D, E, F, L, M, N3, N, P, R	Taxiway Fillet Improvements for Taxiways B, C, D, E, L, M, N
New Pavement (square feet)	Runway 4R-22L	477,000	0	0
	Runway 15R-33L	567,000	62,100	76,000
	Taxiways	193,500	261,000	131,250
	Total	1,237,500	323,100	207,250
Total Costs		$49.2M	$13.4M	$12.3M

3.3.4.4 Airfield Alternatives Comparison

The No-Action Alternative does not meet the purpose and need or Project goals and objectives; it does not meet FAA operational requirements and design standards for Group VI aircraft. Airfield Alternative 1, includes widening both Runway 4R-22L and Runway 15R-33L and would require modifications to Taxiways B, C, D, E, L, M, N, N3, P, and R. This alternative would require the greatest amount of runway and taxiway modifications and would also be the most expensive.

Alternative 2 was developed to minimize overall runway and taxiway design and to minimize cost. This alternative maintains the existing runway widths at 150 feet and has similar shoulder modifications. Alternative 2 was eliminated due to cost and efficiency. Alternative 3, the Proposed Action, was developed to optimize operational efficiency and further minimize runway and taxiway modifications and associated impacts. New pavement would be offset by pavement removal elsewhere on the airfield. **Table 3.6** and **Figure 3.9** compares each of the airfield alternatives and considers runway improvements, shoulder improvements, taxiway improvements, net-new pavement, and total cost.

Airfield Alternative 1 - Widen Runways, Stabilize Shoulders, and Modify Taxiways

- Widen Runway 4R-22L and Runway 15R-33L from 150 feet to 200 feet
- **Stabilize** runway shoulders
- Modify pavement fillets along 10 select taxiways

Cost: $49.2 M
Operational Efficiency: Fewest operational constraints for aircraft movement
New Pavement*: Runway 1,044,000 sf; Taxiway 193,500 sf; Total 1,237,500 sf

(Dismissed)

Airfield Alternative 2 - Stabilize Runway Shoulders and Modify Taxiways

- No runway widening
- Stabilize runway shoulder Runway 15R-33L west of the Runway 4L-22R intersection only
- Modify pavement fillets along 11 select taxiways

Cost: $13.4 M
Operational Efficiency: Many taxiway modifications required, did not maximize efficiency
New Pavement*: Runway 62,100 sf; Taxiway 261,000 sf; Total 323,100 sf

(Dismissed)

Airfield Alternative 3 (Proposed Action) - Reduced Pavement

- No runway widening
- Stabilize runway shoulder Runway 15R-33L to 50-feet west of the Runway 4L-22R intersection only
- Modify pavement fillets along 6 select taxiways

Cost: $12.3 M
Operational Efficiency: Minor modification to runway shoulders on Runway 15R-33L allows greater flexibility for operations. Fewer taxiway modifications required
New Pavement*: Runway 76,500 sf; Taxiway 227,250 sf; Total 304,250 sf

*Pavement removal at the airport would be proposed for all alternatives to offset any impacts to grassland.

Source(s):AECOM

Figure 3.9

Airfield Alternatives Development

3.4 Proposed Action

Massport selected Terminal Alternative C and Airfield Alternative 3 as the Proposed Action. Terminal Alternative C addresses the passenger and operational needs for the entire Terminal E, including the accommodation of Group VI aircraft, improved passenger accommodations, improved passenger connections to the east gates, expanded passenger processing capability, and additional retail and passenger amenities throughout. The proposed renovation and enhancements aim to right-size the passenger processing infrastructure, enhance the passenger level of service, and be on the forefront of innovation. Although Alternative C involves complex construction phasing and is the most costly terminal alternative, the benefit of enhancements throughout the Terminal were found to best meet the Project need for improved efficiency and passenger experience. Massport found that the benefit of the additional renovation and holdroom configuration outweighs the additional cost.

Airfield Alternative 3 meets cost and operational requirements and includes fewer modifications to runways and taxiways than Alternatives 1 and 2.

3.4.1 Proposed Action: Terminal E Renovation and Enhancements Project

The Proposed Action will modify existing facilities and infrastructure on the airfield and at Terminal E. The Project will address the need for Group VI accommodations and improved passenger experience while providing flexibility for the future, minimizing overall cost, and reducing complexity of construction. The details of each element of the Proposed Action are provided in the following sections.

3.4.1.1 Terminal E Renovation and Enhancements

The Proposed Action in the Terminal area includes reconfiguring three existing gates to make them A380 capable and providing internal improvements throughout Terminal E. To simplify the passenger experience, the gates would be renumbers into E1 through E12. Gate reconfigurations and associated improvements at Terminal E would include:

- Demolishing three existing gates and replacing them with three A380 capable gates (Gates E10 [7B], E11 [8A], and E12 [8B]);
- A 93,563-square foot addition to Terminal E;
- Three new holdrooms at Gates E10 (7B), E11 (8A), and E12 (8B); expanded holdroom at the north end of the crescent addition; and a new holdroom at Gate E3 (2) within the existing mezzanine level at the east end of the Terminal;
- New circulation concourse and passenger boarding lounges;
- Improved passenger amenities and concessions;
- Three new airline club facilities;
- Improved passenger throughput and reduced wait-time at the passenger checkpoint;
- Improved passenger way-finding systems throughout the Terminal;
- Modifying inbound baggage handling systems; and
- Sterile corridor for arriving passengers leading to CBP processing areas.

Interior

The renovated Terminal E would enhance the concourse on four levels of construction: Apron (Level 1), Arrivals (Level 2), Departures (Level 3), and Club (Level 4). Level 1 (**Figure 3.10**) would include renovation to the existing baggage claim area. Level 2 (**Figure 3.10**) would process arriving passengers. Level 3 (**Figure 3.11**) would serve departing passengers and would include enhanced concessions and holdrooms. Level 4 (**Figure 3.11**) would house the new airline clubs located above Gates E10 (7B), E11 (8A), and E12 (8B).

Passenger Holdrooms (Departures, Level 3 and Arrivals, Level 2)

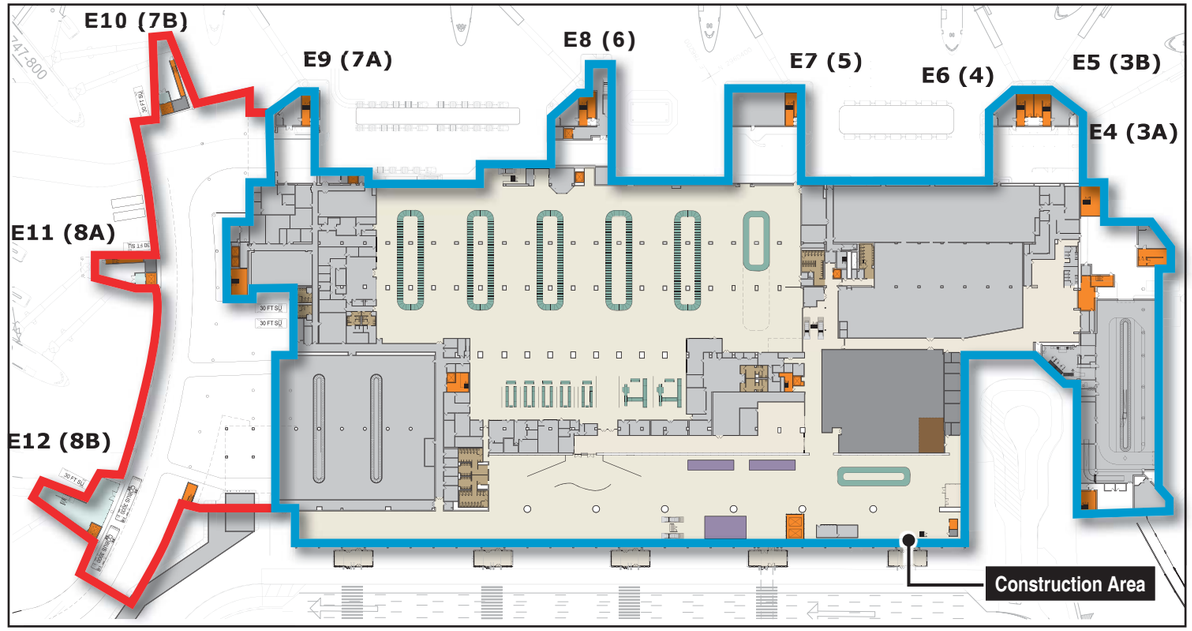
Three new passenger holdrooms would be sized to accommodate one 747-8, one A380, and one 747-400 at Gates E10 (7B), E11 (8A), and E12 (8B) respectively. Additional passenger holdroom space has been provided to address shortfalls in the existing holdroom area at Gate E9 (7A). Specialty seating areas would be used to naturally separate and define the individual holdrooms; this seating is also placed to maximize exposure to adjacent retail areas. The new holdrooms would be designed to seat approximately 860 passengers each, incorporating space for ticket podiums and boarding queues. These holdrooms would be located in the enhanced concourse and connected to the Terminal E departures level by an extension of the existing concourse through a generous, two-level sky-lit space. This enhanced concourse provides convenient access to concessions space, restrooms, and other passenger amenities.

On the east end of the Departures Level, removing an airline club elevator and stair core and relocating Gate E3 (2), resolves the current lack of seating at this holdroom and eliminates inefficient gate boarding operations. A specialty seating area would be located between Gates E6 (4) and E7 (5) to naturally define the boundary of the gate holdrooms, and would be adjacent to both retail and restrooms, enhancing the passenger experience. The east holdroom reconfiguration creates an opportunity to repurpose an existing elevator and add new escalators and stairs down to Level 2 within the existing Terminal, creating a clear connection to Terminal C. At Level 2, escalators down to Level 1, within the existing rotunda area, would be demolished to allow space for a new holdroom and gate entry at Gate E3 (2). Here, restrooms would be renovated and enlarged, and the existing security checkpoint/glass corridor wall would be demolished to allow larger holdrooms for Gate E2 (1A) and E1 (1B).

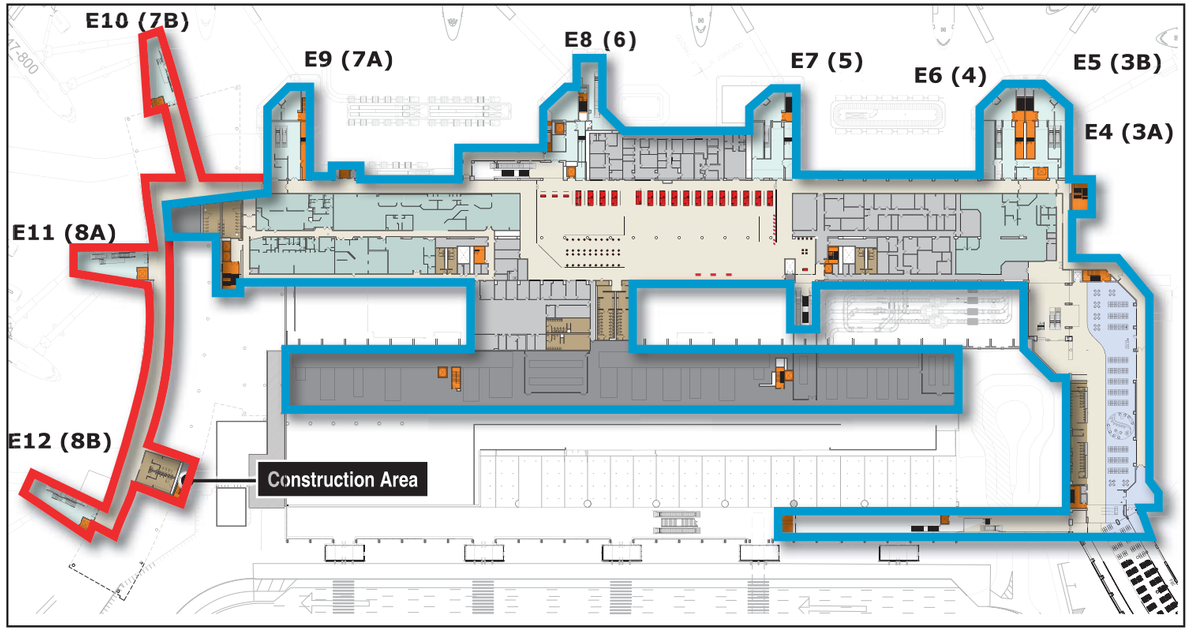
Airline Clubs (Club, Level 4)

Three new 8,000-square foot premium passenger clubs would be located above the new holdrooms at Gates E10 (7B), E11 (8A), and E12 (8B). The clubs would be accessed through the existing vertical circulation core, which would be reconfigured to contain two passenger elevators and a public stairway. All three clubs provide separate access to the adjacent gates through passenger boarding bridge portals, each club being associated with the airline using that gate. In the event an airline whose members may be using the club has aircraft departing from different gates, these would be accessed through the primary vertical circulation core.

Total New Building Area (all levels): 93,563



Level 1 (Apron)



Level 2 (Arrivals)

Newly Constructed Space
Renovated Space
BACK OF HOUSE
BAGGAGE CLAIM
CIRCULATION
CLUB (LEVEL 4)
EXISTING RETAIL
GATE PIER
HOLDROOM
MECHANICAL
RESTROOMS
RETAIL
RETAIL SEATING
TSA
VERTICAL CIRCULATION

Not to Scale

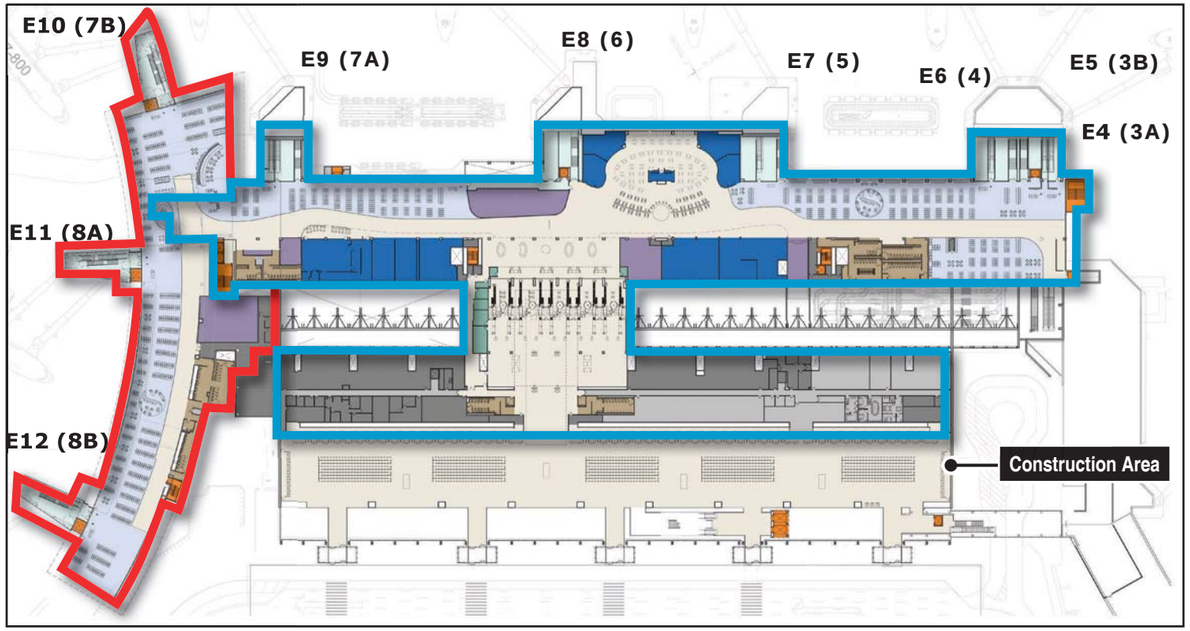
Source: AECOM

Figure 3.10

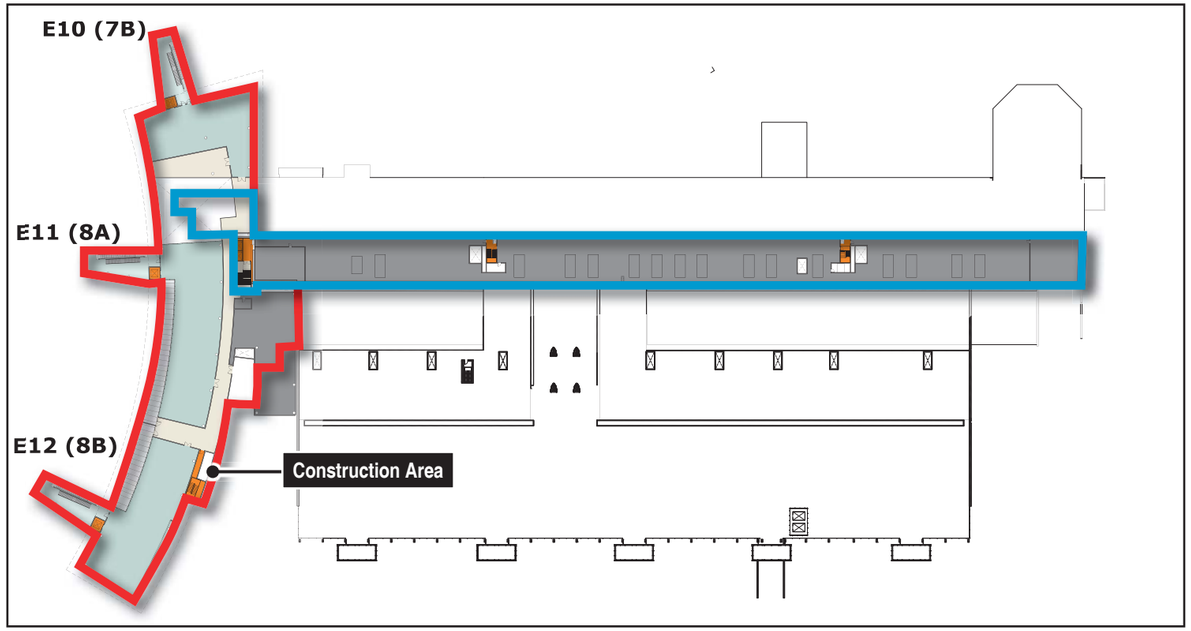
Alternative C (Proposed Action) - Levels 1 and 2

TERMINAL E RENOVATION AND ENHANCEMENTS PROJECT
Boston-Logan International Airport
East Boston, Massachusetts

Total New Building Area (all levels): 93,563



Level 3 (Departures)



Level 4 (Club)

Newly Constructed Space

Renovated Space

- BACK OF HOUSE
- BAGGAGE CLAIM
- CIRCULATION
- CLUB (LEVEL 4)
- EXISTING RETAIL
- GATE PIER
- HOLDROOM
- MECHANICAL
- RESTROOMS
- RETAIL
- RETAIL SEATING
- TSA
- VERTICAL CIRCULATION

Not to Scale

Source: AECOM

Figure 3.11

Alternative C (Proposed Action) - Levels 3 and 4

TERMINAL E RENOVATION AND ENHANCEMENTS PROJECT
Boston-Logan International Airport
East Boston, Massachusetts

Passenger Amenities (Arrivals, Departures, and Club Levels)

Passenger amenities would include improved concessions constructed as part of the new addition and also in renovated spaces through the existing Terminal. Passenger seating, amenities, and way-finding upgrades would be provided throughout the Terminal to create a more intuitive, clear, convenient, and pleasurable experience. Way-finding upgrades would include digital passenger information and interactive digital displays. A seating area would be placed on the major circulation axis at the intersection of the enhanced concourse and the existing building. This area is designed to provide the space with natural light and create a memorable transition space.

The proposed design moves the landside retail to post-security locations where they would see longer customer dwell times and increased revenues. This would free an area large enough within the existing building to accommodate an expanded 10-lane Security Checkpoint and its associated queue and re-composure areas.

Passenger Processing (Arrivals, Level 2 and Departures, Level 3)

Major passenger processing areas contained within Terminal E include:

- Outbound Passenger Processing: Passenger Ticketing and Passenger Security Checkpoint; and
- Inbound Passenger Processing: two CBP processing areas and INS.

International arrivals, located a level below departures at the three reconfigured gates, exit directly to a sterile corridor that connects into the existing sterile corridor at the Terminal. Deplaning passengers would either descend the escalator from Level 3 or stay on Level 2 to pass through the dynamically signed "Welcome Portal." Through the portal, a curving arrival corridor contains two separate restroom facilities located along this route for the convenience of arriving passengers. The corridor ultimately ties into the existing arrivals corridor that leads to the INS Primary Inspection Services.

A new section of sterile corridor would provide passengers arriving from the Level 2 gates with a consistent corridor width leading to INS Primary. Restrooms within INS would be renovated with new finishes and fixtures, and document check would be provided for the "One-Stop" program. The One-Stop process would be aimed at speeding the CBP processes for those arriving international passengers without bags. These passengers would move only through passport control, and then bypass the Bag Claim Hall and Customs lanes, moving directly down to the International Arrivals Hall. While few in number, these passengers would avoid the longer queues within the INS Hall and International Bag Claim, reducing the impact on both INS and CBP. The domestic baggage claim device at Level 1, adjacent to the One-Stop escalators, would be absorbed by the International Claim area and replaced with a larger carousel to accommodate bags for increased passenger volumes.

The existing passenger checkpoint would be expanded into adjacent retail areas within the existing terminal to accommodate the increased passenger screening requirements and passenger queueing areas based upon projected airline peak departures schedules.

The existing Passenger Security Checkpoint consists of seven lanes, with approximately 3,170 square feet of queue space. During the peak period there is a need for greater throughput requiring eight lanes for a 12.3-minute average wait time, nine lanes for a 8.8-minute wait time, or ten lanes for a 5.9-minute wait time, assuming 160 passengers per hour per lane throughput, with all lanes open at the beginning of the peak period. The Proposed Action would include a 10-lane checkpoint with queue area in excess of 3,000 square feet, with

extra table length in front of and behind the bag screening equipment to improve the process of retrieving carry-on bags.

Baggage Handling (Apron, Level 1)

International Baggage Claim currently consists of five large bag claim devices (150-bag carousels) and one small device (75-bag carousel). The small carousel would be converted to a large carousel, providing a total of 1,320 linear feet of claim frontage within the Customs Hall. This would be required to accommodate the 2017 schedule during peak period arrivals. This will make a total of six large bag claim carousels available for exclusive international use.

Support Facilities (All Levels)

Mechanical and other support spaces would be located at the Departures, Arrivals, and Club Levels. While gate entrances and holdroom seating have been placed to maximize airfield views on the west, support spaces, such as mechanical rooms, electrical/communications rooms, and egress stairs are located east of the concourse to minimize service runs along a service "backbone," filling the void between the existing terminal building and enhanced concourse. Service connections to the loading dock on Level 1 are retained. A service drive is provided for efficient ground operation connections between the enhanced concourse and existing building to the East, as well as connection to the existing Outbound Baggage Room to the South. A central loading area with scissor lifts would be located adjacent to a new freight elevator providing service access to all levels of the enhanced concourse.

Exterior

The exterior area includes modifications to gates and the apron/ramp. Gates E10 (7B), E11 (8A), and E12 (8B) would be converted to be A380 capable and the apron/ramp area would be modified to accommodate the parking and fueling requirements of Group VI aircraft.

Gates

Three existing wide-body gates at Terminal E would be reconfigured for A380, 747-8, and 747-400 aircraft use. No new gates are proposed as part of the Project. The Proposed Action (Alternative C) offers a greatly simplified plan on the west, consisting of a crescent-shaped four-level block, with three reconfigured gates accommodating A380s, 747-8s, or 747-400s. Passenger access to the aircraft is through two portals arranged perpendicular to the building face. Gates E9 (7A) and E10 (7B) are currently combined within a single circulation node or boarding portal, containing the necessary stairs, escalators, and elevator common to the two gates. Similarly, Gates E11 (8A) and E12 (8B) have a single boarding portal in common. Since the new passenger boarding bridge configurations and vertical circulation requirements cannot be provided by the existing boarding portals, a new portal design is being proposed for each of the replacement gates serving the Group VI aircraft. These portals are configured to serve each deck of the aircraft from the Departures, Arrivals, and Club Levels. The boarding portal currently serving Gate E9 (7A) would remain, serving that gate exclusively.

Gates E10 (7B), E11 (8A), and E12 (8B) would all be reconfigured to be A380 capable. However, the Gate E9 (7A)/E10 (7B) portal, currently serving two 747-400s, would be serving one 747-400 and one 747-8 in the future. The E11 (8A)/E12 (8B) portal would be replaced and reconfigured and would serve one A380 and

747-400 in the future. As outlined above, the A380 aircraft would be accessed by two passenger boarding bridges, one to the upper deck, and one to the lower deck. These passenger boarding bridges and their connections to the gate portals are arranged to provide passenger boarding to both upper and lower aircraft decks from Levels 3 and 4 of the Terminal, and deplaning from both decks to the sterile corridor level (Level 2). Egress is also provided to Level 1 by both stairs and elevator.

All of the gate piers in the proposed design are located to accommodate A380 aircraft. They are equipped with two passenger boarding bridges (one from Level 3 and another from Level 2), while preserving space for a third bridge to be added in the future at Level 2. Escalators are provided from Levels 2 to 3 and 3 to 4, providing convenient and direct access to the aircraft from both the departures holdroom and the adjacent clubs above. One elevator within the gate pier is dedicated to the general boarding operation and the other to the airline club, maintaining a high level of service for both. Open stairs are provided for convenience, but also for egress from the concourse in case of emergency. Each of the gate piers contains a mechanical space on Level 1 and a loading area with scissors lift that allows for service goods to be brought directly into the club.

Apron/Ramp

Gating the A380s and the 747-8s requires additional apron work in front (airside) of the existing checked baggage inspection system (CBIS) structure, this work primarily being to restripe the apron to provide the necessary requirements for the A380 in an area not currently used for aircraft parking. The area proposed is currently in use as GSE storage.

Ground Service Equipment

The GSE for the A380 consists of standard powered equipment found at typical gate setups. The equipment also includes tugs and tractors for any piece of non-powered equipment such as ground power units, baggage container dollies, and portable boarding stairs. Additional equipment would consist of belt loaders, lavatory service trucks, and container loaders. Most of the required equipment can be electric powered, however, the most critical piece of equipment is the pushback tug or tractor; currently, there are no battery powered models available to handle A380 aircraft. Diesel offerings are considerably quieter and cleaner than older units historically used at airports.

Fueling Systems

Logan Airport currently uses an aircraft hydrant fueling system that provides Jet-A fuel to the majority of aircraft parking gates through the use of fueling hydrants. The existing individual fueling hydrants at the three upsized Terminal E gates would be relocated to accommodate the new positions of aircraft at Terminal E. The final location of fuel hydrants would be determined during final design and would be located to serve multiple aircraft wherever possible.

3.4.1.2 Airfield Improvements

Airfield Alternative 3 is identified as the Proposed Action and would include the following elements:

- Maintain existing width of 150 feet for Runways 4R-22L and 15R-33L;
- Stabilize runway 15R-33L shoulders to 50 feet west of the Runway 4L-22R intersection;

- Adjust fillets for portions of Taxiways B, C, D, E, L, M and N; and
- Use Taxiways M and C for Group VI arrivals and departures.

This Alternative is illustrated in **Figure 3.8**. Stabilizing the Runway 15R-33L shoulders is a key operational efficiency measure to accommodate Group VI aircraft, such as the A380 have larger wingspans than other commercial aircraft. Wingtips of these aircraft would overhang areas adjacent to the runways and taxiways. The engines are located on the underside of the wing and can create a conflict with ground mounted elements such as runway and taxiway edge lighting. As previously noted, current FAA guidance requires an inspection of 150-foot wide runways with 35-foot shoulders after a takeoff or landing of an A380. The purpose of this procedure is to ensure that the aircraft's jetblast would not compromise the operational safety of the next aircraft operation. Runways that are 150 feet wide with 50-foot shoulders, or greater, do not have this requirement. Stabilizing shoulders for Runway 15R-33L west of the Runway 4L-22R intersection addresses this operational concern. Shoulder stabilization is only required west of this intersection because the rest of the Runway already meets the dimensional requirements.

Airfield modifications would include expanding the edge of pavement for six taxiways around the fillets and shoulder areas. This expansion is expected to include additional full strength and shoulder strength airfield pavement, demolishing some areas of existing airfield pavement, minor adjustments to existing stormwater and electrical systems, and modifications to the existing pavement markings.

The selected taxiway route for the A380 minimizes operational impacts on other parts of the airfield as sufficient runway/taxiway centerline-to-centerline clearance is maintained throughout the entire route. The Proposed Action provides sufficient clearance from obstacle free zones, object free areas, and other airfield considerations and has reduced environmental impacts.

4 Affected Environment

4.1 Introduction

This chapter describes the character of the environment in which the proposed Terminal E Renovation and Enhancements Project would occur (the "Baseline Condition"). Environmental resources that could potentially be affected by the Proposed Project/Proposed Action are also described. The Affected Environment for the Proposed Project is documented for each applicable environmental resource category, as specified in Federal Aviation Administration (FAA) Order 1050.1E, Change 1[1] and Order 5050.4B[2] to provide context for understanding the potential impacts of the Project. The Project Area includes the proposed interior and exterior areas at Terminal E including the adjacent apron and a portion of the airfield. The following sections describe the existing environmental conditions specific to the Project Area. **Figure 4.1** shows the existing conditions at Terminal E. **Figure 4.2** shows the Logan Airport Airfield.

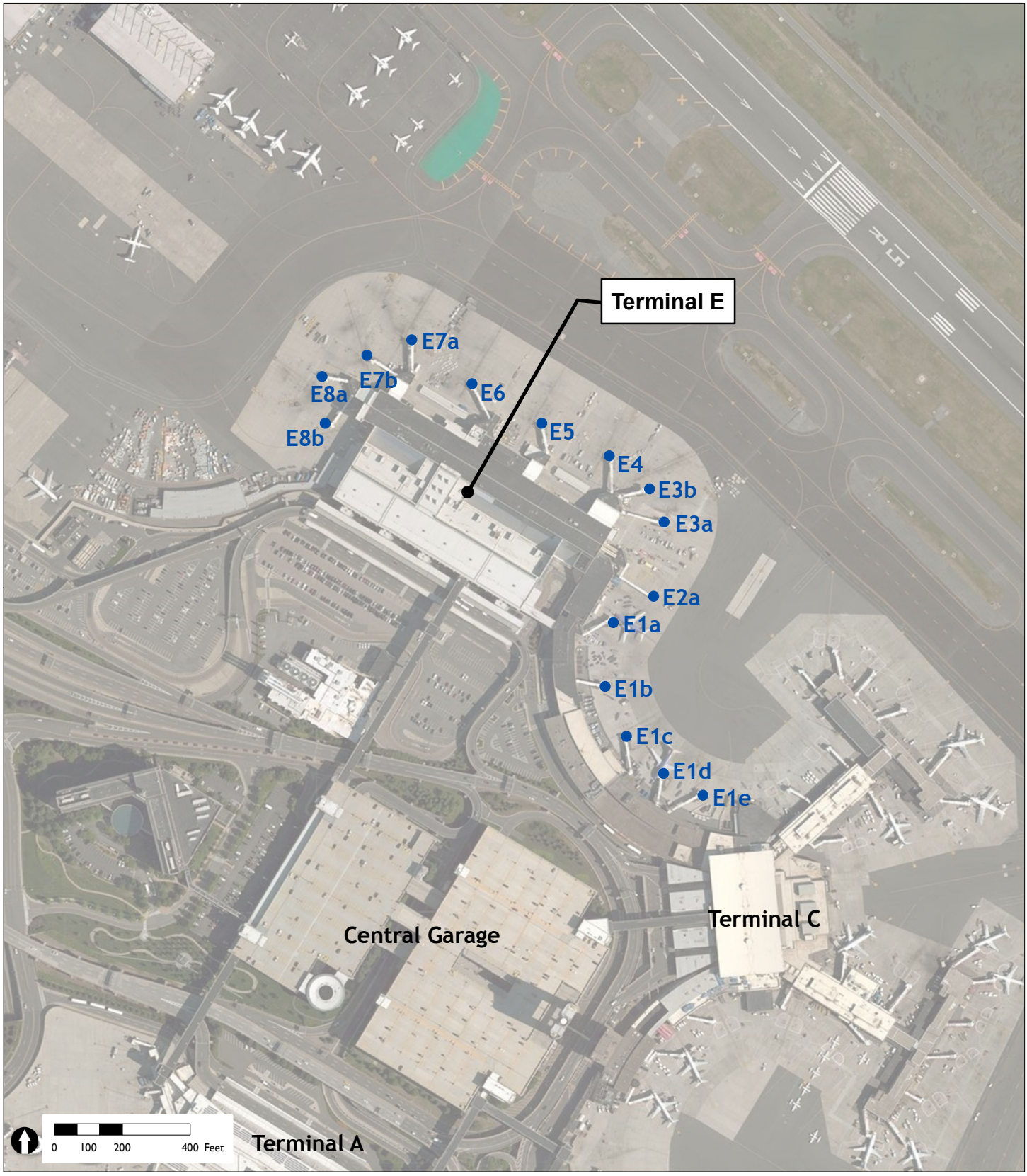
4.2 Project Environmental Setting

The following section describes the general environmental characteristics of Logan Airport and specifically Terminal E and the airfield.

4.2.1 Physical Setting

The Airport boundary encompasses approximately 2,400 acres in East Boston and Winthrop, including 700 acres underwater in Boston Harbor. Logan Airport, shown in **Figure 4.2**, is one of the most land-constrained airports in the nation as it is located primarily on filled land and is surrounded by water on three sides. Logan Airport is close to downtown Boston and is accessible by public transit and a well-connected roadway system.

1 FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures*, released March 20, 2006.
2 FAA Order 5050.4B, National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions, released April 28, 2006

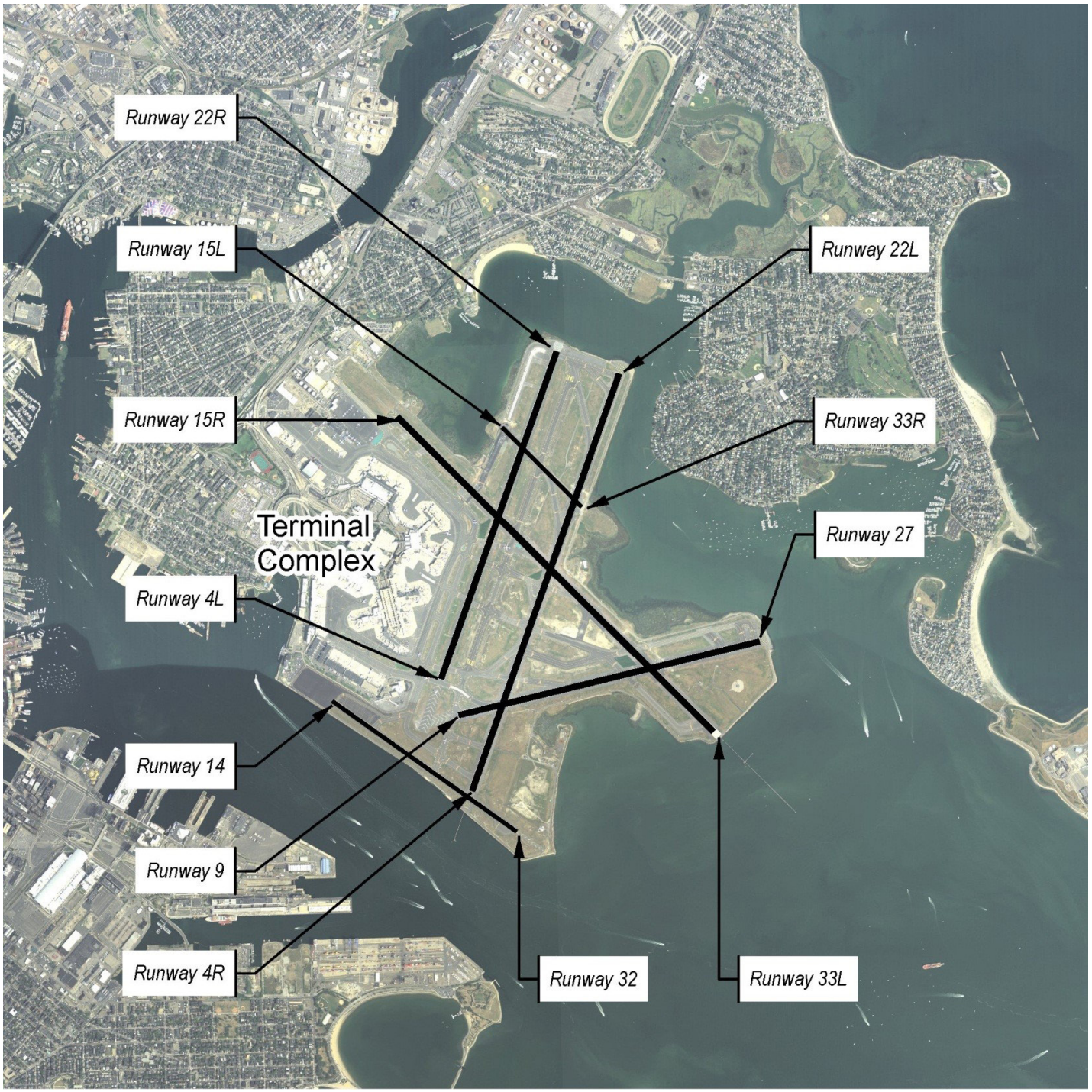


Source(s): MassGIS 2008 15cm Aerial

Figure 4.1

Terminal E Existing Conditions

TERMINAL E RENOVATION AND ENHANCEMENTS PROJECT
Boston-Logan International Airport
East Boston, Massachusetts



Not to Scale

Source: Harris Miller Miller & Hanson Inc. 2010, U.S. Department of Agriculture Imagery Program (NAIP), 2010

Figure 4.2

Logan Airport Airfield

TERMINAL E RENOVATION AND ENHANCEMENTS PROJECT
Boston-Logan International Airport
East Boston, Massachusetts

Logan Airport has four passenger terminals (Terminal 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 safety, security, operational efficiency, and accessibility to and from the Boston metropolitan area, while carefully monitoring the environmental effects of Logan Airport operations.

Separate from this short-term Terminal E Renovation and Enhancements Project, as part of an Authority-wide strategic planning effort, Massport is re-evaluating planning options for future terminal improvements. That effort as well as other foreseeable projects are described in Chapter 5, *Environmental Consequences and Mitigation*. The airfield comprises six runways, approximately 15 miles of taxiway, and approximately 240 acres of concrete and asphalt apron. Runway 15R-33L and Runway 4R-22L are Logan Airport's longest runways; each is just over 10,000 feet in length. Runway 4L-22R is 7,860 feet in length, and Runway 9-27 is 7,000 feet long. Runway 14-32 is 5,000 feet in length and unidirectional; there are no arrivals to Runway 14 and no departures from Runway 32. Runway 15L-33R is Logan Airport's shortest runway at under 3,000 feet long. The airfield includes taxiways which connect runways with ramps, hangars, terminals, and other facilities.

4.2.1.1 Terminal E Interior and Exterior

Terminal E, also known as the John A. Volpe International Terminal, named after the former Governor of Massachusetts and U.S. Secretary of Transportation, is the international terminal for Logan Airport. The original terminal was completed in 1974. Massport constructed the Terminal E Modifications project in 1997, which enhanced passenger facilities. In 2002, Massport began work on the International Gateway Project, which expanded and upgraded the Terminal to provide better service to international passengers. The project was completed in phases. Phase 1, completed in 2004, included a weather-protected airside bus portico linking the ground floor with the second floor to accommodate passengers arriving from remotely parked aircraft. Phase II, completed in 2007, expanded the Federal Inspection Services (FIS) Facility for U.S. Customs, and improved the meeter/greeter lobby and the ticketing area to maximize passenger convenience and reduce processing times. The baggage handling facilities were upgraded as part of an Airport-wide in-line baggage screening project in 2004. . The International Gateway Project included a concourse to be added to the west portion of Terminal E with additional international gates. This "West Concourse" element of the project was never constructed.

Unlike the other Logan Airport terminal buildings which have two levels (the upper level is used for departures while the lower level is used for arrivals), Terminal E has three levels. The third level is used for departures while the ground level is used for arrivals and customs. The second level is used for passport control. Parking for Terminal E is provided in the central parking complex, connected by a pedestrian bridge, and in two surface parking lots near the Terminal entrance.

Currently there are 12 gates at Terminal E, and the terminal processes all international arrivals through the FIS facility. In April 2015, Southwest Airlines relocated from Terminal E to Terminal A to allow those gates to serve international flights. Prior to the move, Southwest Airlines (including the former AirTran Airways) was leasing five domestic gates at the terminal (Gates E1A, E1B, E1C, E1D, and E1E). As part of the Terminal C to E Connector Project currently under construction, gates E1C, E1D, and E1E will remain as domestic gates as part of Terminal C. Gates E1A and E1B will remain part of Terminal E for international use.

Airlines share ticketing facilities called Common Use Facilities. The existing Terminal E facilities include:

- Terminal E Interior Area:
  - Airline ticketing/baggage handling;
  - Passenger holdrooms;
  - Airline clubs;
  - Baggage screening and claim;
  - Passenger Security Checkpoint;
  - Public space;
  - Concessions; and
  - Other, including mechanical/electrical/utility space, non-public circulation areas, and janitorial/storage areas.
- Terminal E Exterior Area:
  - Gates;
  - Fueling locations; and
  - Aircraft apron and parking areas.
- Airfield Area:
- Runways; and
- Taxiways.

4.3 Overview of Environmental Resource Categories Evaluated

The Project Area includes portions of the existing Terminal E, the adjacent gate and apron areas, and several areas on the airfield where specific sections of runway and taxiway shoulders must be stabilized to facilitate safe movement of Group VI aircraft and their wider wingspans. **Figure 4.1** depicts Terminal E existing conditions and **Figure 4.2** depicts airfield existing conditions. **Table 4.1** lists the impact categories required by FAA Order 1050.1E to be evaluated, and identifies whether they are present within the Project Area, and whether they may be affected or not affected by Project implementation. While all resource categories were initially considered, several were not evaluated further because they are not present within the Airport setting and/or the Project Area.

Impact categories not present or affected by implementation of any alternatives are listed in **Table 4.1** below with the rationale for exclusion from further consideration.

Table 4.1 NEPA Environmental Resources Evaluated in this EA

Environmental Resource[1]	(Yes/No)	Explanation
Air Quality	Yes	The Project does not involve increased aircraft operation or increased airport capacity. Air quality operational effects are discussed in Chapter 5. Short term construction impacts are analyzed under Construction. (See Chapter 5, Environmental Consequences and Mitigation).
Coastal Resources	Yes	The Project is proposed within previously developed/disturbed portions of the Airport. The limited airfield modifications would occur in upland areas within the Coastal Zone that are already in use for aeronautical operations.
Compatible Land Use	No	The Project is restricted to activities and purposes compatible with existing airport operations. All work would take place within the Airport boundary and would not alter the existing off-Airport land use patterns. (See below for Surface Transportation). The Project is not expected to have an effect on noise impacts within the DNL 65 dB contour.
Department of Transportation Act, Section 4(f) Properties	No	There are no known Section 4(f) properties within the boundary of the Project Area. There are two known Section 4(f) properties outside the Project Area within the vicinity of the Airport.
Farmlands	No	Farmland of Statewide Importance, as defined by the Farmland Protection Act Policy, does not exist within the Airport boundaries or within the vicinity of the Airport.[2]
Fish, Wildlife, and Plants/ Threatened and Endangered Species	Yes	The Project is within mapped state Priority Habitat for upland sandpiper and grasshopper sparrow, birds that are state-listed as an endangered and threatened species, respectively. There are no federally listed species that are likely to occur within the project area.
Floodplains	No	The Project Area is not located within a 100-year flood hazard zone.[3]
Hazardous Materials, Pollution Prevention, and Solid Waste[4]	Yes	The Project includes reconfiguring the jet fuel hydrant system, which would be conducted in compliance with Federal requirements. There are no National Priority List sites on Logan Airport.

Table 4.1 NEPA Environmental Resources Evaluated in this EA (continued)

Environmental Resource[1]	(Yes/No)	Explanation
Historical, Architectural, Archaeological and Cultural Resources	No	There are no known historical, archaeological, or cultural resources within the Project Area. No impacts anticipated.
Light Emissions and Visual Impact	No	The Project Area is located on-Airport and not adjacent to the residential communities surrounding the Airport.
Natural Resources and Energy Supply/ Sustainable Design	Yes	The Project construction, operation, and maintenance would cause additional demands on energy supplies that can be accommodated by current power suppliers. Impacts to natural resources are not anticipated as part of the terminal renovations, since the landside portion of the project is built on paved land fully developed for airport uses. The new portions of the Project would meet Leadership in Energy & Environmental Design (LEED) Silver and Massachusetts LEED Plus standards and renovated portions will follow Massport's Sustainable Design Standards and Guidelines.
Noise	Yes	There would be no change in aircraft operations or activity levels as a result of the Project and, therefore, aircraft noise levels at or surrounding the Airport are not expected to change. Noise is discussed in Chapter 5. Short term construction noise analysis is included under Construction.
Socioeconomic Impacts and Secondary (Induced) Impacts/Environmental Justice Populations, and Children's Environmental Health and Safety	No	All work for the Project would take place within the Airport boundary and would not alter off-airport land use, surface transportation, noise, air quality, or otherwise adversely impact specific communities.
Surface Transportation[5]	Yes	The Project would not change the number of aircraft operations or passenger activity levels airport-wide, and is anticipated to have only temporary increases in traffic associated with construction. Short term surface transportation construction impacts are included under Construction.
Water Quality	Yes	The Project would require some paved additions to existing runway/taxiway intersections and several runway shoulder areas will be stabilized. New pavement additions are planned to be offset by removal of excess pavement elsewhere on the airport. The project is not expected to result in changes to stormwater management within the Project Area. Short term Water Quality controls are assessed under Construction.
Wetlands	No	Wetlands are present on Logan Airport property; however, there are no wetland resource areas within the Project Area.
Wild and Scenic Rivers	No	There are no wild or scenic rivers within the vicinity of Logan Airport.[6]

1 Environmental resource categories as specified in FAA Order 1050.1E.
2 United States Department of Agriculture, *Farmland Protection Policy Act* (7 U.S.C. 4201-4209), 1981.
3 FEMA flood insurance mapping
4 There are several state-listed disposal sites on-Airport. Refer to the *Logan Airport 2012/2013 Environmental Data Report* where they are listed and tracked in detail.
5 Surface transportation is called out separately to provide a higher-resolution analysis due to an ongoing curb project at Terminal E.
6 As defined by the *Wild and Scenic Rivers Act of 1968*, 16 U.S.C. section 1271 et seq.
Note: Impact Categories further assessed are highlighted in bold. See Chapter 5, *Environmental Consequences and Mitigation.*

As presented in **Table 4.1**, the following environmental resources were evaluated for potential impacts from the Proposed Project.

- Air Quality;
- Coastal Resources;
- Department of Transportation Act, Section 4(f);
- Fish, Wildlife, and Plants;
- Hazardous Materials, Pollution Prevention, and Solid Waste;
- Natural Resources and Energy Supply;
- Noise;
- Surface Transportation; and
- Water Quality

4.3.1 . Project Area Air Quality

According to FAA Order 1050.1E, Change 1 and Order 5050.4B, the project proponent must assess whether a project is likely to result in significant impacts to air quality of the human environment. This section describes the regulatory context related to air quality and the airport-wide air quality conditions at Logan Airport for the Baseline Condition.

4.3.1.1 National Ambient Air Quality Standards

The federal Clean Air Act (CAA), the 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), promulgated to demonstrate compliance with the CAA (and its 1990 amendments), regulate air quality issues in the Boston metropolitan area and state, and are discussed in the next section.

The United States Environmental Protection Agency (EPA) established NAAQS for a group of criteria air pollutants to protect public health, the environment, and the quality of life from the detrimental effects of air pollution. These NAAQS are set for the following six pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$), and sulfur dioxide (SO_2). The NAAQS primary standards (designed to protect human health) and secondary standards (designed to protect human welfare) are summarized on **Table 4.2**.

Based on air monitoring data and in accordance with the CAA, all areas within Massachusetts are designated as *attainment*, *nonattainment*, *maintenance*, or *unclassifiable* with respect to the NAAQS.[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. The current attainment/nonattainment designations for the Boston metropolitan area are summarized in **Table 4.3**.

In May 2012, EPA issued a Clean Data Finding for the Boston area ruling that the area has attained the 1997 NAAQS, suspending many obligations related to SIP development and implementation so long as the area

3 Environmental Protection Agency, *The Green Book Nonattainment Areas for Criteria Pollutants* (www.epa.gov/air/oaqps/greenbk/).

continues to demonstrate attainment based on ambient data. EPA has since proposed to revoke the 1997 8-hour NAAQS completely in June 2013; until this action appears in the Federal Register as a final rule, the Boston area is still subject to any requirements related to its former "moderate" nonattainment status under the 1997 NAAQS that are not excused by the clean data finding. Even despite the clean data finding, once the 1997 standard is officially revoked by final rule, the anti-backsliding requirements of the federal CAA may still obligate the Massachusetts Department of Environmental Protection (MassDEP) to enforce select elements of any federally enforceable SIP prepared to attain the 1997 NAAQS.

Table 4.2 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 Avg	—	0.15	Not to exceed this level. Effective January 12, 2009.
	Quarterly	—	1.5	Not to exceed this level.
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. Effective January 22, 2010.
	Annual	0.053	100	Not to exceed this level.
Ozone (O_3)	8 hour[1]	0.08	157	The average of the annual 4th highest daily 8-hour maximum over a three-year period is not to exceed this level.
	8 hour[2]	0.075	147	The average of the annual 4th highest daily 8-hour maximum over a three-year period is not to exceed this level. Effective May 27, 2008.
Particulate Matter with a diameter $\leq$ 10 µm (PM_{10})	24 hour	—	150	Not to be exceeded more than once a year on average over three years.
Particulate Matter with a diameter $\leq$ 2.5 µm ($PM_{2.5}$)	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	—	15	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	197	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.
	24 hour	0.14	365	Not to be exceeded more than once a year. (The 24 hour standard was revoked as of June 2, 2010).
	Annual	0.03	80	Not to exceed this level. (The Annual standard was revoked as of June 2, 2010.)

Source: EPA, 2011 (www.epa.gov/air/criteria.html).
1 The 1997 NAAQS for ozone.
2 The 2008 NAAQS for ozone.
ppm Parts per million
µg/m³ Micrograms per cubic meter

Table 4.3 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[1]
Ozone (Eight-hour, 2008 Standard)	Attainment/Unclassifiable[2]
Particulate matter (PM_{10})	Attainment
Particulate matter ($PM_{2.5}$)	Attainment
Sulfur Dioxide (SO_2)	Attainment
Lead (Pb)	Attainment

Source: EPA, 2014 (www.epa.gov/air/oaqps/greenbk/).
1 The Boston area was previously designated nonattainment for this pollutant but has since attained compliance with the NAAQS. Maintenance plan requirements have yet to be established.
2 Attainment/Unclassifiable means that the initial data show attainment but additional data are needed to verify longer term conditions.

4.3.1.2 State Implementation Plan (SIP)

A SIP is a state's regulatory plan for bringing nonattainment areas within that state into compliance with the NAAQS. MassDEP is required to submit updated SIPs to the EPA periodically to address CAA requirements. The current and future SIPs for the Boston area are summarized in **Table 4.4**.

Table 4.4 State Implementation Plan for Ozone

Standard	Title	Status	Comments
One-Hour	One-hour Ozone Attainment Demonstration for the Massachusetts Portion of the Boston-Lawrence-Worcester, Massachusetts-New Hampshire Ozone Nonattainment Area.	Published December 6, 2002, as final rule.	EPA approved this SIP revision and established an attainment date of November 15, 2007, for the entire multi-state nonattainment area. EPA has further determined that there are no additional obligations under the one-hour standard for this area.
Eight-Hour	Final Massachusetts State Implementation Plan To Demonstrate Attainment of the National Ambient Air Quality Standard for Ozone	Submitted to EPA, January 31, 2008, for approval.	This standard calls for the attainment of the 1997 eight-hour NAAQS for ozone by 2010 and focuses on the control of NO_x and VOCs as precursors to ozone. As of April 2012, EPA has determined that the Boston area is compliant with the 2008 standard, thus no SIP is required for eight-hour ozone.[1, 2]

Source: MassDEP (www.mass.gov/dep/air/priorities/sip.htm).
In 2007, the 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 more strict (i.e., lower) than the former standard.
The original SIP established the Logan Airport Parking Freeze and the limit of 17,319 commercial and 3,373 employee spaces at the Airport in 2007, which was changed to 18,019 commercial and 2,673 employee spaces in 2011.

4.3.1.3 Logan Airport Emissions Inventory

This section provides a summary of the 2012/2013 Logan Airport emissions inventory for pollutants, including volatile organic compounds (VOC), CO, NO_x, and $PM_{10}/PM_{2.5}$. Emissions of O_3 are not directly computed as it is a secondary pollutant formed by the interactions of NO_X and VOC 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 compounds.

- The aircraft emissions inventory was computed based on the most recent airport aircraft and facility operations in 2013. Below is a summary of the emissions inventory as established in the *Logan Airport 2012/2013 Environmental Data Report (EDR).*
- Total modeled VOC emissions at Logan Airport were 459 tpy (1,138 kg/day).
- Total NO_X emissions from all Airport-related sources were estimated to be 1,617 tpy (4,020 kg/day). This represents an overall decrease of 30 percent from 1999 levels.
- Total modeled CO emissions at Logan Airport in 2013 were 2,953 tpy (7,340 kg/day).
- Total estimated $PM_{10}/PM_{2.5}$ emissions at Logan Airport in 2013 were 37 tpy (92 kg/day).
- Since 2007, Massport has voluntarily prepared an inventory of direct and indirect greenhouse gas (GHG) emissions and published the findings in the annual EDR. Tenants and passenger vehicles represent the largest source of GHG emissions at 75 to 77 percent, followed by electrical consumption at 10 to 14 percent, and Massport at 10 to 13 percent. Overall, total GHG emissions associated with the Airport in 2013 were approximately 60,000 metric tons carbon dioxide equivalent (CO_2e).

4.3.2 Project Area Coastal Resources

Logan Airport is located primarily on filled land within Boston Harbor, within the heavily urbanized Boston Harbor Watershed and is entirely located within the designated Coastal Zone of Massachusetts. The entire Project Area is currently in use for aeronautical activity associated with the Airport.

4.3.3 Department of Transportation Act, Section 4(f) Properties

Section 4(f) properties are publicly owned parks, recreation areas, wildlife or waterfowl refuges, or historic properties or archaeological sites on or eligible for the National Register of Historic Places. There are no Section 4(f) properties within the boundaries of the Airport. There are two Section 4(f) properties in the vicinity of the Airport: the East Boston Memorial Stadium Park; and Porzio Park. Both parks are located outside the Project Area. The 17.7-acre East Boston Memorial Stadium Park is located off-Airport adjacent to and north of the Southwest Service Area (SWSA) site and includes former Massport land that was provided to the City of Boston in 2003 and was used to expand the park. The facilities include a baseball field, softball field, little league field, football/lacrosse/rugby field, play equipment/tot lot, cricket, a passive area, and a running track. Pedestrian and vehicular access is at the southwest corner of the park, via a paved area. The park facilities are operated and maintained by the Boston Parks and Recreation Department.

The 2.4-acre Porzio Park is located in the Jeffries Point neighborhood of East Boston between Sumner and Maverick Streets. The park faces Boston Harbor and is approximately 200 feet from the edge of the Airport and more than 4,000 feet away from Terminal E. The facilities include a basketball court, tennis courts, a street hockey rink, play equipment/tot lot, a spray fountain, handball courts, and a passive area. The park facilities are operated and maintained by the Boston Parks and Recreation Department.

4.3.4 Project Area Fish, Wildlife, and Plants/Threatened and Endangered Species

According to FAA Order 1050.1E and 5050.4B, the FAA must assess whether the project is likely to result in significant impacts to fish, wildlife, and plants.[4] This section describes the existing plant communities and wildlife observed in the Project Area and assesses the potential for significant impacts (as compared against thresholds specified in the Order) to these resources.

The sections below describe the existing fish, wildlife, and plants, including vernal pools and state-listed threatened and endangered species, in the vicinity of the Proposed Project.

4.3.4.1 Plants

The airfield is managed for aviation activity and is mowed regularly to aid with ground visibility for pilots. Much of the Airport's airfield is grass. At the water's edge, in a number of locations on Airport property, there are stands of common reed (*Phragmites australis*), an invasive species that can overtake native vegetation. Salt marsh also exists on Airport property near the Runway 22R end at the northwestern end of the Airport. And in Wood Island Bay Marsh north of Runway 15L 33R. There is an eelgrass bed off of Runway 33L. There are no rare or unique plant communities at the Airport.

4.3.4.2 Wildlife

Birds and other species are controlled on the airfield in accordance with the FAA's wildlife hazard management requirements. Bird species are the most common form of wildlife observed at the Airport. Some of the species observed at Logan Airport include: killdeer; various raptors including snowy owl, red tailed hawk and kestrel; herring and black backed gulls; sparrows; and starlings. These are common species assemblages for grassland and coastal habitats in eastern Massachusetts.

4.3.4.3 Threatened and Endangered Species

The United States Fish and Wildlife Service's (USFWS) county list does not include any federally listed fish, wildlife, or plants known to occur in uplands in the vicinity of the Airport although there are listed marine species reported for Boston Harbor. Review of the Massachusetts Division of Fish and Wildlife, Natural Heritage and Endangered Species Program (NHESP) Atlas indicates that a large portion of the airfield at Logan Airport is mapped as Priority Habitat for the upland sandpiper (*Bartramia longicauda*), and grasshopper sparrow (*Ammodramus savannarum)* which are listed as endangered in Massachusetts (**Figure 4.3**). These species have been known to occur in small numbers in the large grassy uplands in the interior of the airfield.

Massport follows wildlife hazard management best practices to eliminate safety hazards that obstruct flight paths or visibility. Airfields with less frequently mowed grasslands often represent the type of habitat preferred by these species, although Massport's primary objective is maintaining airfield safety.

4 Federal Aviation Administration. 20 March 2006. Order 1050.1E, *Environmental Impacts: Policies and Procedures.*

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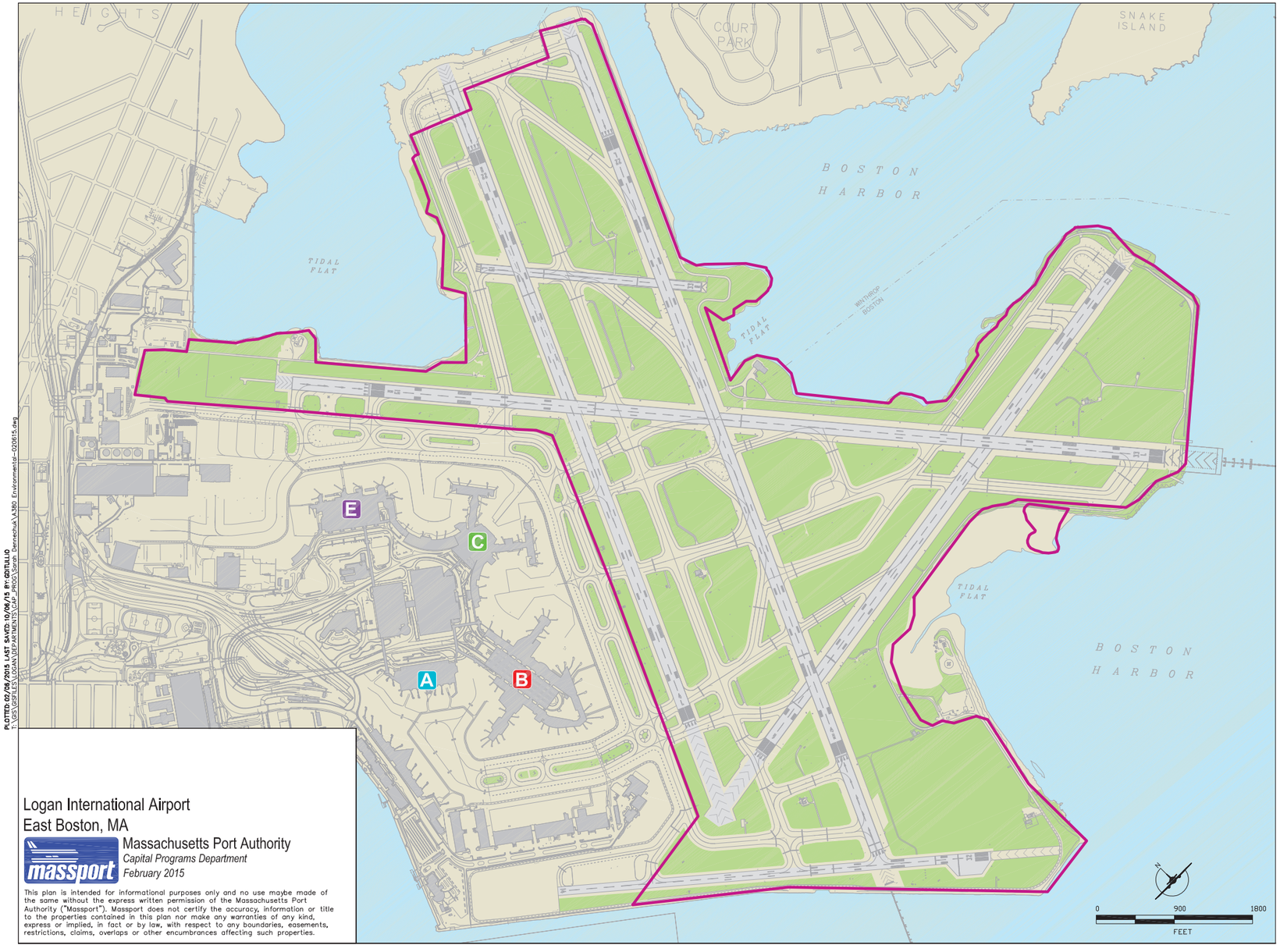

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Logan International Airport
East Boston, MA

Massachusetts Port Authority
Capital Programs Department
February 2015

Not to Scale

NHESP Mapped Priority Habitats of Rare Species, 2008

Source: AECOM

Figure 4.3

NHESP Priority Habitats of Rare Species

TERMINAL E RENOVATION AND ENHANCEMENTS PROJECT
Boston-Logan International Airport
East Boston, Massachusetts

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4.3.5 Project Area Hazardous Materials, Pollution Prevention, and Solid Waste

To minimize the risk of fuel spills, a central fueling farm is located at the north end of the Airport and is connected to the terminals via a buried fueling loop around each of the terminal buildings. Fuel is transferred from fueling pits to aircraft at each gate utilizing fuel pump tucks or hydrant carts. Although there have been reported spills and releases at Logan Airport, these have been addressed through the MCP (310 CMR 40) process, and no releases have occurred within the terminal area construction limits of the Project. No fueling occurs in the airfield areas where limited shoulder improvements are planned.

There are no National Priority List (NPL) sites on Logan Airport. In accordance with the MCP process, Massport continues to assess, remediate, and bring to regulatory closure areas of subsurface contamination. 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. Tracking of MCP activity is reported annually by Massport and can be found in the *Logan Airport 2012/2013 EDR* (EEA # 3247).

4.3.6 Project Area Natural Resources and Energy Supply/Sustainability/Resiliency

Logan Airport is a complex of interconnected buildings, transportation facilities, utility infrastructure, natural environments and management systems. FAA Order 1051.E, Change 1 and 5050.4B require that the project employ principles of environmental design and sustainability, including pollution prevention, waste minimization, and resource conservation. The long-range planning, ongoing development, and day-to-day operations present opportunities to adopt sustainable practices that mirror Massport's environmental goals and demonstrate its leadership within New England and the aviation industry. In November 2013, the Federal Government enacted Executive Order 13653: *Preparing the United States for the Impacts of Climate Change*. In response, the FAA is evaluating activities undertaken by airports to increase infrastructure resilience.

4.3.6.1 Natural Resources and Energy Supply

In Fiscal Year (FY) 2012, the year of the most complete available data, Logan Airport consumed 180,789 MWh (megawatt hours) of electricity, 53 percent of which supplied the terminals. Approximately 10.5 percent of the electricity use was consumed by Massport operations, and tenant consumption constituted the remainder of the total electric load. In addition to energy, Logan Airport also consumes natural gas and heating oil. When accounting for all energy types, including electricity, natural gas, and fuel oil numbers 2 and 6, Logan Airport consumed 1,074,446 MMBtu (million British thermal units) in FY2012. This represents an energy intensity of 92.9 kBtu (thousand British thermal units) per square foot in FY2012, a significant reduction from 110.5 kBtu per square foot in FY2011.[5] In FY2012, 749,666 kWh (kilowatt hours) of electricity were generated by onsite renewable energy projects at Logan Airport.

Massport continues to make strides in reducing energy use at the Airport. In 2009, Massport began developing a comprehensive Airport Energy Master Plan for all Massport facilities. In 2010, the Massport Board approved the Energy Master Plan. Further, the Board allocated funding for a capital project to implement energy efficiency improvements targeted at achieving energy efficiency, GHG reductions, and renewable energy targets as defined by the Governor's Executive Order 484 - *Leading by Example* (EO 484). Massport recently completed an

5 Arup. Logan Energy Analysis. October 8, 2013

analysis of its progress to date on FY2012 and FY2020 Leading by Example targets. Massport is ahead of its energy intensity target and has far surpassed the target for renewable energy procurement. Massport has decreased its GHG emissions by 11 percent, to 94,790 metric tons, from its FY2004 baseline during a period of construction and increased passenger levels, though it is still striving to achieve its FY2012 target of a 25 percent decrease.

4.3.6.2 Sustainability at Logan Airport

Sustainability is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."[6] Massport has a commitment to implementing sustainable practices, and continues to make progress on a range of initiatives. The *Logan Airport 2012/2013 EDR* describes how sustainability is incorporated into many aspects of Massport's activities including goals and commitments; planning and design; construction; operations, and maintenance. The following sections generally describe the current sustainable goals and initiatives at Logan Airport.

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.[7] In October 2004, Massport prepared the *Massachusetts Port Authority Sustainability Plan* which presented Massport's initial long-term and short-term sustainability goals. It also identified the actions necessary to achieve the goals, the staff members responsible for each sustainability goal, and the timeline for achieving the goals. To oversee many of these sustainability initiatives, Massport appointed its first full-time Sustainability Program Manager in 2008.

In 2009, Massport participated in the *2010 Environmental Benchmarking Survey* sponsored by Airport Council International-North America (ACI-NA) in order to assess solar power, purchase of renewable energy, availability of low emission ground transportation, recycling and "green" purchasing. Also in 2009, Massport published its *Sustainable Design Standards and Guidelines* (SDSG) for use by architects, engineers, and planners working on capital improvement projects for Massport facilities. The SDSG apply to both new construction and rehabilitation projects (building and non-building) of any square footage or monetary value.

Additionally, Massport is committed to supporting the Commonwealth's sustainable initiatives, including the recent EO 484 promulgated by Governor Patrick in April 2007. EO 484 establishes the LBE Program as a way to oversee and coordinate sustainability efforts (for example, promote energy conservation, waste reduction, natural resource protection) by state agencies and encourage private sector developers to implement sustainable practices. As part of EO 484, the Executive Office for Administration and Finance mandates a set of minimum standards for sustainable design and construction of new buildings and major renovations by Executive Agencies (the Massachusetts "LEED® Plus" program). While Massport is not an executive agency of the Commonwealth, it is nevertheless committed to constructing its facilities, in accordance with MA LEED (Leadership in Energy and Environmental Design) Plus whenever feasible. Elements of the MA LEED Plus program related to energy performance and water efficiency are incorporated into the SDSG. For new construction at Logan Airport Massport strives, at a minimum, to meet LEED Silver requirements.

6 Brundtland Report, United Nations. "Report of the World Commission on Environment and Development." General Assembly Resolution 42/187, December 11. 1987.
7 The Environmental Management Policy can be viewed on Massport's website at: www.massport.com/environment/Pages/EnvironmentalManagementPolicy.aspx

With FAA grant-funding, Massport developed the *Logan Airport Sustainability Management Plan (SMP)*. The *Logan Airport SMP* takes a broad view of sustainability that focuses on Economic viability, Operational efficiency, Natural resource conservation, and Social responsibility. The focus areas of the SMP include energy and GHG emissions; water conservation; materials, waste management, and recycling; resiliency; and community, employee, and passenger well-being. The SMP provides Massport with a robust framework of sustainability goals, objectives, metrics, and targets, and an implementation plan for recommended sustainability initiatives.

4.3.6.3 Resiliency

Massport is a national leader in airport resiliency planning. As noted on Massport's website[8] – "Changing climate is real and the consequent disruptions (such as increased storms and fluctuations of extreme temperatures) will be more frequent in the future. This requires us to change the way we plan, design, and manage both our built and non-built environment – with the end goal of creating a resilient and sustainable future for ecosystems, human communities, and economic viability." After the Superstorm Sandy event, Massport established a Resiliency Working Group to identify threats and hazards, likely scenarios, and current vulnerabilities.

A high-level evaluation of the resiliency of Massport's facilities to natural (hurricanes, storms, flooding, earthquakes), man-made (fires), and technological (data loss) threats was undertaken. In addition, Massport commissioned the Disaster and Infrastructure Resiliency Planning (DIRP) Study which took detailed review into resiliency at Logan Airport. The DIRP study assesses critical infrastructure and vulnerabilities that the Airport may face during future climate scenarios. Consideration was given to projected sea level rise and other environmental factors (e.g., high tide or low tide).

Massport's Resiliency Program has identified several goals including:

- Improve resiliency for overall infrastructure and operations;
- Restore operations during and after disruptive events in a safe and economically viable time frame;
- Create robust feed-back loops that allow new solutions as conditions change;
- Inform operations and policy, and implement design/build decisions, through the application of sound scientific research and principles that consider threats, vulnerabilities, and cost-benefit calculations;
- Become a knowledge-sharing exemplar of a forward-thinking, resilient port authority; and
- Work with key influencers and decision makers to strengthen understanding of the human, national, and economic security implications of extreme weather, changing climate, and man-made threats to Massport's facilities and the region.

8 Massport. "Resiliency and Climate Change." https://www.massport.com/business-with-massport/resiliency/resiliency-and-climate-change/ Website accessed on April 10, 2015.

4.3.7 Project Area Noise Environment

As described in the *Logan Airport 2012/2013 EDR*[9], Massport strives to minimize the noise effects of Airport operations on its neighbors through the use of a variety of noise abatement programs, procedures, and other tools. Logan Airport has an extensive noise abatement program, which includes: residential and school sound insulation programs; flight tracks designed to optimize over-water operations (especially during nighttime hours); and preferential runway use goals. The foundation of Massport's comprehensive noise abatement program is the *Logan Airport Noise Abatement Rules and Regulations*[10] (the "Noise Rules") which have been in effect since 1986. All of the residences exposed to levels greater than a day-night average sound level (DNL) of 65 decibels (dB) in 2013 that have chosen to participate in the Massport's residential sound insulation program (RSIP) have been sound-insulated by Massport.

In general, DNL 65 dB is considered by FAA as the threshold for noise impacts. The 2013 DNL 65 dB contour encompasses the Terminal E study area. The nearest residential and recreational locations (described in Section 4.3.3) to the Project Area are within the DNL 60 dB contour. In 2013, the estimated overall number of people exposed to DNL values greater than 65 dB was 4,307 people.[11] Within the DNL 70 dB contour the number of people was 130.

4.3.8 Project Area Surface Transportation

Since the mid-1970s, Massport has been committed to increasing use of high occupancy vehicle (HOV) ground transportation modes for traveling to and from Logan Airport. Massport programs have encouraged use of various high occupancy modes, including public transit, water taxis, and Logan Express bus service. Vehicle access in the terminal areas is focused on furthering that commitment by allocating a large portion of existing terminal curbside space for high-occupancy vehicles. Pedestrian access is provided by a combination of marked crosswalks with flashing beacons, overhead walkways, internal terminal walkways, and sidewalks.

4.3.8.1 Vehicular Circulation

The bi-level, Terminal Area roadway system provides direct access to the Departure and Arrival Level curbsides of Terminal E for both private and public transit vehicles. Two lanes of travel are provided entering and exiting the Terminal E curbside. Curbside 1 and Curbside 2 roadways expand to provide four lanes and three lanes of travel, respectively, through the terminal. The U-shaped taxi stand alignment to the east of the curbsides has two lanes of travel. The Terminal E parking lots are located south of the terminal curbsides and are accessed from the Terminal E roadways. The Terminal E roadway network is shown in **Figure 4.4**.

Massport's Ground Transportation Unit (GTU), in conjunction with the Massachusetts State Police, manages the operation and enforcement of ground transportation services. The following list of curbside users demonstrates the large variety of ground transportation modes serviced by the Terminal E curbsides:

- Passenger car active pick-up (Arrival Level) and drop-off (Departure Level);
- Limousines and Taxi pick-up (Arrival Level) and drop-off (Departure Level);
- Logan Express Buses (Arrival and Departure Levels);

9 *Logan Airport* 2012/*2013 Environmental Data Report (*EOEA #3247), December 2014.
10 *Logan Airport Noise Abatement Rules and Regulations* are codified at 740 CMR 24.01 et seq.
11 Based on the 2010 Census.

- Charter Buses (Arrival and Departure Levels);
- Scheduled Transit Buses– Peter Pan, P&B, Concord Coach, Vermont Transit, C&J Dartmouth Coach (Arrival and Departure Levels);
- MBTA Silver Line Buses (Arrival Level);
- Shared Van Services pick-up (Arrival Level) and drop-off (Departure Level);
- Hotel Courtesy and off airport parking Shuttle Buses pick-up (Arrival Level) and drop-off (Departure Level);
- Rental Car and MBTA Blue Line Shuttle (Arrival and Departure Levels), Parking Shuttle Buses (Arrival and Departure Levels)
- Route 11: Massport Inter-terminal Shuttle Bus (Arrival Level);
- Route 33: Rental Car Center (RCC) and Airport Station (Blue Line) – Terminals C & E Shuttle Bus (Arrival and Departure Levels);
- Route 55: RCC and Airport Station (Blue Line)– All Terminals Shuttle Bus (Arrival and Departure Levels);
- Route 66: Massport Water Transportation Dock, Airport Station (Blue Line), and Logan Office Center – All Terminal Shuttle Bus (Arrival Level);
- Route 77: Massport Off-Airport Employee Parking - All Terminals Shuttle Bus (Departure Level); and

Route 88: Massport Economy Parking - All Terminals Shuttle Bus (Arrival Level).

Terminal roadways and curbs interact on an Airport-wide basis where queues at one terminal could lead to traffic congestion at another terminal. Private vehicles picking up passengers at Terminal E are encouraged to utilize parking located adjacent to Terminal E or the Central Garage and meet passengers in the Terminal. However, active passenger car pick-up does occur at the Terminal E Arrival Level curbside. Active pick-up does occasionally encroach into curbside areas allocated to high-occupancy vehicles; this can cause operational problems for those ground transportation modes.

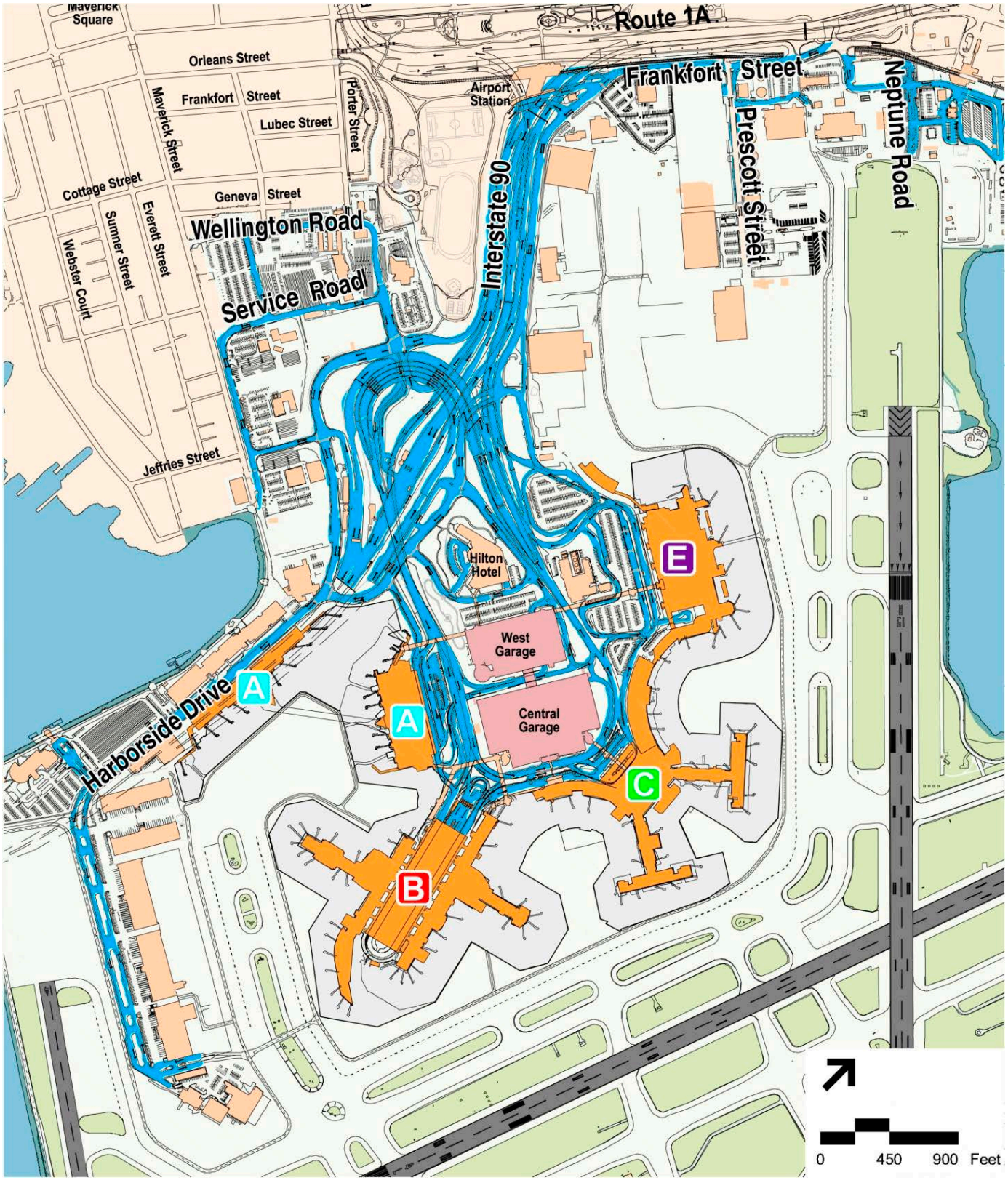


Figure 4.4

Logan Airport Roadway Network, 2012-2013

4.3.8.2 Surface Transportation Traffic Assessment

This section describes the surface transportation traffic assessment methodology and baseline traffic conditions for the Project Area.

Methodology

To verify the observed curb congestion at Terminal E and establish a baseline for comparison to future conditions, an analysis of curbside operations was performed using the Quick Analysis Tool for Airport Roadways (QATAR) spreadsheet model.[12] Based on existing peak hour vehicle demands for each curbside zone, QATAR calculates a curbside zone utilization and level of service (LOS) as well as double and triple parking impacts on the adjacent roadway lanes. LOS is a measure used to rate how well the curbside zone is operating, with a rating of "LOS A" reflective of excellent operations and a rating of "LOS F" reflective of failing operations and substantial curbside congestion. Peak hourly arriving and departing passenger flows by each travel mode were developed using these hourly passenger numbers and mode split percentages from the latest Logan Air Passenger Survey.

Field observations and traffic data collection were conducted during the peak international arrival periods in order to assess existing congestion and circulation issues at the Terminal. Type and number of vehicles using the curb, estimated travel speeds, estimated vehicle dwell times, and the magnitude of double lane activity were observed. This information was used in the development of the QATAR model to help accurately represent existing curbside operations and develop future conditions. It was particularly important in the development of the recirculation number used in the existing curbside analysis.

Existing Traffic Conditions

A review of the 2014 passenger projections (which are based on the 2014 fight schedule) determined a peak hour passenger demand of 1,091 passengers and 1,562 passengers for the Departure and Arrival Level curbsides, respectively. The peak hour was 6:00 to 7:00 PM for the Departure Level and 7:00 to 8:00 PM for the Arrivals Level. Peak hour vehicle usage of each of the curbside zones for Terminal E was developed by applying the following information to the peak hour passenger demand:

- Ground transportation mode split percentages (2013 Logan Air Passenger Survey);
- Vehicle occupancy; and
- High-occupancy vehicle schedules or headway data.

This vehicle demand was entered into the QATAR model along with dimensional and usage information regarding curbside allocation. The detailed summary of volume development and QATAR analysis output is provided in the **Appendix B.** The Terminal E Departure Level curbside operates at LOS A. All zones along Curbside 1 of the Terminal E Arrivals Level (serving scheduled bus, Logan Express, Silver Line, the consolidated rental car shuttle, and airport shuttles) also operate at LOS A. Curbside 2 zones on the Terminal E Arrival Level (serving charter bus, courtesy bus/shared van, and private automobiles) operate as follows:

12 "Airport Curbside and Terminal Area Roadway Operations." LeighFisher, Dowling Associates Inc., JD Franz Research Inc., and WILTEC. *Airport Cooperative Research Program, Report 40*. Transportation Research Board (2010), Print.

- Active passenger car pick-up occurs within the first three zones along Curbside 2.
  - The first zone, which is the longest of the three zones, has two travel lanes and a curbside lane operating at LOS E.
  - Due to the passenger vehicle demand and reduced curbside length, the adjacent travel lanes in the remaining two pick-up zones operate at LOS F. The curbside lanes operate at LOS E.
- The charter bus zone operates at LOS B for travel lanes and LOS A for the curbside lane.
- The shared van and courtesy bus curbside zone accommodates hotel and other shuttle buses, as well as reserved or fixed schedule vans and limousines. This demand, combined with limited space, results in a LOS D for the curbside lane and LOS E for the adjacent travel lanes.

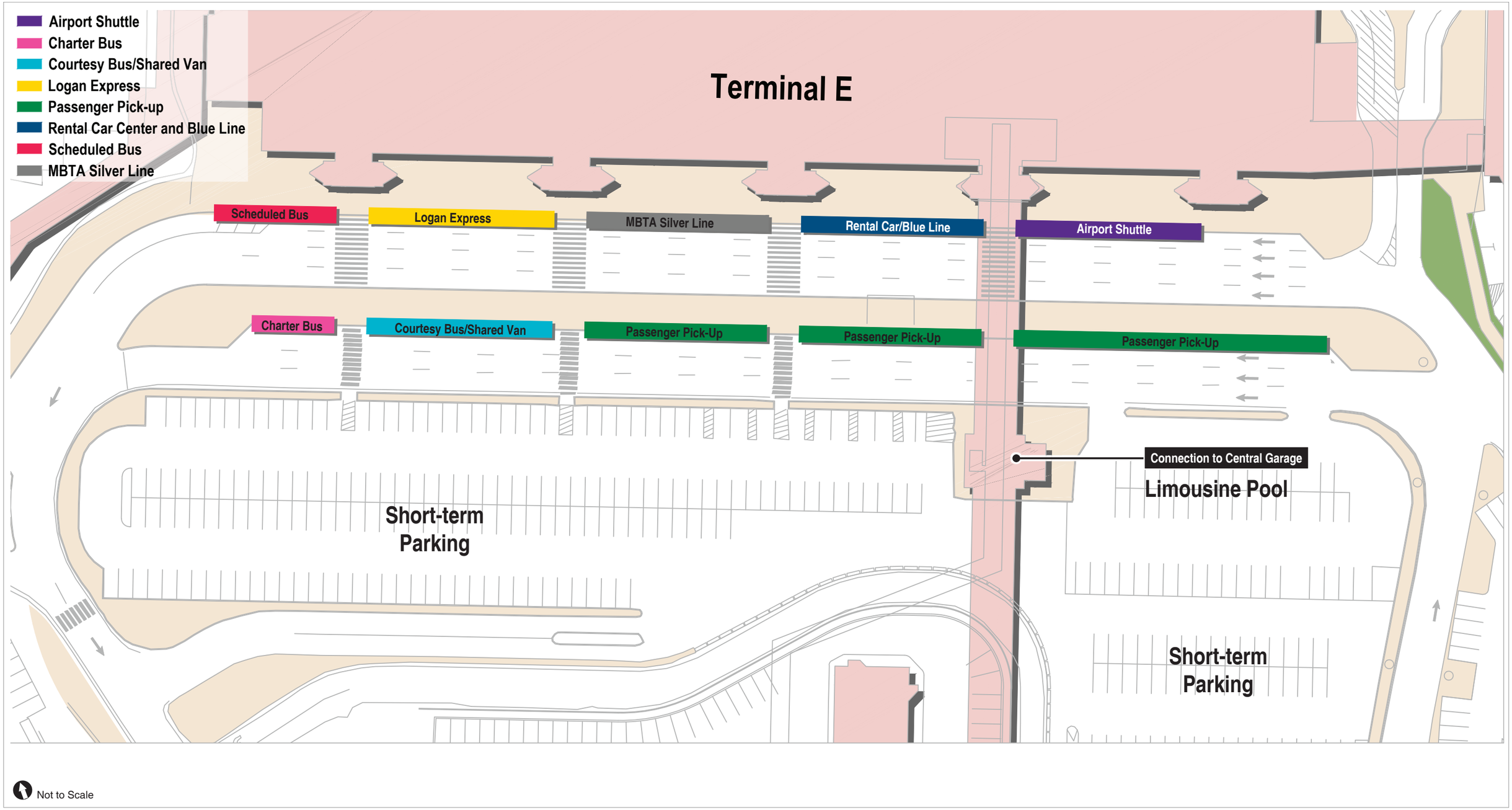
Existing curbside conditions are shown in **Figure 4.5**. Separate from the Terminal E Renovation and Enhancements Project, Massport is currently improving ground access deficiencies with curbside improvements that will be place before the Proposed Project is operational in the summer of 2017. The proposed improvements are described in Chapter 5, *Environmental Consequences and Mitigation*.

4.3.9 Project Area Water Quality

FAA Order 1050.4B and 1050.1E require that the Environmental Assessment include sufficient description of the proposed action's design and mitigation measures developed for non-point sources (such as rainfall runoff) under Section 319 of the federal Clean Water Act (CWA), and construction controls to demonstrate what water quality standards and any permit requirements will be met. The CWA 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 EPA and MassDEP National Pollutant Discharge Elimination System (NPDES) Program. The NPDES permit covers Massport and its co-permittees at Logan Airport. It establishes effluent limitations and monitoring requirements for discharges from specified stormwater outfalls.

Massport's primary water quality goal is to prevent or minimize pollutant discharges, thus limiting adverse water quality impacts associated with airport activities. Massport employs several programs to promote awareness of Massport and tenant activities that may impact surface and groundwater quality, thus improving water quality. Programs include implementing best management practices (BMPs) for pollution prevention by Massport, its tenants, and its construction contractors; training staff and tenants; and a comprehensive stormwater pollution prevention plan (SWPPP). In addition, Massport voluntarily participates in the State's Leading by Example (LBE) Program[13], continuing its commitment to operate Logan Airport in an environmentally sound manner. Massport complies with the Massachusetts Contingency Plan (MCP) by monitoring fuel spills and tracks the status of spill response actions. The MCP lays out a set of regulations that govern the reporting, assessment, and cleanup of spills of oil and hazardous materials in Massachusetts. Massport also maintains a Tank Management Program, a SWPPP, and a Spill Prevention Control and Countermeasure Plan (SPCC).

13 Massachusetts' Leading by Example Program is intended to reduce the environmental impacts of state government buildings and operations. The program includes energy efficiency standards for state buildings, such as clean energy and greenhouse gas goals, as well as sustainable practices such as waste reduction, water conservation, and recycling.



Source: VHB

Figure 4.5

Existing Terminal E Ground Transportation Mode Curbside Allocation

TERMINAL E RENOVATION AND ENHANCEMENTS PROJECT
Boston-Logan International Airport
East Boston, Massachusetts

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Massport is responsible for compliance with applicable state and federal environmental laws and regulations. Massport promotes appropriate environmental practices through pollution prevention and remediation measures, and works closely with Airport tenants and Airport operations staff to improve compliance. Massport's environmental programs pertaining to water quality and environmental compliance and management include:

- Stormwater management;
- Water quality management;
- Fuel use and spills;
- MCP compliance;
- Storage tank compliance;
- Compliance auditing and inspections;
- Environmental Management System (EMS) implementation; and
- Clean State Initiative and Leading by Example Program participation.

The Stormwater Management system at Logan Airport consists of both a closed and open conveyance system. The closed system includes catch basins and pipes to convey stormwater from runways, taxiways, and the perimeter roadway (approximately 910 acres) to Airfield Outfalls A-1 through A-44 discharging into Boston Harbor. The open stormwater system uses the airfield's grass swales and open channels to infiltrate stormwater from runway surfaces. Refer to **Figure 4.6** for the Logan Airport drainage areas and outfalls. The terminal complex drains to the North Outfall which is equipped with end-of-pipe pollution control facilities that remove debris and floating oil and grease from stormwater prior to discharge into Boston Harbor.

On July 31, 2007, EPA and MassDEP issued an individual NPDES permit for Logan International Airport (NPDES Permit MA0000787). The new 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: www.epa.gov/NE/npdes/logan/pdfs/finalma0000787permit.pdf. Massport holds a separate NPDES permit for the Fire Training Facility (NPDES Permit MA0032751).

Source: 2012/2013 EDR

Figure 4.6

Logan Airport Drainage Areas and Outfalls

TERMINAL E RENOVATION AND ENHANCEMENTS PROJECT
Boston-Logan International Airport
East Boston, Massachusetts

5 Environmental Consequences and Mitigation

5.1 Introduction

According to the Council on Environmental Quality (CEQ) Regulations for Implementing the National Environmental Policy Act (NEPA) (40 CFR 1500.2(f)), project proponents shall, to the fullest extent possible:

"Use all practicable means consistent with the requirements of the Act and other essential considerations of national policy, to restore and enhance the quality of the human environment and avoid or minimize any possible adverse effects of their actions on the quality of the human environment."[1]

In accordance with the NEPA regulations, this chapter documents the potential effects of the Proposed Project/Proposed Action for each applicable environmental resource category, as specified in Federal Aviation Administration (FAA) Order 1050.1E, Change 1[2] and Order 5050.4B[3] and listed in **Table 5.1**. This chapter also evaluates measures that would avoid and/or minimize impacts, including limiting the degree or magnitude of the Proposed Action and its implementation.

This Environmental Assessment (EA) provides an analysis of whether an impact is significant, in accordance with FAA guidance on impact thresholds for significant adverse effects provided in FAA Order 1050.1E, Change 1. The impact thresholds identified in FAA Order 1050.1E, Change 1 are discussed in Section 5.2.6, *Significance Thresholds*. For each resource category analyzed in this EA, a finding of significance is provided and summarized at the end of this chapter. Based on this impact analysis, there are no significant adverse environmental impacts associated with the Proposed Action.

5.2 Methodology

The following section describes how the environmental consequences were determined for each resource category for the Proposed Action.

1 Council on Environmental Quality, Regulations for Implementing the National Environmental Policy Act (40 CFR 1500), http://ceq.hss.doe.gov/nepa/regs/ceq/toc_ceq.htm.
2 FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures*, released March 20, 2006.
3 FAA Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*, released April 28, 2006

5.2.1 Analysis Conditions Years

In accordance with NEPA, the Proposed Action is compared to the No-Action Condition in the same analysis year for each environmental impact category to determine the effect (beneficial or adverse) of the alternative. As described in Chapter 4, *Affected Environment*, the baseline condition is 2013, the year for which the most recent complete set of data is available. Construction of the Project is scheduled to be complete at the end of 2016; the summer of 2017 represents the peak conditions for which the facility is designed. For analysis purposes, 2017 is the future build year. Chapter 2, *Purpose and Need*, describes the passenger and aircraft operations activity levels for the future No-Action and Build Conditions in 2017. The project is proposed in order to accommodate planned regular service by new large aircraft reliably, safely, and efficiently on the airfield and at Terminal E.

As presented in Chapter 2, *Purpose and Need*, between 2017 and 2022, an anticipated growth rate of 1.5 percent per year, consistent with the FAA TAF, is anticipated. The number of passengers and aircraft operations is expected to be the same or not significantly different with the future No-Action and with the Proposed Project. With the Proposed Project in place, the level of passenger service would be enhanced in comparison to the No-Action Alternative in 2017 and 2022.

5.2.2 Direct Impacts

Direct impacts are defined by NEPA as impacts caused by the Proposed Action and occur at the same place and at the same time. The list of resource categories evaluated was developed based on the FAA's NEPA regulations (FAA Order 1050.1E, Change 1) and described in Chapter 4, *Affected Environment*. The categories evaluated in this Chapter include:

- Air Quality;
- Coastal Resources;
- Fish, Wildlife, and Plants;
- Hazardous Materials, Pollution Prevention, and Solid Waste
- Natural Resources, Energy Supply, Sustainable Design/Resiliency;
- Noise;
- Surface Transportation;
- Water Quality; and
- Construction.

5.2.3 Indirect Impacts

Indirect impacts are defined as those impacts that are caused by a Proposed Action and occur later in time or at another location, but that are still reasonably foreseeable. Indirect impacts could occur elsewhere at Logan Airport or in the nearby neighborhoods as a result of the Proposed Action.

The Proposed Action would not cause off-Airport indirect impacts since the Project elements, located at Terminal E and on the existing airfield, are consistent with current uses and are sufficiently far from neighboring communities so as not to result in visual changes to the Airport. The Proposed Action would not result in an overall increase in Airport operations as the same number of aircraft operations would occur under the No-Action Alternative. The Project elements would not result in off-Airport changes to the ground transportation, air quality, or noise environments.

5.2.4 Temporary Construction-related Impacts

Temporary impacts occur on a short-term basis during construction based on construction methods, duration, materials, and equipment. Temporary, construction-related impacts were evaluated for surface transportation, air quality, and noise.

5.2.5 Cumulative Impacts

FAA's NEPA regulations describe cumulative impacts as the incremental impact of a proposed project when added to the past, present, and reasonably foreseeable future projects undertaken by any agency or person. The Terminal E Renovation and Enhancements would not result in a change to the number of passengers or aircraft projected to be accommodated at Logan Airport compared to the No-Action Condition. The Project would upgrade existing gates to accommodate larger-sized aircraft but would not result in changes to the overall airport aircraft operations and passenger activity level forecasts.

The Logan Airport Environmental Data Reports (EDRs) and Environmental Status and Planning Reports (ESPRs) evaluate the cumulative impact of overall airport operations through a comprehensive assessment of current and future cumulative airport impacts in the areas of surface transportation, noise, air quality, and water quality. The EDRs and ESPRs take future activity levels and projects under consideration into account in the future impact assessments.

The timeframe for consideration of cumulative impacts takes into account past projects within the last five years, current impacts, and future impacts from full operation of the Proposed Action. The assessment of temporary construction impacts (ground transportation, air quality, and noise) includes a cumulative assessment (qualitative) by taking other construction activities elsewhere on-Airport scheduled to coincide with the Proposed Action's construction duration. Key projects are identified and assessed, and an assessment of cumulative impacts is provided in Section 5.4, *Cumulative Impacts*.

5.2.6 Significance Thresholds

For each environmental resource category, the Project was compared to the No-Action Alternative in the same year to determine the effect (beneficial or adverse). This section provides an analysis of whether that impact is significant, based on FAA guidance for significant adverse effects provided in FAA Order 1050.1E, Change 1 Significance thresholds identify the minimum attributes and characteristics that need to be present in a resource category (such as noise, water quality, or historic resources) for that category to be identified as potentially adversely affected by the action.

Significance thresholds for environmental resources relevant to the Project are summarized in **Table 5.1**. This table excludes those impact categories that the No-Action and Proposed Action would not affect and/or are not present in the Project Area, as discussed in Chapter 4, *Affected Environment.* Measures proposed to avoid, reduce, or minimize the potential impacts are presented, as applicable.

Table 5.1 FAA Order 1050.1E, Change 1: Impact Thresholds for Significant Adverse Effects[1]

Section Number	Impact Category	Order 1050.1E Impact Threshold for Significant Adverse Effects
5.3.1	Air Quality	When a project or action exceeds one or more of the National Ambient Air Quality Standards (NAAQS).
5.3.2	Coastal Resources	No Significant Thresholds established. FAA responsibilities state that when a proposed action affects (changes the manner of use or quality of land, water, or other coastal resources, or limits the range of their uses) the coastal zone in a State with an approved coastal zone management (CZM) program, the EA or EIS shall include a consistency review.
5.3.3	Fish, Wildlife, and Plants/Threatened and Endangered Species	Consider scientific literature on and information from agencies having expertise addressing the affected species. Consider information on: project effects on population dynamics; sustainability; reproduction rates; natural and artificial mortality (aircraft strikes); and the minimum population size needed to maintain the affected population.
5.3.4	Hazardous Materials and Solid Waste	When an action involves a property on or eligible for the National Priority List (NPL). Uncontaminated properties within a NPL site's boundary do not always trigger this significant impact threshold. For solid waste: None established.
5.3.5	Natural Resources and Energy Supply/ Sustainable Design, Resiliency	When an action's construction, operation, or maintenance would cause demands that would exceed available or future (project year) natural resource or energy supplies.
5.3.6	Noise	When an action compared to the no action alternative in the same timeframe would cause noise sensitive areas located at or above DNL 65dB to experience a noise increase of at least DNL 1.5dB.
5.3.7	Surface Transportation	Disruption in local traffic patterns that would substantially reduce the level of service of roads serving the airport and surrounding communities.
5.3.8	Water Quality	When an action would not meet water quality standards. Potential difficulty in obtaining a permit or authorization may indicate a significant impact.
5.3.9	Short-term Construction Impacts	Air Quality: When a project or action exceeds one or more of the NAAQS.

Note: Excludes categories that the No-Action and Action alternatives would not affect and/or those resources not present in the Study Area.
1 FAA Order 5050.4B, Appendix A

5.3 Environmental Consequences

Project-related impacts are described below for each impact category, as listed in **Table 5.1**. This section also identifies measures that would avoid and/or minimize impacts, where applicable.

5.3.1 Air Quality

Air quality is evaluated in terms of any changes in emissions in mobile and stationary sources associated with the Proposed Action when compared to the No-Action condition. As described above, the No-Action and Proposed Action would have the same aircraft operations and activity levels, and the same ground transportation vehicular conditions and volumes. The Terminal E Renovation and Enhancements would include energy-efficient new construction as well as renovations to existing building layouts and heating/cooling systems. To the extent possible, the Project would use existing energy infrastructure and be constructed using sustainable design concepts and materials. Thus, from the standpoint of air quality, the only change to air

emissions associated with the project are attributable to introducing new, large aircraft operations (likely replacing multiple existing aircraft operations) and construction activities. Otherwise, the Proposed Action is not expected to increase Airport-related mobile or stationary source emissions substantially over the No-Action conditions.

The entire Boston metropolitan area (including the area surrounding Logan Airport) is currently designated as attainment for all the U.S. Environmental Protection Agency (EPA) "criteria" pollutants except ozone.[4] The Boston area is also currently designated as attainment/maintenance for carbon monoxide (CO). Because of these designations, the General Conformity requirements of the federal CAA potentially apply to the planned improvements to Terminal E. This regulation stipulates that any entity of the federal government (i.e., the FAA) that engages in, supports, or in any way provides financial support for, licenses or permits, or approves any activity, to demonstrate that the project conforms to the applicable State Implementation Plans (SIPs).[5]

As discussed in Section 5.3.1.1, *Mobile Source Emissions*, the introduction of new larger aircraft do not represent a significant change in aircraft-related emissions and in most cases represents a reduction in emissions overall.

Furthermore, as demonstrated in Section 5.3.9, *Temporary Construction-Related Impacts*, emissions from construction vehicles and equipment are estimated to be substantially below the Federal General Conformity *de minimis* thresholds of 50 tons per year (tpy) of volatile organic compounds (VOC) and 50 tpy of nitrogen oxides (NOx), and 100 tpy of carbon monoxide. Therefore, a Clean Air Act General Conformity Determination is not required.

Based upon this assessment, the Proposed Action:

- Would not increase mobile or stationary source emissions above the General Conformity Rule *de minimis* thresholds;
- Would not cause or contribute to violations of National Ambient Air Quality Standards (NAAQS);
- Would not cause additional or worsen existing violations of, or contribute to, new violations of the NAAQS; and
- Would not affect attainment of the NAAQSs.

5.3.1.1 Mobile Source Emissions

Three airlines have announced their intentions to up-gauge current aircraft to new large aircraft. The anticipated aircraft changes include operations during the peak hours. Emirates will replace the Boeing 777 to an A380, British Airways will replace Boeing 747-400 operations by A380s, and Lufthansa will substitute the Boeing 747-8 for the Boeing 747-400. As discussed in Chapter 3, the Proposed Action would not alter the level of aircraft operations at Logan Airport, but would allow regular Group VI aircraft service.

4 Criteria pollutants consist of: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM) which includes particulate matter with a diameter between 2.5 and 10 micrometers (PM_{10}) and particulate matter smaller than 2.5 micrometers ($PM_{2.5}$), and sulfur dioxide (SO_2). Nitrogen oxides (NOx) and volatile organic compound (VOC) emissions are precursors to ozone formation.

5 The CAA requires states to develop a general plan to attain and/or maintain the primary and secondary NAAQS in all areas of the country and to develop a specific plan to attain the standards for each area designated nonattainment for a National Ambient Air Quality Standards (NAAQS). These plans, known as State Implementation Plans (SIPs), are developed by state and local air quality management agencies and submitted to EPA for approval.

On the landside, and as shown in the surface transportation analysis, the ongoing curbside improvements (part ofthe No-Action condition) have been designed to accommodate passenger surface transportation access at the Terminal E curb, with acceptable levels of service and no increases in curbside idling and congestion from private automobiles dropping off or picking up passengers, as well as from other modes of transportation such as taxis and limousines. The Terminal E Renovation and Enhancements Project would be operational after improvements in curbside access activities at Terminal E are in place. These improvements would facilitate existing roadway traffic flow, and curbside operations at Terminal E.

Because the proposed improvements would not have an effect on aircraft operations nor a substantial effect on the fleet mix at Logan Airport; auxiliary power units (APUs) or ground support equipment (GSE); or motor vehicles traveling to, from, and moving about the Airport, operational emissions are expected to be the essentially same under both the Proposed Action and No-Action condition

However, for completeness and disclosure purposes, a quantitative assessment of aircraft emissions was conducted comparing the new Airbus 380 and the Boeing 747-8 that would replace the Boeing 747-400 and the Boeing 777-300. The emissions inventory was prepared using FAA's Emissions and Dispersion Modeling System Version 5.1.4.1 (EDMS v.5.1.4.1) within the landing/take-off cycle (LTO). Aircraft models and engine types were obtained by reviewing the British Airways, Lufthansa and Emirates fleets for these four aircraft types. Appropriate emission rates were then obtained from the FAA EDMS database and an emissions inventory was competed for one LTO. Emissions of CO_2, CO, VOCs, NO_x, SO_x and $PM_{10}/PM_{2.5}$ were estimated and are summarized in **Table 5.2** in tons per LTO.

As shown, the Airbus 380 and the Boeing 747-8 overall generate fewer VOC and CO emissions compared to the Boeing 747-400 and the Boeing 777. The differences in emissions of the remaining pollutants are comparable among the four aircraft types.

Table 5.2 Aircraft Emissions Comparisons for the No Action Condition and Proposed Action

Emissions Per Landing/Take Off Cycle A380 compared to Boeing 747-400

	Pollutant (tons)						
Aircraft	CO_2	CO	VOC	NOx	SOx	PM_{10}	$PM_{2.5}$
Airbus 380	13.6	0.033	<0.001	0.102	0.006	<0.001	<0.001
Boeing 747-400	13.7	0.071	0.019	0.091	0.006	0.001	0.001
Difference*	-0.1	-0.038	-0.019	0.011	0.000	<0.001	<0.001

*Represents difference in emissions between a Boeing 747-400 and an Airbus 380.

Emissions Per Landing/Take off Cycle Boeing 747-8 compared to 747-400

	Pollutant (tons)						
Aircraft	CO_2	CO	VOC	NOx	SOx	PM_{10}	$PM_{2.5}$
747-8	12.69	0.0296	0.0026	0.0547	0.0052	0.00056	0.00056
Boeing 747-400	12.19	0.0315	0.0040	0.0512	0.0050	0.00055	0.00055
Difference*	0.50	-0.0019	-0.0014	0.0035	0.0002	0.00001	0.00001

Source; KB Environmental Sciences, Inc., 2015
*Represents difference in emissions between a Boeing 747-400 and a Boeing 474-8

Table 5.2 Aircraft Emissions Comparisons for the No Action Condition and Proposed Action /Continued.

Emissions Per Landing/Take off Cycle A380 Compared to Boeing777

	Pollutant (tons)						
Aircraft	CO_2	CO	VOC	NOx	SOx	PM_{10}	$PM_{2.5}$
A380	13.26	0.0307	0.0005	0.0937	0.0054	0.00050	0.00050
Boeing 777	8.89	0.0592	0.0081	0.0412	0.0037	0.00047	0.00047
Difference*	4.37	-0.0285	-0.0077	0.0525	0.0018	0.00003	0.00003

Source: KB Environmental Sciences, Inc., 2015
*Represents difference in emissions between a Boeing 777 and an Airbus 380
Note: CO – carbon monoxide; NOx – nitrogen oxides; SO2 – sulfur dioxide; PM particulate matter of 10 and 2.5 micrometers or less in diameter, respectively; and VOC – volatile organic compounds.

This assessment concludes that replacing the Boeing747s and 777s with the A380s and Boeing 747-8s does not represent a significant change in air emissions and in many cases represents a reduction. Moreover, because the new gates will be furnished with gate-furnished electricity and air conditioning, the need for APU use (and associated emissions) will be minimized, further reducing emissions.

The emissions of mobile sources Airport-wide would remain substantially unchanged between the No-Action Condition and Proposed Action. Because the Terminal E Project-related construction emissions are subject to the General Conformity Rule, they are evaluated in the construction section (See Section 5.3.9, Temporary Construction-Related Impacts).

5.3.1.2 Stationary Source Emissions

No significant changes to stationary sources of emissions, including Greenhouse Gas (GHG) emissions associated with building energy use, would result due to the Proposed Action. The Proposed Action would include new construction as well as renovations to existing building layouts and heating/cooling systems. To the extent possible, the Proposed Action would use existing energy infrastructure. New air-handling units at existing terminal mechanical penthouses would replace original existing high-maintenance and low-efficiency machines resulting in lower emissions. All jet bridges are planned to be upgraded with state-of-the art 400 Hertz (Hz) power and pre-conditioned air (PCA) units to reduce the use of on-board diesel powered APUs and associated air emissions, including GHG emissions.

5.3.2 Coastal Resources

FAA Order 5050.1E, Change 1 requires that when a proposed action changes the manner of use or quality of land, water, or other coastal resources, or limits the range or the use of the coastal zone in a State with an approved coastal zone management (CZM) program, the EA must include a determination as to whether the proposal is consistent with the approved State Coastal Zone Management program.

As described in Chapter 4, *Affected Environment*, the entire Airport is located within the defined coastal zone for Massachusetts. Proposed improvements are limited to those areas of the airfield and terminal that are already in use for aviation activities, and would not change the manner of use, quality of land, or limit the range of use of or access to the coastal zone. The Project Area is proposed within entirely previously developed/disturbed portion of the Airport. The Program is consistent with the MA Coastal Zone Management Plan.

5.3.3 Fish, Wildlife, and Plants / Threatened and Endangered Species

Under FAA Order 1050.1E, Change 1 and Order 5050.4B, a significant adverse effect may occur when the proposed project would cause significant adverse impacts on population dynamics, sustainability, reproduction rates, natural and artificial mortality (aircraft strikes), or the minimum population size needed to maintain the affected population. The Proposed Action would not have a significant adverse impact on fish, wildlife, plants or threatened or endangered species.

There are no federally-listed species threatened or endangered species or habitats in the Project Area. However, portions of the airfield are located within state-mapped Priority Habitat for the upland sandpiper, listed as endangered in Massachusetts[6].

The proposed Terminal improvements would occur on previously developed areas and would not alter any Priority Habitat areas. To accommodate the A380 and other Group VI aircraft, some airfield improvements would be needed to allow for safe and efficient airfield operations and to meet FAA requirements. These include areas of new pavement added to selected runway shoulders, taxiway shoulders, and taxiway fillets. These areas of new pavement are located in areas regularly maintained as mown grass adjacent to active runways and taxiways. The Proposed Action would add approximately 4.2 acres of pavement at these locations (See **Figure 5.1**).

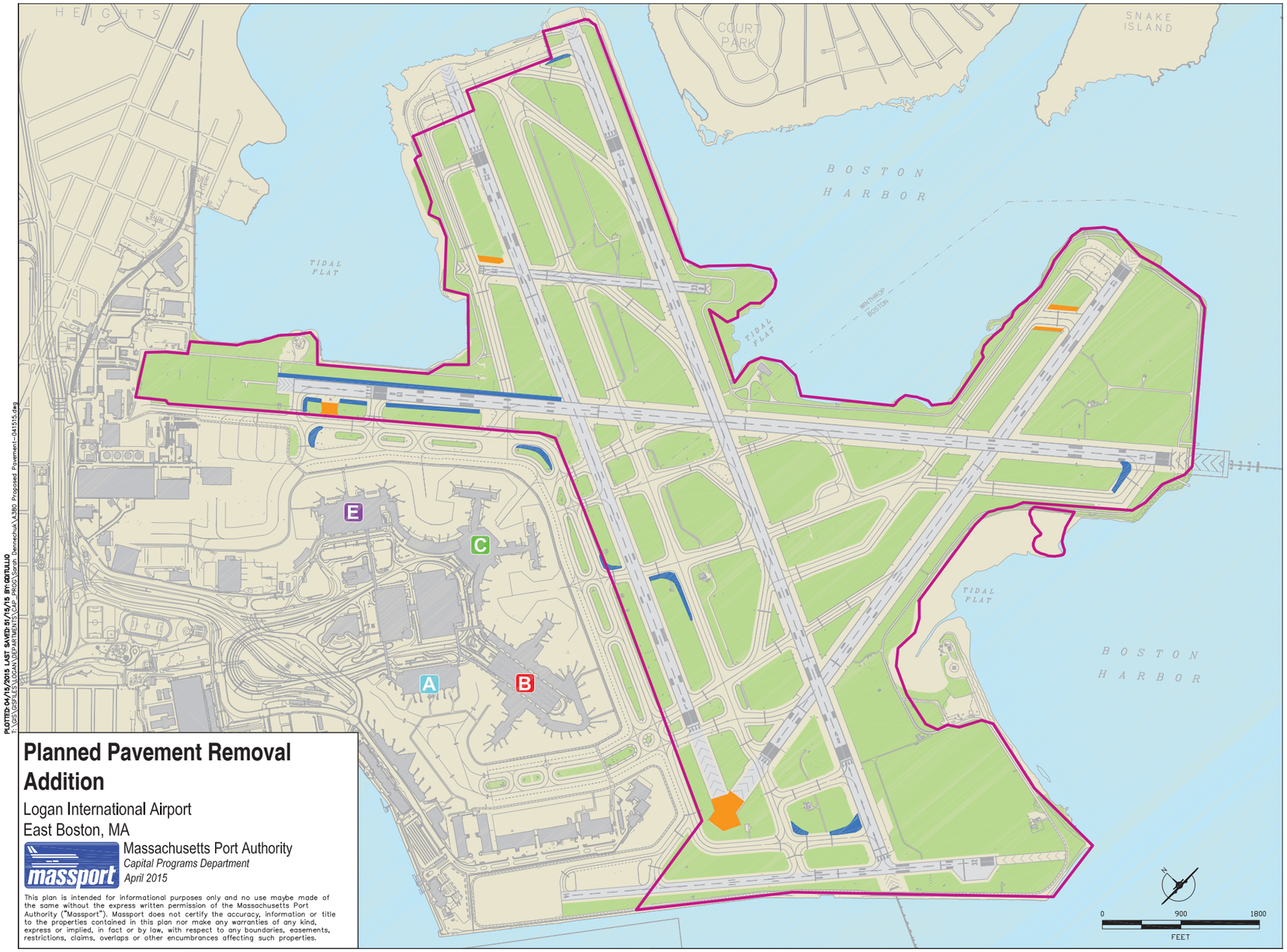
To offset new areas of pavement, Massport proposes to remove pavement on the airfield. These areas would be planted with grass to offset grassland lost through the proposed airfield improvements. Massport has minimized conversion of grassland by selecting an airfield alternative that minimizes taxiway improvements and runway shoulder improvements.

The Massachusetts Natural Heritage and Endangered Species Program (NHESP) has determined that the Proposed Action, including proposed pavement offsets, would not result in a "take" of the species of concern and its habitat as long as certain specific conditions are met. Massport will submit final project design plans to NHESP for review and approval prior to the start of work, construction on the airfield will be phased to avoid the nesting season (May 1 to July 31), and all grassland areas temporarily disturbed by construction activities shall be restored to grasslands with NHESP oversight on seed mixes . In addition to state-listed species, the minimal loss of grassland habitat immediately adjacent to the runways and taxiways would not affect populations of non-listed wildlife species that may occur on the airfield. Agency correspondence with NHESP is included in Appendix D.

Indirect impacts to wildlife and endangered species may occur due to temporary construction noise at the Airport. This is anticipated to be minimal and consistent with routine airfield maintenance practices as the level of daily operations at Logan Airport results in an environment with high levels of noise and activity. Additional construction equipment noise generated by these paving and pavement removal activities would be unlikely to create a significant change from what occurs today.

6 The Massachusetts Endangered Species Act December 1990 (M.G.L c.131A).

Massport to work with NHESP to identify appropriate areas for pavement offset.



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Planned Pavement Removal Addition

Logan International Airport
East Boston, MA

Massachusetts Port Authority
Capital Programs Department
April 2015

Not to Scale

- New Pavement
- Pavement Removal
- Potential NHESP Mapped Priority Habitats of Rare Species

Total Square Footage of Pavement within the Boundary: 4.2 acres

Source: Massport

Figure 5.1

Planned Pavement Removal/Addition

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5.3.4 Hazardous Materials and Solid Waste

Under FAA Order 1050.1E, Change 1 and Order 5050.4B, a significant adverse effect may occur when the proposed project involves a property on or eligible for the National Priority List (NPL) or involves significant hazardous or solid waste activities. The Proposed Action would not have a significant adverse impact related to hazardous materials or solid waste.

The Proposed Action includes several supporting infrastructure elements, including relocating the existing jet-fuel hydrants that would serve the three reconfigured aircraft gates on the apron. A central fuel farm is located at the north end of the Airport and is connected to the terminals by a buried fueling loop around each of the terminal buildings. Fuel is transferred from fueling pits to aircraft at each gate by fuel pump tucks or hydrant carts. The existing individual fueling hydrants at the three upsized Terminal E gates would be relocated to accommodate the new positions of aircraft at Terminal E. The Proposed Action would meet National Fire Protection Association (NFPA) requirements either by appropriate distance or by building face treatment with deluge sprinkler systems.

In addition to a new fueling line and hydrant pits, a metering system would be installed at each hydrant pit as well as emergency cut-off valves on the building at each gate. Cathodic protection would also be installed to be compatible with the existing system and upgraded where possible.

Under the Proposed Action, Massport would continue to ensure that any areas of subsurface contamination discovered within the Project Area are properly assessed, remediated, and brought to regulatory closure, in accordance with the Massachusetts Contingency Plan (MCP). The Project would generate construction-related material waste. Massport would require the construction contractor to implement control plans for Hazardous Materials, Pollution Prevention, and Solid Waste. Construction-related waste is discussed further in Section 5.3.9, *Temporary Construction-Related Impacts*.

No direct or indirect hazardous materials, pollution prevention, or solid waste-related impacts are anticipated from the Proposed Action.

5.3.5 Natural Resources, Energy Supply, Sustainability, and Resiliency

Under FAA Order 1050.1E, Change 1 and Order 5050.4B, a significant adverse effect occurs when the proposed project would cause significant adverse impacts on energy supplies or natural resources. The Proposed Action would not have a significant adverse impact on energy supply or natural resources because there is existing capacity available to support operation of the new building systems. The Project will be built to Leadership in Energy and Environmental Design (LEED®) and Massachusetts LEED Plus standards, to achieve LEED Silver, or higher certification for the newly constructed portion of the Terminal. Both renovated and new building areas would be designed with efficient building systems, in accordance with Massport's *Sustainable Design Standards and Guidelines* (SDSG), as described further below.

5.3.5.1 Sustainable Design Opportunities

The Proposed Action includes new construction as well as renovations to existing building layouts, finishes, and systems. The Project will be built to Leadership in Energy and Environmental Design (LEED®) and Massachusetts LEED Plus standards, to achieve LEED Silver, or higher certification for the newly constructed portion of the Terminal. In addition, the Project design team consulted Massport's SDSG for projects in

Massport's Capital Program.[7] These guidelines are one component of Massport's overall sustainability program, which include diverse sustainability initiatives ranging from facilities maintenance to innovative partnerships and public incentives. The standards are tailored to Massport's operations, facilities, and geography, and are intended to be used by architects, engineers, and planners working on capital projects for Massport. The standards apply to both new construction and rehabilitation projects (building and non-building) of any square footage or monetary value, and may also be used on tenant alterations or development projects on Massport property. During the Preliminary Design Phase and later design phases for the Project, the following sustainable design opportunities will be considered for their feasibility and applicability:

- Measures to reduce energy use by at least 20 percent;
- Incorporation of infrastructure for collection, storage and handling of recyclables (approved pre-security and post-security recycling stations, on-site collection bins, and storage dumpsters);
- Design for deconstruction and flexible re-use of space as terminal needs change over time;
- Passive solar options for building envelope efficiency such as broad roof overhangs or shading devices to reduce solar heat gain and glare;
- Energy efficiency measures for building mechanical, electrical, and plumbing systems;
- Measures to reduce water use by 50 percent;
- Alternative and/or renewable energy systems;
- White roof to reduce solar glare;
- Stormwater capture and re-use; and
- 400-HZ/PCA jet bridges and other state-of-the-art energy efficiency upgrades for gates to reduce use of on-board diesel and serve Group VI aircraft

Additional sustainable design opportunities will be addressed as the Project progresses into Design Development and Construction Documents, especially as they relate to the proper specification of sustainable materials and construction practices.

5.3.5.2 Natural Resources/Energy Conservation

Mechanical systems that service the existing, renovated, and new building construction would be new, high efficiency units and ductwork. Energy modeling analysis would be conducted and would continue throughout the design phase to identify measures to reduce energy use by at least 20 percent compared to a baseline standard per Massport's Energy Initiative.

The following areas of the design would be reviewed to achieve the overall energy reduction performance goal for the Proposed Action:

- Building Envelope:

  - Thermal insulation of exterior walls, roof, and second floor slab with unconditioned space below;

7 Massachusetts Port Authority. *Logan Airport Sustainable Design Standards and Guidelines – Version 1*, June 2009.

- Glazed window area limited to where needed for views;
- High-efficiency glazing and solar shading devices to reduce solar heat gain; and
- Vestibules and air sealing of wall openings on air-side of building.

- Lighting:
  - Reduced lighting energy intensity (watts/square foot) where feasible for occupancy;
  - Daylight sensors and daylight-harvesting lighting controls; and
  - Lighting controls including occupancy sensors and timer systems.
- Mechanical:
  - Energy-efficient equipment;
  - Heat recovery systems;
  - Automatic control systems; and
  - Commissioning of systems for proper functioning.
- Building equipment:
  - Energy efficiency/energy harvesting technologies on major equipment such as escalators, elevators, and baggage handling equipment; and
  - Energy Star kitchen appliances and office computers.

5.3.5.3 Resiliency

Massport considers resiliency and climate adaptation strategies in each of the planning phases for new capital projects. For the Terminal E Renovation and Enhancements Project, the design considers the location of critical infrastructure such as energy sources or digital services. Critical systems such as electrical supply were identified and positioned in locations above Design Flood Level. Consistent with the Massport's resiliency and energy goals, the Project will also incorporate redundant power capability where feasible. The ability of facilities to withstand extreme weather conditions such as high winds and flooding is also factored into the design process.

- Passenger holdrooms;
- Airline clubs;
- Baggage screening and Baggage claim.

5.3.6 Noise

Under FAA Order 1050.1E, Change 1 and Order 5050.4B, a significant adverse effect occurs when the action as part of the proposed project, compared to the no action alternative in the same timeframe, would cause noise sensitive areas located at or above DNL 65dB to experience a noise increase of at least DNL 1.5dB. The Proposed Action for this EA would not have a significant adverse noise impact.

This section presents a discussion of future noise conditions, including the characteristics of the future sources under the No-Action and Proposed Action conditions. Noise related to construction activities is discussed in Section 5.3.9, *Temporary Construction-Related Impacts*. The current noise environment in the Project Area is described in Chapter 4, *Affected Environment*. Noise is evaluated in terms of any changes in noise sources

associated with the Proposed Action when compared to the No-Action condition. The Proposed Action would not cause an increase in the annual average day-night average sound level (DNL) noise contours, as the level of operations at the airport and time of day of flights does not change due to the Proposed Action. The Proposed Action allows for up-gauging of aircraft on certain international routes using Terminal E. These Group VI aircraft are certificated Stage 4[8] and overall generate lower noise levels on a per flight basis (in addition to carrying additional passengers) than the aircraft operating on those routes in the No-Action Condition.

The Airbus A380 is a double-deck, wide-body, four-engine jet manufactured by Airbus, the European consortium. It is the world's largest commercial passenger aircraft and the upper deck extends along the entire length of the fuselage. The A380 is also the quietest wide-body jetliner flying today, generating less noise energy on departure than other aircraft in its class, as well as generating less noise when landing – all while carrying 40 percent more passengers. The Boeing 747-8 is the largest and most efficient 747 variant in use[9]. It includes a longer fuselage and redesigned wings. Under the Proposed Action, Group VI aircraft are planned to be part of the regularly-scheduled aircraft fleet at Logan Airport in 2017 and will operate from Terminal E.

5.3.6.1 Methodology

The qualitative noise analysis for this EA was conducted in accordance with the FAA Order 1050.1E, Change 1 and Order 5050.4B; and NEPA as specified in the CEQ Regulations for Implementing the National Environmental Policy Act (40 CFR 1500-1508).

FAA Order 1050.1E Change 1, effective March 20, 2006, specifies a number of requirements for the noise analyses, including which noise models are acceptable under various circumstances, what constitutes significant impact, and when supplemental noise analyses are needed. The Integrated Noise Model (INM), the Helicopter Noise Model (HNM), or the Noise Integrated Routing System (NIRS) must be used to determine the significance of changes in exposure; and the INM or HNM must be used to produce DNL 75 decibel (dB), DNL 70 dB, and DNL 65 dB contours and others as needed. Since the issuance of this Order, the FAA has integrated the HNM with the INM in the version 7.0 release in 2007 and issued guidance with the release that INM is to be used for helicopter noise analyses, thus eliminating the use and support of the HNM.

Since the primary differences between the No-Action and the Proposed Action conditions are the usage of the gates at Terminal E and aircraft types, no noise modeling was required for this analysis. A comparison of noise levels based on aircraft type was used to compare the No Action Condition to the Proposed Action. The proposed aircraft types that would use the new gates generate less noise on a per flight basis and would not cause an increase in the average annual DNL contours. The level of operations, time of day, and usage of runways remains substantially same in both conditions. Single Event analysis was also used to model existing routes and develop noise contours for the new aircraft.

5.3.6.2 Thresholds of Significance

FAA Order 1050.1E, Change 1 and Order 5050.4B identify the threshold of "significant impact" based on the yearly DNL. If a location of incompatible land use is exposed to a project-related increase in noise level of DNL 1.5 dB or more, and that location lies within the 65 dB DNL noise contour for the "Proposed Action"

8 Stage 4 Aircraft are certificated with a cumulative 10 dB reduction below Stage 3 standards.
9 Currently, Lufthansa does include Boeing 747-800 aircraft in its fleet at Logan Airport.

condition, then the location is considered to be significantly impacted by noise and must be identified as such in environmental evaluations.

In 1992, the Federal Interagency Committee on Noise (FICON) recommended that in addition to significant impacts, less-than-significant noise level changes be identified for noise-sensitive locations exposed to project-related increases. FICON recommended reporting any changes in DNL of 3 dB or more between 60 and 65 dB DNL, and increases of 5 dB or more between 45 and 60 dB DNL. The FAA's subsequent Air Traffic Noise Screening (ATNS) procedure further emphasized the importance of these changes in DNL, so that they are also now included in FAA Order 1050.1E, Change 1. These recommendations only apply to cases where the significant threshold (increase of 1.5 dB or more within the 65 dB DNL contour) is met or exceeded. Levels of significance for noise sensitive locations are summarized below.

Significant noise impact:

- DNL increase of 1.5 dB or more in areas of 65 dB DNL and higher.

Less than significant impact:

- DNL increase of 3 dB or more in areas between 60 and 65 dB DNL; and
- DNL increase of 5 dB or more in areas between 45 and 60 dB DNL.

5.3.6.3 Future No-Action Noise Conditions

Under the No-Action condition, the gates would not be able to serve Group VI aircraft. The No Action Condition would not change noise levels at the Airport.

5.3.6.4 Proposed Action Noise Conditions

The Terminal E Renovation and Enhancements Project would allow for an efficient boarding process since three gates would be capable of handling Group VI aircraft. The Proposed Action would not result in any increase in noise to the community since the level of ramp movements remains the same as the No-Action Condition. In addition the Proposed Action would include fully Stage 4 compliant aircraft which are larger than the aircraft operating in the No-Action condition but would not increase noise levels on the ramp.

Specifically:

- There are no significant noise impacts associated with the Terminal E Renovation and Enhancements Project. By modifying the gates to accommodate the A380, the terminal will be able to handle some of the most efficient and quiet aircraft in the fleet today .
- The proposed improvements do not result in any change in the level of operations or time of day of aircraft flights and would not result in any change in the annual average DNL contour.

Since there are no significant differences between the No-Action and the Proposed Action condition other than how the aircraft use the Terminal E gates there will not be an increase of DNL 1.5 dB in any noise sensitive areas near the Terminal.

Aircraft Certification Data

Table 5.3 provides the aircraft certification values for each aircraft type operating in the No-Action and Proposed Action conditions. For lateral (sideline) and arrivals all of the Group VI aircraft have lower values than the aircraft operating today with the lateral noise reduction greater than 4 dB and the arrival noise reduction between 3 to 5 dB. For departures the A380-841 and the B747-8 have reductions compared to today with the A380-841 2.4.dB less and the B747-8 3.5 dB less. Only the A380-641 shows a 2.6 dB increase compared to the B777-300 operating today.

Table 5.3 Noise Analysis of No Action and Proposed Action by Aircraft Type

			Noise Levels (EPNdB)			Difference in Noise Level Compared to No-Action Condition		
Aircraft Types	MTOW (kg)	MLW (kg)	Lateral Level	Departure Level	Arrival Level	Lateral Level	Departure Level	Arrival Level
No-Action Condition								
B747-400	396,893	285,763	98.8	98.0	103.4		-	-
B777-300ER	351,534	251,290	98.7	92.8	100.5		-	-
B747-400	396,893	285,763	98.8	98.0	103.4		-	-
Proposed Action								
A380-841	569,000	391,000	94.2	95.6	98.0	-4.6	-2.4	-5.4
A380-861	569,000	391,000	94.4	95.4	97.2	-4.3	2.6	-3.3
B747-8	447,696	312,072	94.0	94.5	100.4	-4.8	-3.5	-3.0

Source: European Aviation Safety Authority (EASA) Type-Certificate Data Sheet for Noise (TCDSN)
Note: EPNdB – Effective Perceived Noise Level, MTOW - Maximum Takeoff Weight, MLW – Maximum Landing Weight

Single Event Level Contours

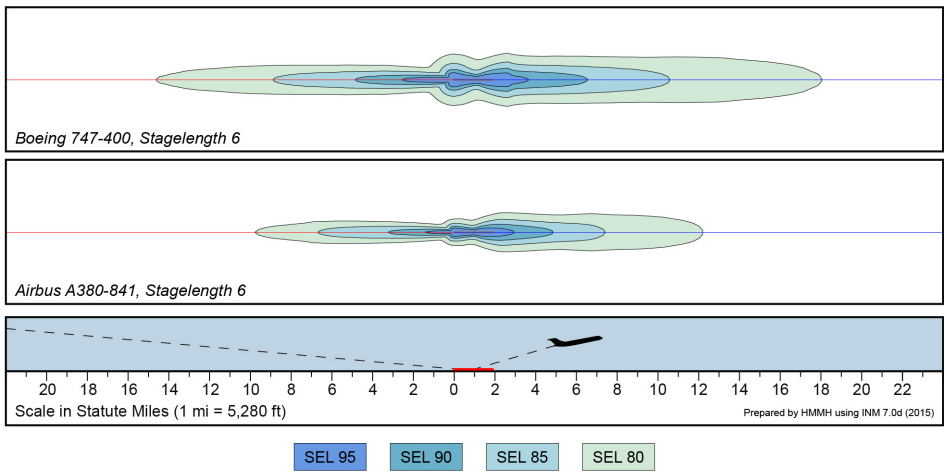
Single Event Level (SEL) contours were developed using the Federal Aviation Administration (FAA) Integrated Noise Model (INM) using a 10,000′ runway and Boston Logan annual weather conditions. These were developed for each existing route so that the aircraft Stage length (which is a surrogate for weight) was included in the results. The SEL contour includes an arrival to the runway and a departure. The SEL contours used INM standard profiles for arrival and departure. For arrivals, most of the profiles include a level segment at 3,000′ Above Field Elevation (AFE) which is a typical average arrival profile at an airport.

Figure 5.2 displays the SEL contours for each of the three routes where a Group VI aircraft is proposed to replace the current aircraft in the No-Action fleet. The three routes are British Airways -Boston to London, Emirates – Boston to Dubai and Lufthansa – Boston to Frankfurt. These SEL contours demonstrate that the replacement in the Proposed Action by these more efficient Group VI aircraft will not increase the noise levels around Boston Logan Airport and will most likely reduce average levels in the community and will as shown here result in reductions on a single event basis.

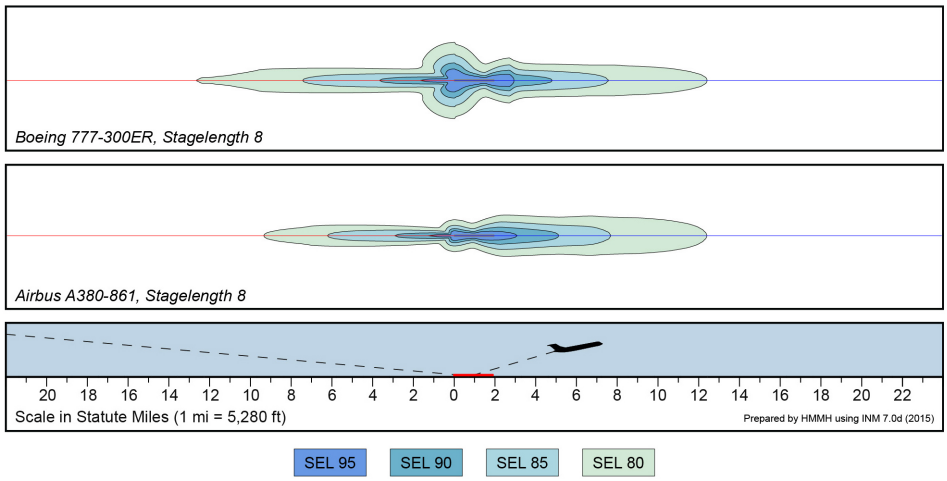
- British Airways – Boston to London, the A380-841 aircraft is quieter on approach and on departure compared to the current B747-400 aircraft in the No Action condition affecting a smaller region around the airport with aircraft noise. The reductions also on sideline during takeoff will be a benefit to nearby communities.
- Emirates – Boston to Dubai, the A380-861 aircraft is quieter on approach and while the initial climb is slightly louder on departure, the departure length of the SEL 80 dB contour is no longer than the current B777-300ER aircraft. In addition the large reductions on sideline during takeoff will be a benefit to nearby communities to the airport resulting in an overall lower noise footprint than in the No Action condition.
- Lufthansa – Boston to Frankfurt, the B747-8 aircraft is quieter on departure compared to the current B747-400 aircraft affecting a smaller region around the airport with aircraft noise. The arrival SEL 85 – 95 dB contours are similar between the two aircraft types however the B747-8 has a small extended area in the SEL 80 dB contour due to the level approach part of the profile for that aircraft. The reductions also on sideline during takeoff will be a benefit to nearby communities to the airport.

These SEL contours demonstrate that the more efficient Group VI aircraft will not increase the noise levels around Boston Logan Airport and will most likely result in reduction of average noise levels in the community and reductions on a single event basis. The use of Group VI aircraft is consistent with the broader, long-term industry trend of more passengers per flight. Over the long run, when compared to 15 to 20 years ago, for example, new engine technology, improved aircraft design and more passengers per flight has resulted in significant noise reductions while still accommodating passenger growth.

British Airways Aircraft To and From London



Emirates Aircraft To and From Dubai



Lufthansa Aircraft To and From Frankfurt

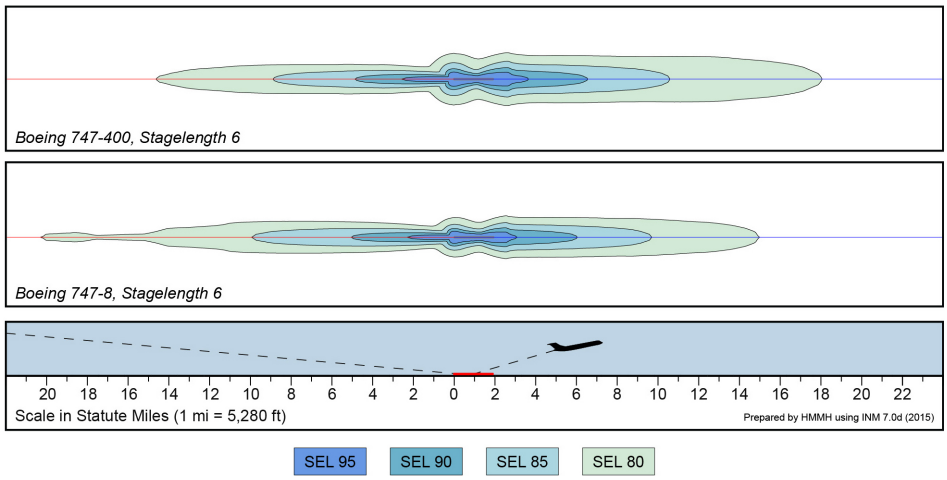


Figure 5.2

Comparative SEL Noise Contours

5.3.7 Surface Transportation

FAA Order 5050.4B requires an assessment of the surface transportation system as part of the NEPA process when the action could cause disruption of local traffic patterns that substantially reduce the level of service of roads serving an airport and its surrounding communities.[10] The Terminal E Renovation and Enhancements Project would not change the number of aircraft operations or passenger activity levels Airport-wide, and is anticipated to have only temporary increases in traffic associated with construction workers and vehicles. (See Section 5.3.9, *Short-term Construction Impacts*) The Proposed Action would not change local traffic patterns or affect the level of service on roads serving Logan Airport.

To assess curbside operations, the peak month, average weekday daily condition was analyzed since this represents the time period where the curbs would accommodate the highest passenger activity levels.

5.3.7.1 Future 2017 No-Action Condition

At Terminal E, there have been recent changes to curbside allocation on the Arrivals Level to make additional space available for passenger pick up, with a focus on promoting HOV modes. Charter bus space has been relocated from the outer curbside to the inner curbside (closest to the terminal) and the courtesy bus zone has been shifted to the previous charter bus zone along the outer curbside. Shared vans now wait in allocated spaces within the parking lot previously designated for limousines only. These changes are shown on **Figure 5.3**.

New wayfinding signs have also been installed along the Terminal E Arrival Level outer curbside. The goal of the signage is to direct passenger pick-up vehicles to parking lots in the Terminal E area, which is designed to decrease the number of recirculation trips on the Arrival Level roadway. Massport is actively managing these lots to ensure use for short-term parking.

Future passenger activity levels were developed for 2017 based on a number of input data related to air passenger activity at the terminal. Peak air passenger demand estimates were determined based on future flight schedules for all air carriers operating at Terminal E. The analysis is based on a future analysis condition of the summer of 2017, the first peak period after construction of the Terminal E Renovation and Enhancements Project is complete.

10 Federal Aviation Administration Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Projects*, Federal Aviation Administration United States Department of Transportation, April 28, 2006.

As indicated in Table 5.4, daily passenger demand is anticipated to grow between 13 to 24 percent by 2017 while future peak hour passenger activity is estimated to flatten due to the projected daily flight schedule.

Table 5.4 Curbside Passenger Demand Comparison

	2014 Existing		No-Action/Action 2017	
Curbside	Daily Passengers	Peak Hour Passengers	Daily Passengers	Peak Hour Passengers
Arrival Level	7,760	1,562	8,825	1,377
Departure Level	6,185	1,091	7,715	1,059

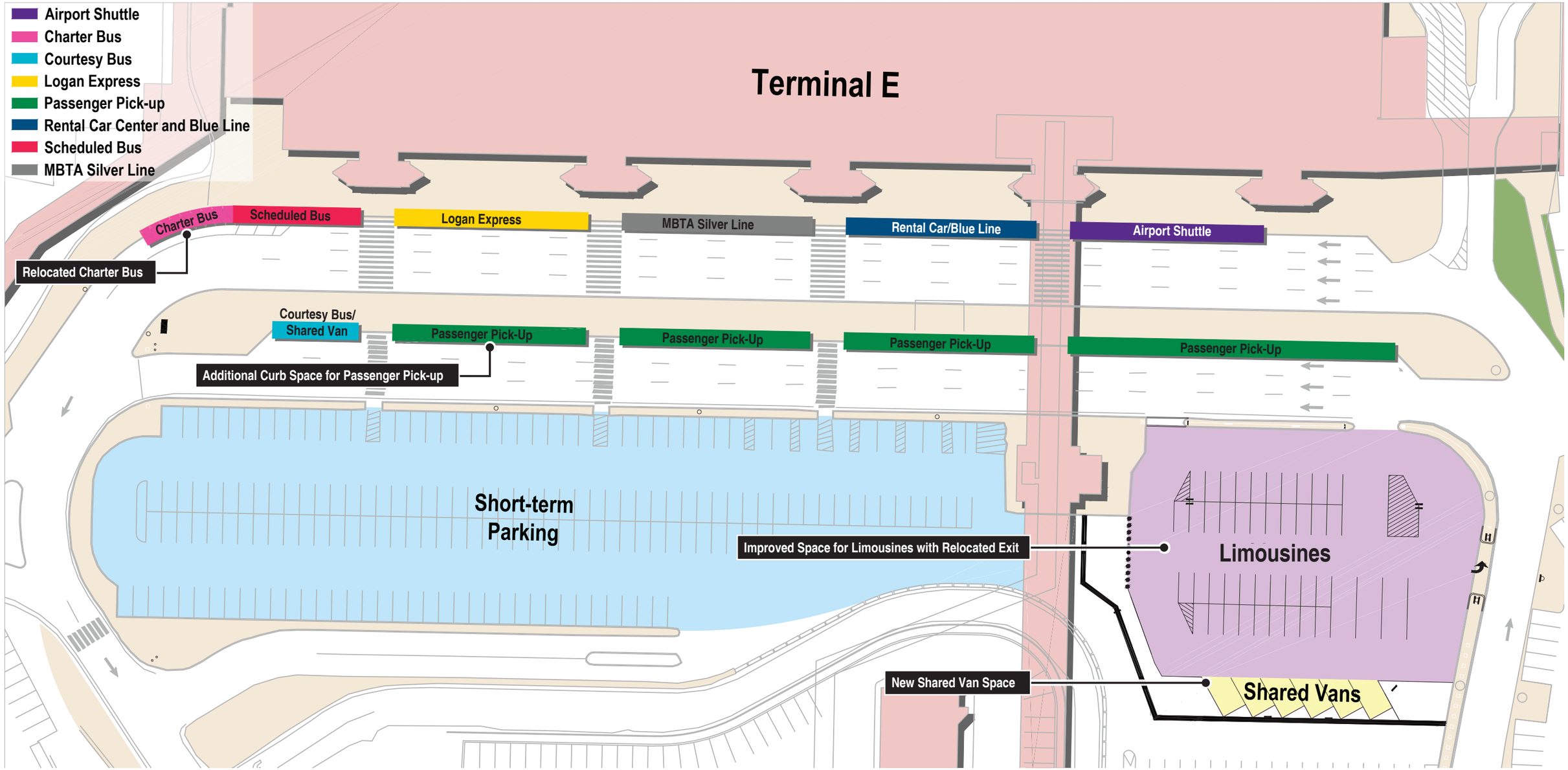
Note: The 2017 flight schedule and peak passenger demands are equivalent under the No-Action and Proposed Action conditions.

The 2017 flight schedule and peak passenger demands are equivalent under the No-Action and Proposed Action conditions. While gate accommodations and efficiencies would be improved in the Proposed Action condition, passenger processing limitations through the Federal Inspections Services (FIS) for incoming international passengers are expected to meter passenger flow from the Terminal to the curbside through roughly the same doors and at a similar rate under the No-Action and Proposed Action conditions. The daily arrival timing of international flights is associated with the Airport's geographic location on the eastern seaboard of the United States; this is tied to peak passenger activity at the Airport, and is not expected to change under the No-Action and Proposed Action conditions.

Future curb demand for the Arrival and Departure Level curbsides at Terminal E was calculated using the 2017 future peak hour passenger levels and ground transportation mode share information from the 2013 Logan Air Passenger Survey, as described in Chapter 4, *Affected Environment*. As described above, the same number of passengers would be accommodated in the No-Action and Proposed Action conditions. As part of this analysis, a recirculation number was developed to account for the number of cars using the Terminal roadway more than once per trip, based on assumptions on future use of short-term parking and use of parking lots outside of Terminal E. Inputs, calculations and a list of all assumptions are provided in Appendix B.

As described in Chapter 4, *Affected Environment*, the Terminal E curbside currently is experiencing unacceptable levels of service (LOS). By the time the Terminal E Renovation and Enhancements Project is constructed, improvements would be in place to address these delays. With these improvements and the expected spread in future peak passenger demand levels, curbside operations are projected to improve over existing operational conditions. These improvements would take place independently of the Terminal E Renovation and Enhancements Project. Therefore future curbside conditions are the same for the No-Action and the Proposed Action conditions. The outer curbside is expected to experience the greatest change.

- The first passenger pick-up zone travel lanes would improve from LOS E to LOS B.
- The two remaining (currently existing) passenger pick-up zones would improve from LOS F to LOS B.
- The new passenger pick-up zone (previously used by shared vans and charter buses) would improve from LOS E to LOS B in travel lanes, and from LOS D to LOS C in the curbside lane.
- The courtesy bus zone travel lanes would improve from LOS B to LOS A, while the curbside lane would remain LOS A.
- Overall, the curbside is projected to operate at LOS C or better and the travel lanes are expected to operate at LOS B or better. Complete copies of the Quick Analysis Tool for Airport Roadways (QATAR) analysis can be found in Appendix B.



Source: VHB

Figure 5.3

Future Terminal E Ground Transportation Mode Curbside Allocation

TERMINAL E RENOVATION AND ENHANCEMENTS PROJECT
Boston-Logan International Airport
East Boston, Massachusetts

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Curbside operations for high-occupancy vehicle zones are not projected to change. Operational details (such as schedule, headway, or vehicle type) for those ground transportation modes have sufficient existing capacity and would not require changes to accommodate the No-Action passenger levels expected in 2017.

5.3.7.2 Proposed Action Curbside Operations

The improvements described in 5.3.1.1 above would be in place for both the No-Action and Proposed Action conditions. The Proposed Action would not result in a change to the overall number of passengers or aircraft projected to be accommodated at Logan Airport compared to the No-Action condition, and would not result in changes to the overall airport forecasts. Curbside operations under the 2017 Proposed Action condition are equivalent to the 2017 No-Action condition.

5.3.8 Water Quality

FAA Order 1050.1E, Change 1 and Order 5050.4B require that the EA include sufficient description of a proposed action's design and mitigation measures developed for non-point sources under Section 319 of the Clean Water Act (CWA), and construction controls to demonstrate that water quality standards and any permit requirements will be met. No direct or indirect water quality impacts are anticipated from the Proposed Action. Under the No Action condition, there would be no change to the Terminal Area or the airfield.

5.3.8.1 Terminal Improvements

The areas proposed for Terminal E exterior improvements are already paved and the Project would not result in increased impervious surfaces or pollutant-generating activities on the apron or ramp. The distribution of stormwater between the building and apron would shift to more roof collection, but the aggregate amount of stormwater and overall stormwater runoff quality would remain unchanged from the No-Action Alternative. The system would be modified as necessary to accommodate the new roof area drainage, and surface drainage both landside and airside. The Terminal would continue to drain to the North Outfall, which is equipped with end-of-pipe treatment to remove of debris and floating oil and grease from stormwater prior to discharge into Boston Harbor.

Aircraft deicing operations are conducted by each airline with mobile deicing trucks at their individual gates as well as designated deicing locations. Aircraft deicing practices would be the same under the Proposed Action as under No-Action. Massport's Stormwater Pollution Prevention Plan (SWPPP) addresses stormwater pollutants in general, and also addresses deicing and anti-icing chemical, potential bacteria, fuel and oil, and other sources of stormwater pollutants. Under this SWPPP, Massport manages stormwater discharges and protects groundwater resources from aircraft deicing operations during the winter months. In accordance with the Logan Stormwater Permit (MA0000787) and Logan SWPPP, the 2011 Annual Certificates of Compliance were submitted to EPA and the Massachusetts Department of Environmental Protection (MassDEP) on December 13, 2011, for Massport and each tenant co-permittee. As described in Chapter 4, *Affected Environment*, Massport holds a National Pollutant Discharge Elimination System (NPDES) permit for stormwater discharge at the major outfalls within the Airport. In compliance with the NPDES permit, Massport monitors discharges and submits reports to the EPA and MassDEP. No changes to storm water runoff or water quality would occur in the No Action condition.

5.3.8.2 Airfield Improvements

Under the Proposed Action Airfield improvements would include additional areas of pavement adjacent to selected taxiways and runways, which would be offset by a reduction of pavement in other areas. These new impervious areas would drain to existing stormwater inlets within the grassed airfield, which are sufficiently sized to handle the incremental runoff from each new area. The pavement areas to be added would be located on runway shoulders and interior curves of existing taxiways. These areas would be installed to provide a measure of safety in areas adjacent to where large aircraft are operating and would not have active regular use that would result in deposition of pollutants. Stormwater runoff from new areas of pavement would be directed to existing stormwater treatment infrastructure within each drainage basin. To balance total pavement on the Airport, Massport would remove an area of pavement to offset the gain in impervious cover; therefore, there would not be any notable difference in airfield water quality or runoff compared to the No-Action Alternative. The Proposed Action will comply with the Massachusetts Stormwater Standards.

All outfalls would continue to be handled under the Airport's existing NPDES permit. The majority of the airfield discharges to minor outfalls located around the Airport perimeter. Stormwater sampling of the airfield outfalls is an ongoing requirement of the NPDES permit and would continue following the construction of the airfield improvements. Stone rip rap at the outfalls prevents erosion and sedimentation that could result from stormwater discharges.

5.3.9 Temporary Construction-Related Impacts

In accordance with Order 5050.4B and Order 1050.1E, Change 1, Appendix A, Section 5, Massport has analyzed potential construction-related impacts, including construction noise; dust and noise from heavy equipment traffic; disposal of construction debris; and air and water pollution. Temporary, construction-related impacts occur on a short-term basis during the construction period based on construction methods, duration, materials, and equipment. Construction impacts alone are rarely significant pursuant to NEPA; however, Massport has identified best practices that would minimize the likelihood of negative impacts on the natural and built environments.

Enabling activities, such as interior demolition, are anticipated to begin in the third quarter of 2015. Construction of new building areas is also anticipated to commence in the third quarter, with completion during the first quarter of 2017. The Terminal building improvements would be constructed in a single phase. Airfield improvement construction is anticipated to commence in late fall 2015 and would be completed over an 18-month period. Multiple construction phases are needed for the airfield improvements to limit airfield operational impacts, in conjunction with other on-going airfield projects, and for cost consideration. This section provides an overview of the construction methods, equipment and durations for the terminal and airside improvement elements of the Proposed Action.

5.3.9.1 Terminal Improvements

A Transportation Security Administration (TSA)-approved temporary Security Identification Display Area (SIDA) fence would be constructed as part of the Terminal E Renovation and Enhancements Project to allow construction activities to occur outside of secured areas, to avoid airside security issues during the terminal building construction. Construction laydown areas would be located in the construction zone within the approved SIDA fence.

The terminal building is considered a landside construction project. Large construction equipment, major material deliveries, demolition materials and trash hauling would use the North Gate. Once at the construction site, contractor staff would access the building area through a contractor's construction entrance door/corridor within the Terminal. Massport strives to complete all work during daytime hours to avoid construction noise impacts on the surrounding communities. New terminal foundations would be comprised of deep pilings, pier caps, grade beams and structural slabs. All superstructure is anticipated to be structural steel. Construction cranes would be used for steel erection and precast panel installation. **Table 5.5** presents the construction equipment requirements for the terminal building.

Table 5.5 Terminal E Renovation and Enhancements Project - Landside Equipment Requirements

	2015		2016				2017
Equipment Estimate	Aug-Sept*	Oct-Dec	Jan-Mar	April-June	July-Sept	Oct-Dec	Jan-Mar
Aerial Lift	1	1	1	-	1	-	-
Asphalt Paver	-	-	-	-	-	1	1
Auger	1	-	-	-	-	-	-
Backhoe	1	1	1	-	-	-	-
Bulldozer	1	1	1	1	-	1	1
Concrete Paver	-	-	1	-	-	-	-
Concrete Pump Truck	-	1	1	1	-	1	1
Concrete Transit Mixer	3	3	5	1	-	1	1
Crane- Mobile	1	1	1	1	1	-	-
Dump Trailer	1	2	1	-	-	-	-
Dump Truck	-	2	3	2	-	-	-
Dumpster	1	1	1	1	1	1	1
Excavator	1	1	1	-	-	-	-
Front End Loader	-	-	1	-	-	-	-
Grader	1	-	-	1	-	-	-
Material Handler	1	2	1	-	1	-	-
Pile Vibrator	1	1	-	-	-	-	-
Primer Truck	-	-	1	-	-	-	-
Roller- Dirt	-	1	1	1	-	1	1
Roller- Pvmt	-	-	-	-	-	1	1
Sweeper	1	1	1	1	-	-	-
Tack Truck	-	-	-	-	-	1	1
Truck And High-Bed Trailer	2	2	3	2	3	1	1
Utility Truck	-	1	1	-	-	-	-
Vibratory Plate Compactor	1	1	1	1	-	-	-
Water Pump	1	1	-	-	-	-	-
Water Truck	1	1	-	-	-	-	-
Welding Machine	-	1	1	1	-	-	-
TOTAL	20	26	28	14	7	9	9

Note: Numbers denote average equipment per daily shift
* Construction would begin late fall 20015.

5.3.9.2 Airfield Improvements

Construction laydown areas would be located either within the project site or at the North Campsite Contractor's Trailer and Storage Area. Depending on the work area and impact to operations related to the airside improvements, work may occur during weekend daytime hours. This portion of the Project would occur entirely on the airfield, and contractors would access the airfield primarily through the North security gate. Construction equipment and materials would access the Airport in the same manner as discussed above.

The work consists of excavation, placing granular sub base and base materials, and asphalt paving. Guidance signs and lighting would be modified and adjustments to stormwater drainage structures may be required. **Table 5.6** presents the construction equipment requirements for the airfield portion of the Project.

Table 5.6 Terminal E Renovation and Enhancements Project - Airfield Equipment Requirements

	2015			2016		
Equipment Estimate	Aug-Sept*	Oct-Dec	Jan-March	April-June	July-Sept	Oct-Dec
Air Compressor	1	1	-	1	1	1
Asphalt Paver	1	1	-	1	1	1
Backhoe	1	1	-	1	1	1
Bulldozer	1	1	-	1	1	1
Crane- Mobile	1	1	-	1	1	1
Dump Trailer	1	1	-	1	1	1
Dump Truck	3	3	-	3	3	3
Excavator	2	2	-	2	2	2
Front End Loader	1	1	-	1	1	1
Grader	2	2	-	2	2	2
Material Handler	1	1	-	1	1	1
Reclaimer	1	1	-	1	1	1
Roller- Dirt	1	1	-	1	1	1
Roller- Pvmt	3	2	-	2	3	2
Sweeper	1	1	-	1	1	1
Tack Truck	1	1	-	1	1	1
Truck And High-Bed Trailer	1	1	-	1	1	1
Utility Truck	1	1	-	1	1	1
Vibratory Plate Compactor	1	-	-	1	1	1
Water Truck	1	1	-	1	1	1
TOTAL	26	24	0	25	26	25

Note: Numbers denote average equipment per daily shift
* Construction would begin late fall 20015.

During construction there would be limited short-term impacts from added vehicle trips to and from the site by construction equipment, fugitive dust, and noise. Demolition materials and other routine construction wastes would be appropriately recycled and disposed. These short-term impacts are discussed in Section 5.3.9.3.

5.3.9.3 Coordination with Other Construction Activities

The following projects are anticipated to be ongoing during construction of the Proposed Action:

Table 5.7 Ongoing and Foreseeable Logan Airport Projects

Project	Construction Period	Peak Construction Quarters	Peak Equipment Usage (trucks/dozers etc.)
Terminal C to E Connector	Underway - 2016	NA	Trucks, mobile cranes, excavators, concrete pump trucks, pavers, and miscellaneous equipment
Parking Garage Consolidation Project	Underway 2015	Q2/Q3	Trucks, mobile cranes, excavators, concrete pump trucks, pavers, and miscellaneous equipment
Gate 37/38 connector	2016-2018	NA	Trucks, mobile cranes, excavators, concrete pump trucks, pavers, and miscellaneous equipment
Central Heating Plant upgrade	2017- and beyond	NA	Trucks, mobile cranes, excavators, concrete pump trucks, pavers, and miscellaneous equipment
Installation of Airfield Wide Snow melters	Through 2019	Q2/Q3 each year	Trucks, excavators
Runway 4R Approach Light Pier Upgrade	2017	Q2/Q3	Trucks, milling machines, pavers, rollers
Taxiway Echo and Kilo West Rehab	2015	Q3	Trucks, milling machines, pavers, rollers
Rehabilitation of Runway 4R	2015 & 2017	Q2-2015, Q2/Q3 -2017	Trucks, milling machines, pavers, rollers
Runway 4L-22R rehabilitation	2016	Q2/Q3	Trucks, milling machines, pavers, rollers
Taxiway A and B East Improvements	2016 & 2017	Q2/Q3	Trucks, milling machines, pavers, rollers
Runway 22L rehabilitation	2017	Q2/Q3	Trucks, milling machines, pavers, rollers
Taxiways F, H, P, E, and M1 rehabilitation	2017	Q2/Q3	Trucks, milling machines, pavers, rollers
Taxiway Y realignment	2017	Q2/Q3	Trucks, milling machines, pavers, rollers

NA – Not Available

5.3.9.4 Construction Surface Transportation Impacts

Short-term construction impacts are expected to be limited to the segments of the East Boston roadways that provide direct access to the Airport's entrances (Service Road, Frankfurt Street, and Prescott Street) and on-Airport roadways (Transportation Way, Harborside Drive, and Terminal Area roadways). As documented in Massport's construction management specifications, construction vehicles are restricted from using local roads.

Project construction would be primarily undertaken from a defined work area on the airfield. All materials and workers would be delivered to the Terminal E construction area with secure escort from the North Gate. Materials to be delivered by truck to the Airport would primarily include asphalt pavement, concrete, granular base and sub base materials and miscellaneous metals. Construction workers would not be allowed to drive or park at the Airport (with the exception of limited supervisory personnel). The majority of workers would be transported to the site by shuttle bus from a remote contractor lot or arrive on existing Airport shuttles.

Construction Traffic Methodology

The estimated numbers of pieces of construction equipment associated with the construction schedule are provided in **Tables 5.5** and **5.6** and Appendix B for each week from 2015 through 2017. Estimates of the types and numbers of pieces of heavy equipment required for the Proposed Action construction per work shift were developed based on these equipment schedules.

Construction Truck Traffic

Peak construction activity related to the terminal building and airside improvements occur at different times. The combined peak is anticipated to occur between October and December 2015, generally associated with overlapping activities including foundation work, apron reconstruction, foundation, and utility connection activities. The detailed construction equipment schedules indicate that a maximum of 26 pieces of construction equipment would be required each day during the peak period of 2015 for the terminal building) and 24 pieces of equipment would be required each day during the same period for the airside improvements). Peak equipment use related to airside improvements is expected to occur between July and September 2015 when 26 pieces are in service. However, during this time only 20 pieces of equipment would be required for terminal building construction. For the purposes of this traffic analysis, the peak period construction period is the fourth quarter (October to December) of 2015, with a combined anticipated total of 50 pieces of construction equipment required each day.

Most of the heavy construction equipment, including some mobile cranes, excavators, concrete pump trucks, pavers, and miscellaneous equipment (welders, compressors, vibro-compactors) would be stored on the Airport during non-work hours. This equipment would be used during most workdays; however this equipment would not enter or leave the Airport as a daily construction trip. The following types of equipment would enter and leave the Airport for each work shift:

- Concrete Transit Mixers;
- Dump Trucks;
- Dump Trailers;
- Truck / High-bed Trailers;
- Water Trucks; and
- Utility Trucks.

The projected daily need for these types of heavy and light trucks was used to estimate the daily number of total truck trips (arrivals plus departures) to the airport, as presented in **Table 5.8**. Cumulatively, the proposed Terminal E Renovation and Enhancement Project construction would generate approximately 10 to 42 total truck trips per weekday, depending on the project phase. It is expected that construction would take place primarily during the day shift, approximately 7:00 AM to 7:00 PM. It was assumed that most light duty trucks, such as escort trucks and pick-up trucks associated with supervisory workers, would all arrive to the project site during the morning peak hour and exit during the evening peak hour. No significant nighttime or weekend work related to terminal building construction is anticipated. Nighttime or weekend work in relation to the airside improvements may occur and would be further determined during construction phasing development.

Table 5.8 Total Daily Construction Trips

Year	2015		2016				2017
Period	July-Sept	Oct-Dec	Jan-Mar	April-June	July-Sept	Oct-Dec	Jan-Mar
Daily Trips (Terminal Building)	8	18	18	10	6	4	4
Daily Trips (Airside Improvements)	14	14	0	14	14	14	0
Daily Trips (Misc.)	10	10	6	10	10	10	6
Total Daily Trips	32	42	24	34	30	28	10

Construction Truck Routes

Massport requires that the Contractor use direct construction truck traffic access to the Terminal E and all airside construction sites be through the Airport's North Gate for the duration of construction (**Figure 5.4**). Airport access by the Contractor would be limited to federal or state highways and segments of local roadways that provide direct access to the Airport's entrances. As noted previously, construction vehicles are restricted from using local roadways through East Boston. Truck trips directly to the project site are anticipated to come from all directions and would be routed in any of the following ways (**Figure 5.4**):

- Access via McClellan Highway (Route 1A) southbound, Transportation Way, Hotel Drive, Service Road (SR-2), and Prescott Street; egress via Prescott Street, SR-2, and the Airport Exit ramp from Terminal E to Route 1A northbound.
- Access via Callahan Tunnel, Route 1A Northbound, Frankfort Street off-ramp, Frankfort Street southbound and Prescott Street; egress via Prescott Street, SR-2, the Airport Exit ramp from Terminal E, Route 1A Southbound to the Sumner Tunnel.
- Access via Ted Williams Tunnel, Ramp T-S, Hotel Drive, SR-2 and Prescott Street; Egress via Prescott Street, SR-2, and the Airport Exit ramp from Terminal E to Ted Williams Tunnel.

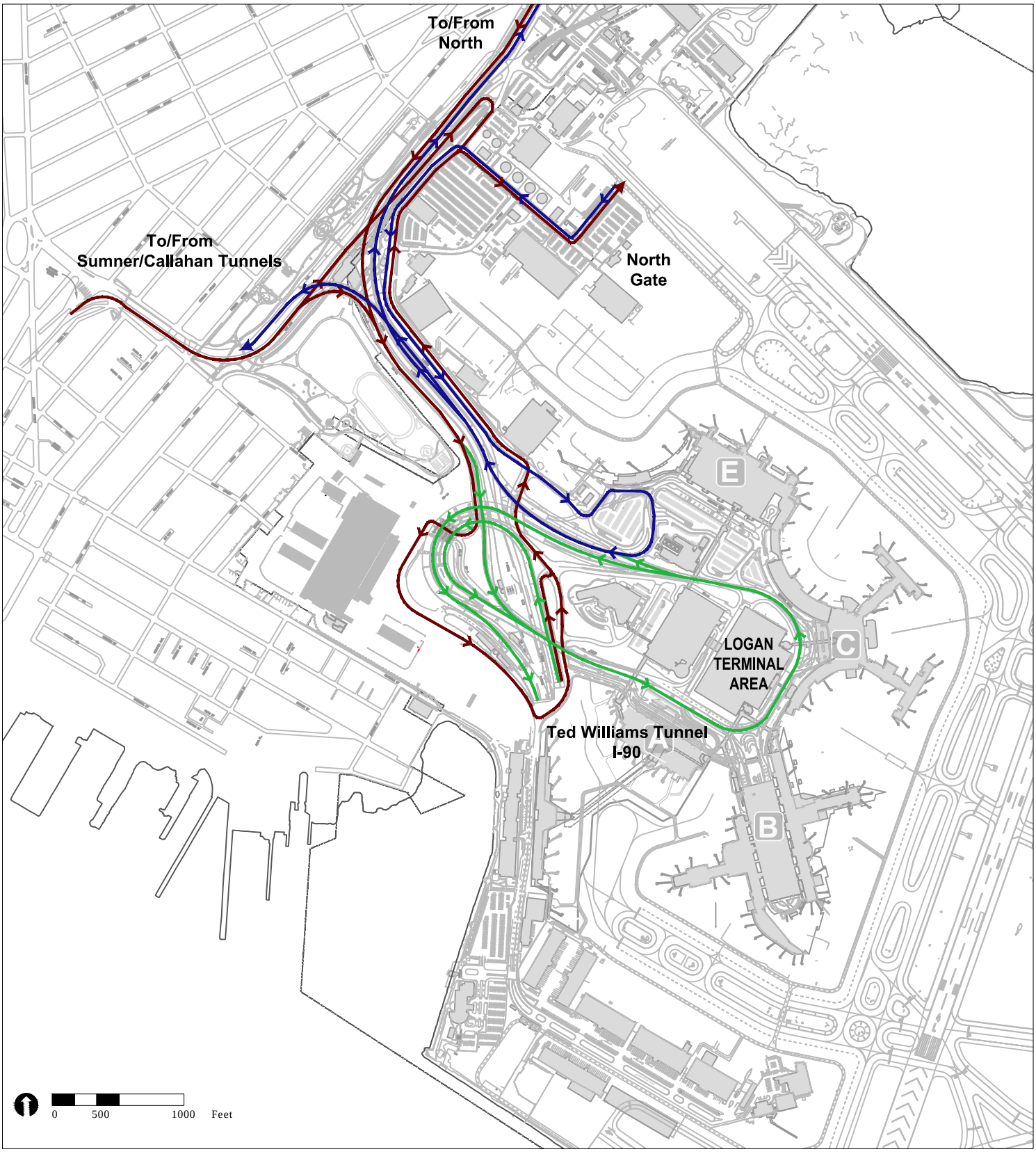
Construction Traffic Management

Vehicular traffic flow on the Airport roadway network during construction would be managed to maintain acceptable levels of service. If necessary, Massport has the ability to modify contractor schedules and access routes to minimize impacts.

Based on the maximum of 42 total daily construction truck trips and the access restrictions described above, the Terminal E Renovation and Enhancements Project would have minimal impact on Airport or regional roadways. The Airport roadway infrastructure accommodates over 119,000 daily trips each weekday and can accommodate the anticipated 42 additional daily construction truck trips associated with the Proposed Action's construction without further impacting capacity or delay.

Due to the minimal impact of the Proposed Action's construction on the roadways and the distance from other construction activities (shown in **Table 5.7**) in different areas of the Airport, the concurrent construction of the other ongoing and reasonably foreseeable projects can be adequately accommodated by the Airport and regional roadway systems.

\\vhb\proj\wat-ev\12848.00 aecom-terminal e\graphics\figures\temp construction routes.dwg



Legend

- Access Routes
- Egress Routes
- Small Vehicle Contractor Access

massport

Figure 5.4

Temporary Construction
Access/Egress Routes

TERMINAL E RENOVATION
AND ENHANCEMENTS PROJECT
Boston-Logan International Airport
East Boston, Massachusetts

Construction Traffic Mitigation

The Airport roadways can support the anticipated construction-related traffic; therefore, no specific mitigation is proposed and no Project-specific transportation access plan is proposed. Massport requires all contractors to limit construction-related traffic to access and egress through the North Gate via only state and federal highways and the Airport roadway network, prohibiting construction-related traffic on the local East Boston roadways.

Massport requires contractors to implement construction worker vehicle trip management, including requiring off-Airport parking and high-occupancy vehicle transportation modes for employees.

5.3.9.5 Construction Air Quality Impacts and GHG emissions

Project construction would generate temporary construction period air emissions and fugitive dust associated with demolishing and constructing the new portions of the terminal, as well as from construction vehicles and equipment. The emissions from construction activities are not expected to be substantial. Emissions produced by operating construction equipment include NOx, VOCs, CO, and particulate matter (PM), and are expected to be short-term due to the transitory nature of construction activity. City of Boston and Massachusetts Clean Air Quality requirements would be enforced during the construction. Massport is exempt from City of Boston regulations, but voluntarily complies with Air Quality Requirements for its projects.

Construction Air Quality Methodology

Construction activities associated with the Proposed Action are temporary and the emissions occur predominantly in the engine exhaust from the operation of construction equipment and vehicles (for example, scrapers, dozers, cranes, delivery trucks, etc.), but are also attributed to fugitive dust produced from demolition activities, and construction materials staging.

Construction equipment typically utilized in airport projects comprises both on-road (i.e., road-licensed) and non-road equipment (i.e., off-road). The former category of vehicles are used for the transport and delivery of supplies, material and equipment to and from the site, and also include construction worker vehicles. The latter categories of equipment are operated on-site for activities such as soil/material handling, site clearing and grubbing.

For this analysis, the *Airport Construction Emissions Inventory Tool* (ACEIT), developed in support of the Airport Cooperative Research Program (ACRP) Report 102 (*Guidance for Estimating Airport Construction Emissions*), was used to estimate construction-related emissions associated with the terminal and airfield construction improvements.

Construction project footprint(s) and cost(s) were used to estimate construction activities and equipment/vehicles activity data (e.g., equipment mixes/times) within the ACEIT and default emission factors were assigned based on location and type of construction project. ACEIT uses emission factors derived from U.S. EPA-approved emissions models for non-road (i.e., NONROAD) and on-road (i.e., MOVES) vehicles.[11]

11 Transportation Research Board, ACRP Report 102, *Guidance for Estimating Airport Construction Emissions*, http://onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_102.pdf.

Both exhaust and fugitive emission factors were used. Other ACEIT input variables included the Project's years of construction, which were assumed to start in August 2015 and end in September 2016.

Construction Air Quality

These construction emissions associated with the Proposed Action are summarized in **Table 5.9,** segregated by Project component and location (terminal or airfield) and emission source. On-Road sources are mobile emissions from construction vehicle transportation and material hauling, and Non-Road sources are emissions from on-site construction equipment. For completeness and disclosure purposes, emissions of sulfur dioxide (SO_2), PM_{10}, and $PM_{2.5}$ are also shown. For comparative purposes, the applicable *de minimis* thresholds of the General Conformity Rule are also provided.

Table 5.9 Project-related Construction Emissions (tons per year)

Project Type/Area	Emission Source	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	VOC
Terminal	Non-Road	9	19	<1	1	1	2
	On-Road	23	2	<1	<1	<1	1
	Fugitive	0	0	<1	<1	<1	<1
	Subtotal	32	21	<1	2	2	3
Airfield	Non-Road	6	15	<1	1	1	1
	On-Road	2	<1	<1	<1	<1	<1
	Fugitive	<1	<1	<1	<1	<1	6
	Subtotal	8	16	<1	1	1	7
TOTAL		40	37	<1	3	3	11
de minimis Thresholds		100	100	n/a	n/a	n/a	50
Exceeds *de minimis* Threshold?		No	No	n/a	n/a	n/a	No

Notes: Terminal Area projects include a new building area and interior renovations.
Airfield Area projects include paving fillets and shoulders, restriping and adjusting runway and taxiway lights and signs, as well as pavement demolition/removal.
Values may reflect rounding and represent the highest of the two-year construction period.
CO – carbon monoxide; NOx – nitrogen oxides; SO2 – sulfur dioxide; PM – particulate matter of 10 and 2.5 micrometers or less in diameter, respectively; and VOC – volatile organic compounds.

As shown, the total Project-related emissions associated with construction activities are well below the *de minimis* threshold of 100 tons per year for CO and NOx, and 50 tons per year for VOC. Therefore a formal Conformity Determination is not required, as the Proposed Action is presumed to comply with the SIP and is not expected to cause, or contribute to, a violation of the NAAQS.

Construction Air Quality Mitigation

As part of the Project approvals process and to minimize air emissions, Massport would require all contractors to comply with certain construction guidelines that relate to:

- Construction vehicle/equipment anti-idling;
- Retrofitting of appropriate diesel construction equipment with diesel oxidation catalyst and/or particulate filters; and
- Construction worker vehicle trip management, including requiring contractors to provide off-Airport parking, and use high-occupancy vehicle transportation modes for employees.

Emissions from construction activities may be further reduced by employing the following best management practices:

- Reducing exposed erodible surface area through appropriate materials and equipment staging procedures;
- Covering exposed surface areas with pavement or vegetation in an expeditious manner;
- Reducing equipment idling times;
- Reducing vehicles speeds onsite;
- Ensuring contractor knowledge of appropriate fugitive dust and equipment exhaust controls;
- Stabilizing soil with cover or periodic watering;
- Using low- or zero-emissions equipment;
- Using covered haul trucks during materials transportation; and
- Suspending construction activities during high-wind conditions.

5.3.9.6 Construction Noise

The construction of the Proposed Action would generate noise associated with the renovation and improvement activities. Construction equipment is expected to be used intermittently throughout the Project's construction phase, only during daytime hours. Normal flight operations would continue to function during project construction.

City of Boston Construction Noise Criteria

The City of Boston has established regulations for evaluating sound levels associated with construction activities. Although Massport is exempt from City Ordinances, these regulations are used as guidelines for assessing projects and Massport voluntarily complies with these local regulations when possible. The Air Pollution Control Commission of the City of Boston, acting under the authority granted in Chapter 40, Section 21 of the General Laws of the Commonwealth of Massachusetts, and by the City of Boston Code, Ordinances, Title 7, Section 50, has adopted regulations for the Control of Noise in the City of Boston. Regulation 3: "Restrictions on Noise Emitted from Construction Sites" establishes maximum allowable sound levels based upon the land use impacted by the

construction of a proposed project. The noise criteria provided in the regulations were used to evaluate whether or not the Project would generate sound levels that result in adverse impacts.

The City of Boston noise control regulation considers construction sound levels to be an impact if operation of construction devices exceeds the L_{10}[12] sound levels shown in **Table 5.10**

Table 5.10 City of Boston Construction Noise Limits, dB(A)

Land Use	L10 Sound Level	Lmax Maximum Noise Level
Residential or Institutional	75	86
Business or Recreational	80	--
Industrial	85	--

Source: Regulations for the Control of Noise in the City of Boston, City of Boston, Air Pollution Control Commission.

If the existing background L_{10} sound level already exceeds the limits referenced in **Table 5.10**, the L_{10} sound level during construction must not exceed the background L_{10} sound level by 5 dB(A) or greater. Unless exempt, such as impact devices, no individual piece of construction equipment can generate a noise level exceeding 86 dB(A) at a distance of 50 feet from the device.

Construction Noise Methodology

The noise analysis used the Federal Highway Administration's (FHWA) Roadway Construction Noise Model 1.1(RCNM)[13] to calculate the sound levels associated with construction equipment at the closest receptor locations, typically residential areas.

The noise analysis evaluated sound levels of construction activities associated with the Project. Construction sound levels are a function of the types of equipment being used, the number of each type of equipment, and the distances between the construction equipment and the sensitive receptor locations. Overall construction sound levels are governed primarily by the noisiest pieces of equipment operating at a given time. The RCNM contains both equipment specification reference sound level data and actual measured sound level data. The noise analysis used the highest value for all equipment, and used the default equipment usage factor from the model.

The type and units for each piece of equipment vary depending on the construction phase. During any particular activity, multiple pieces of equipment may operate simultaneously and for various durations throughout the construction period. **Table 5.11** presents the construction equipment and the reference sound levels associated with the various types of construction equipment for both the landside and airside construction.

12 L_{10} level is the A-weighted sound level exceeded ten percent of the time, as defined by the Regulations for the Control of Noise in the City of Boston, Regulations for the Control of Noise in the City of Boston, City of Boston, Air Pollution Control Commission

13 FHWA *Roadway Construction Noise Model (RCNM): User's Guide* Federal Highway Administration, FHWA-HEP-05-054, January 2006.

The Study Area includes on- and off-Airport areas in the vicinity of the Airport in proximity to Terminal E and the airfield improvement areas. The noise analysis identified nine sensitive receptor locations in the vicinity of the Study Area. These sensitive receptors were evaluated for noise impacts resulting from construction activities associated with the Project. These receptor locations included:

- Receptor 1 – East Boston Memorial Park (Tennis Court) – Boston;
- Receptor 2 – East Boston Memorial Park (Football Field) – Boston;
- Receptor 3 – Intersection of Bremen Street and Putnam Street – Boston;
- Receptor 4 – Swift Terrace – Boston;
- Receptor 5 – Intersection of Short Street and Coleridge Street – Boston;
- Receptor 6 – Intersection of Thurston Street and Bayswater Street – Boston;
- Receptor 7 – New Court Road near Albert Ave – Winthrop;
- Receptor 8 – Intersection of Foam Street and Grand View Avenue – Winthrop; and
- Receptor 9 – Intersection of East 1st St. and Farragut Road – South Boston.

These receptor locations were selected based on land use considerations and represent the closest most sensitive locations (residential and recreational uses) in the study area that are likely to experience changes in sound levels due to the proposed project. **Figure 5.5** presents the receptor locations used in the noise analysis.

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Source(s): MassGIS

Legend

R1 Noise Receptor

Figure 5.5

Construction Noise Receptors

TERMINAL E RENOVATION AND ENHANCEMENTS PROJECT
Boston-Logan International Airport
East Boston, Massachusetts

Table 5.11 Construction Equipment Reference Sound Levels, dB(A)

Equipment	Usage Factor (%)	Lmax at 50 feet[1]	Unit per day for landside activities[2]	Unit per day for airside activities[2]
Aerial Lift	20	85	0 - 1	0 - 0
Asphalt Paver	50	85	0 - 1	0 - 1
Auger	20	85	0 - 1	0 - 0
Backhoe	40	80	0 - 1	0 - 1
Bulldozer	40	85	0 - 1	0 - 1
Concrete Paver	50	85	0 - 1	0 - 0
Concrete Pump Truck	20	82	0 - 1	0 - 0
Concrete Transit Mixer	40	85	0 - 5	0 - 0
Mobile Crane	16	85	0 - 1	0 - 1
Dump Trailer[3]	40	84	0 - 2	0 - 1
Dump Truck	40	84	0 - 3	0 - 3
Dumpster[4]	40	84	1	1
Excavator	40	85	0 - 1	0 - 2
Front End Loader	40	80	0 - 1	0 - 1
Grader	40	85	0 - 1	0 - 2
Material Handler[5]	40	80	0 - 2	0 - 1
Pile Vibrator	20	101[8]	0 - 1	0 - 0
Primer Truck[4]	40	84	0 - 1	0 - 0
Dirt Roller	20	85	0 - 1	0 - 1
Pavement Roller	20	85	0 - 1	0 - 3
Sweeper	10	82[8]	0 - 1	0 - 1
Tack Truck[4]	40	84	0 - 1	0 - 1
Truck and High Bed Trailer[4]	40	84	1 - 3	0 - 1
Utility Truck[7]	40	75[8]	0 - 1	0 - 1
Vibratory Plate Compactor	20	83[8]	0 - 1	0 - 1
Water Pump	50	81[8]	0 - 1	0 - 0
Water Truck[4]	40	84	0 - 1	0 - 1
Welding Machine	40	74[8]	0 - 1	0 - 0

1 Source: Reference sound level data based on equipment specifications, Federal Highway Administration, Roadway Construction Noise Model, Version 1.1, December 2008.
2 Represents range of equipment in operation per day.
3 Assumed reference sound level is equivalent to a dump truck.
4 Assumed reference sound level is equivalent to a flatbed truck.
5 Assumed reference sound level is equivalent to a front end loader.
6 Assumed reference sound level is equivalent to a pavement scarifier.
7 Assumed reference sound level is equivalent to a pickup truck.
8 Reference sound level is based on actual measurements obtained from the RCNM.
Lmax Maximum sound level

Construction Noise Levels

Massport strives to minimize the noise effects of airport operations on its neighbors through the use of a variety of noise abatement procedures and tools. Massport's Noise Abatement Office is responsible for the implementation of the noise abatement actions.

Project construction is expected to generate typical sound levels associated with construction activities, including use of heavy equipment operations for excavation, material transport, and pile driving. Heavy machinery would be used intermittently throughout construction and these activities would occur during normal weekday working hours. The type of equipment and number of units of equipment would vary between the different construction phases. Most of the construction activities would occur on the airfield side of the Terminal. **Table 5.12** presents the projected range of sound levels associated with construction activities. All receptor locations evaluated are below the City of Boston's noise criteria. The highest L_{10} value is 69 dB(A), which is below the City's criteria of 80 dB(A) for recreational land use and 75 dB(A) for residential land use. The highest projected L_{max} of 70 dB(A) is also below the City's criterion of 86 dB(A).

Table 5.12 Construction Equipment Sound Levels, dB(A)

	Project Sound Levels		City of Boston Criteria[1]	
Receptor Locations	L_{10}[2]	L_{max}[3]	L_{10}	Lmax
Receptor 1 - East Boston Memorial Park (Tennis Court) - Boston	60 - 69	54 - 70	80	N/A
Receptor 2 - East Boston Memorial Park (Football Field) - Boston	58 - 67	52 - 67	80	N/A
Receptor 3 - Intersection of Bremen Street and Putnam Street - Boston	55 - 65	49 - 65	75	86
Receptor 4 - Swift Terrace - Boston	55 - 66	48 - 64	75	86
Receptor 5 - Intersection of Short Street and Coleridge Street – Boston	55 - 66	48 - 63	75	86
Receptor 6 - Intersection of Thurston Street and Bayswater Street – Boston	50 - 60	43 - 59	75	86
Receptor 7 - New Court Road near Albert Ave – Winthrop	50 - 60	43 - 58	75	86
Receptor 8 - Intersection of Foam Street and Grand View Avenue – Winthrop	44 - 57	37 - 53	75	86
Receptor 9 - Intersection of East 1st St. and Farragut Road – South Boston	45 - 56	37 - 53	80	N/A

1 City of Boston's noise criteria for residential or recreational use.
2 L_{10} represents total sound level of all equipment.
3 L_{max} represents sound level of noisiest piece of equipment.

The noise analysis demonstrated that the sound levels from construction activities associated with the Terminal E Renovation and Enhancements Project comply with the City of Boston's noise criteria. The methodology (FHWA's RCNM) used in the noise analysis was conservative because it used the highest available sound level for all equipment between the specification reference level and actual measured level in the RCNM. Construction-related sound levels at Memorial Park, located across the Airport Roadway from Terminal E would comply with City noise criteria.

The construction noise analysis evaluated the potential cumulative impacts associated with the construction activities of the Proposed Action and the other Logan Airport construction projects. Since sound levels decrease with distance it is expected that the Proposed Action would have minimal additive noise effect to other ongoing construction projects.

Construction Noise Mitigation

Sound levels from activities associated with the construction of the Proposed Action comply with the City of Boston's noise criteria; therefore no noise mitigation is required. However, construction equipment would use noise-reduction measures.

5.3.9.7 Construction Water Quality

The Terminal E Renovation and Enhancements include changes to the hydrant fuel system on the apron surrounding Terminal E, as well as associated apron and airfield pavement additions that would disturb more than one acre. Soil disturbance from construction activity creates the potential for water quality impacts from stormwater runoff and erosion. Therefore, the project would be required to comply with the requirements of the NPDES General Permit for Stormwater Discharges from Construction Activities. NPDES requires filing a Notice of Intent and preparing a SWPPP. As part of the SWPPP an Erosion and Sedimentation Control Program would be put in place to minimize construction phase impacts to Boston Harbor.

Spill prevention measures and sedimentation controls would be deployed throughout the construction phase to prevent pollution from construction equipment and erosion. The following best practices would be deployed throughout the construction phase in order to prevent pollution from construction equipment or material:

- Erosion and sedimentation controls would be used during the airfield earthwork and construction phases. Proposed controls are provided as recommendations for the site contractor and do not constitute or replace the final SWPPP that must be fully implemented by the Contractor and owner in Compliance with EPA NPDES regulations and with Massport's contractor requirements.
- Perimeter Barriers like straw wattles or compost-filled "silt sock" barriers would be placed around upland work areas to trap sediment transported by runoff before it reaches the drainage system or leaves the construction site.
- Existing catch basins within the work areas would be protected with barriers (where appropriate) or silt sacks throughout construction.
- Open soil surfaces would be stabilized within 14 days after grading or construction activities have temporarily or permanently ceased.
- The contractor or subcontractor would be responsible for implementing each control shown on the Sedimentation and Erosion Control Plan.

5.3.9.8 Construction Hazardous Materials, Pollution Prevention, and Solid Waste

The Fuel Distribution System site has an existing Release Tracking Number (for a 500-gallon AST located near Gate 29, as discussed in Chapter 4, *Affected Environment*), which would be covered by a Release Abatement Measure plan(s) filed with MassDEP, as appropriate. The construction SWPPP would include provisions for responding to any releases that result from construction activities, such as fuel or hydraulic fluid spills. Contaminated materials encountered during construction would be managed according to the Massachusetts Contingency Plan (310 CMR 40.00) and Massachusetts General Law Chapter 21E; Oil and Hazardous Materials Release Prevention and Response Act.

5.3.9.9 Construction Period Mitigation Summary

Construction impacts and mitigation are considered under each of the individual impact review categories above. During construction there would be limited short-term impacts from added vehicle trips to and from the site by construction equipment, fugitive dust, noise, negligible amounts of sediment added to the area's stormwater collection system, and demolition materials and other routine construction wastes in need of proper disposal.

Massport specifically prohibits delivery of materials through residential streets, creation of borrow pits and disposal of spoil, burning of debris, and water pollution from erosion. In addition, Massport would require that the project design and construction planning would incorporate appropriate environmental protection measures. All construction impacts would be mitigated as required by construction contracts, therefore, a significant adverse effect would not be allowed to occur.

Massport would develop and implement a comprehensive Soil Erosion and Sediment Control Plan in accordance with NPDES and MassDEP standards. The SWPPP would include best practices for soils and spill management, including the use of sediment control methods (such as silt fences or compost-filled silt sock barriers) during excavation to prevent silt and sediment entering the stormwater system, and waterways and applying water to dry soil to prevent dust production.

Airfield construction would be phased to avoid nesting periods for the upland sandpiper,

Temporary, short-term impacts from construction activities would be mitigated to the extent practicable. Appropriate construction mitigation measures would be incorporated into the contract documents and specifications governing the activities of contractors and subcontractors constructing elements of the Proposed Action. All construction activities would comply with FAA Advisory Circular 150/5370-10 (latest edition), Standards for Specifying Construction of Airports. These construction-period mitigation measures would be the responsibility of Massport. Specific mitigation measures would be developed during the final design.

5.4 Cumulative Impacts

For over two decades, Massport has had in place an industry-leading state environmental review process that assesses Logan Airport's cumulative environmental impacts. The process provides a context against which individual Airport projects meeting state and federal environmental review thresholds are evaluated on a project-specific basis.

Massport prepares an Environmental Data Report (EDR) annually, and a more comprehensive Environmental Status Planning Report (ESPR) approximately every 5 years. The ESPR provides a long-range analysis of projected operations and passengers while EDRs review environmental conditions for the reporting year compared with 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. The *2011 ESPR*, filed in early 2013, reported on calendar year 2011 updated passenger activity levels and aircraft operations forecasts through 2030. The *2012/2013 EDR*, filed in December 2014, provides a comprehensive, cumulative analysis of the effects of all Logan Airport activities based on actual passenger activity and aircraft operation levels in 2012/2013 and presents environmental management plans for addressing areas of

environmental concern. All planned airport projects, including the Terminal E Renovation and Enhancements Project were described in Chapter 2, Planningthe 2012/2013 Logan Airport EDR.

Logan Airport is a dynamic facility that must respond to the changing needs of the airline industry, the regulatory environment, and the traveling public. This section describes the status of projects that were completed in the last five years, and those projects currently underway or are expected to proceed under reasonably foreseeable circumstances. The construction period impact analysis above considered peak activity from projects that may be under construction at the same time as the Terminal E Renovation and Enhancements Project to ensure that the cumulative effects would not exceed any significance thresholds.

5.4.1 Recently Completed Actions

The analysis of impacts described in the following sections takes into account baseline conditions that include major construction projects proposed at the Airport that will be substantially complete in the future build year. The projects in the vicinity of Terminal E include curbside improvements at Terminal E undertaken prior to construction of the Proposed Action and the relocation of Southwest Airlines from five gates at Terminal E to gates at Terminal A which occurred in April 2015. These projects will be complete by 2017, and are included in the baseline assumptions for the impacts analysis of the Proposed Action for the Terminal E Renovation and Enhancements Project.

5.4.1.1 Curbside Improvements to Terminal E

Massport is implementing improvements to address existing congestion and delay at the Terminal E curbs. At Terminal E, there have been recent changes to curbside allocation on the Arrivals Level to make additional space available for passenger pick-up. Charter bus space has been relocated from Curbside 2 to Curbside 1 and the courtesy bus zone has been shifted to the previous charter bus zone along Curbside 2. Shared vans now wait in allocated spaces within the parking lot previously designated for limousines only. These improvements will be in place prior to construction commencing on the Proposed Action and are unrelated to the Terminal E Renovation and Enhancements Project and will have a positive impact on surface transportation.

5.4.1.2 Relocate Southwest Airlines

Southwest Airlines (and its recent merger partner AirTran) had previously provided service out of five gates at Terminal E. Southwest Airlines relocated to Terminal A in April 2015. The two gates to the west (E1A and E1B) will be converted to be compatible with international passenger processing, and the three gates to the east (E1C, E1D, and E1E) will be part of Terminal C. This project is unrelated to the Terminal E Renovation and Enhancements Project and was implemented independently of the proposed improvements at Terminal E included in the Proposed Action.

5.4.1.3 Other Recently Completed Projects

The following table documents projects completed at Logan Airport in the last five years and assesses their primary project impacts. With the Terminal E Renovation and Enhancements Project, taken together, none of the projects would significantly increase the potential impacts identified for the Terminal E Renovation and Enhancements Project.

Table 5.13 Cumulative Impacts Recently Completed Projects

Project	Construction Schedule	Primary Project Impacts	Cumulative Considerations
Southwest Service Area (SWSA) Redevelopment Program) Consolidated rental car operations and associated shuttle bus service. Reduced VMT and emissions, customer service improvement, stormwater enhancements.	Rental Car Center opened in the fall of 2013.	Temporary construction; underground fuel storage system remediation; services relocation (EEA 14137) FONSI issued 2010	No cumulative impacts. The SWSA Project's impacts do not escalate or augment the potential impacts identified for the Terminal E Renovation and Enhancements Project.
Green Bus Depot Constructed a LEED Silver bus maintenance facility to maintain the Airport's clean fuel shuttle bus fleet.	Construction was completed in 2012.	Temporary construction (EEA 14629)	No cumulative impacts. The Green Bus Depot Project's impacts do not escalate or augment the potential impacts identified for the Terminal E Renovation and Enhancements Project.
Martin A. Coughlin (East Boston-Chelsea) Bypass Project Constructed a limited-access roadway between the Airport and the Chelsea Street Bridge.	The Bypass Road opened in 2011.	Temporary construction (EEA 14661) Improved commercial vehicle access and reduces congestion on local streets.	No cumulative impacts. The Martin A. Coughlin Bypass Project's impacts do not escalate or augment the potential impacts identified for the Terminal E Renovation and Enhancements Project.
Economy Parking Project in the North Cargo Area Constructed an interim two-level deck above the existing surface economy parking lot to consolidate the existing temporary parking spaces throughout the airport at one location.	Construction was completed in 2012.	Temporary construction Consolidation of temporary parking	No cumulative impacts. The Economy Parking Project in the North Cargo Area's impacts do not escalate or augment the potential impacts identified for the Terminal E Renovation and Enhancements Project.
Logan Airport Runway Safety Area (RSA) Improvements Project at Runway Ends 33L and 22R, and 33L Light Pier Replacement Project Enhancements for safety and regulatory compliance with construction of the Runway 33L Runway Safety Area (RSA) and replacement of the Light Pier for 33L.	33L RSA improvements completed in 2012. 22R RSA improvements completed in 2014.	Temporary construction; Permanent loss of eelgrass, saltmarsh, and shellfish resources. Long-term water quality benefits from installing multiple Stormceptors (EEA 14442) FONSI issued 2011	No cumulative impacts. The Runway 33L RSA and Light Pier Replacement Projects' impacts do not escalate or augment the potential impacts identified for the Terminal E Renovation and Enhancements Project.
Terminal B Renovations and Improvements, and Terminal B Garage Improvement Project Reconfigured and renovated Terminal B, Pier B, and Pier A for passenger processing and circulation. Repaired and rehabilitated the garage with accompanying curbside improvements.	The renovation project was completed in 2014.	Temporary construction FONSI issued 2012 Improved circulation	No cumulative impacts. The Terminal B Renovations and Improvements and Garage Improvement Projects' impacts do not escalate or augment the potential impacts identified for the Terminal E Renovation and Enhancements Project.
Runway 15L-33R RSA Improvement Project Runway adjustment to accommodate an expanded Runway Safety Area for the 15L approach per congressionally-mandated FAA criteria.	Construction was completed in 2014.	Temporary construction	No cumulative impacts. The Runway 15L-33R RSA Improvement Project's impacts do not escalate or augment the potential impacts identified for the Terminal E Renovation and Enhancements Project. Grassland impacts for this project were offset with a slightly higher area of pavement removal.

Source: *2012/2013 Environmental Data Report*, Massport 2014, updated for this EA.

5.4.2 Projects Underway

Several projects are underway at Logan Airport. These projects are not related to the Terminal E Renovation and Enhancements Project, and have independent utility, but may have construction schedules that overlap with the construction of the Proposed Action.

5.4.2.1 Terminal C to E Connection

This project provides a post-security connection between Terminals C and E. With ongoing changes in airline partnerships, there is a need to increase the flexibility of the terminals and reduce the need for security re-screenings for passengers needing to make both domestic and international connections. This project facilitates connections between Terminal C and E, enhancing security and customer service while also reducing the burden on the Terminal E Security Checkpoint and the TSA operations. The project is scheduled to be complete by 2017. This project was approved as part of the Environmental Assessment for Terminal B Improvements, and taken in conjunction with the Proposed Action is not expected to exceed any significance thresholds for construction, air quality, or traffic.

5.4.2.2 Parking Garage Consolidation

Massport is constructing structured and surface parking spaces that will consolidate 2,050 temporary parking spaces as part of an addition to the West Garage and other surface locations to be confirmed. The West Garage addition is atop the existing Hilton Hotel parking lot. The project will incorporate sustainable design and resiliency elements. The project will be in full compliance with the Logan Airport Parking Freeze. The parking consolidation is expected to be completed before 2017. This project was reviewed through a Categorical Exclusion, and taken in conjunction with the Proposed Action is not expected to exceed any significance thresholds for construction, air quality, or traffic.

5.4.2.3 Hangar 16 Demolition Project

Hangar Building Number 16, the former American Airlines hangar, is currently being demolished as it is no longer suitable for the hangar operations and maintenance of modern aircraft. Once demolition is complete, this area will serve as additional Remain Overnight aircraft parking apron. Demolition of the Hangar building includes abatement of asbestos, removal of the concrete slab, and removal of all remaining building elements in preparation to construct a new aircraft parking apron. The project will be complete in later summer 2015, before construction begins on the Proposed Project, and is unrelated to the Proposed Action. Impacts include temporary construction activities and removal and disposal of construction debris including asbestos that will be disposed of at an approved facility. The Hangar 16 Demolition Project was issued a FONSI in 2014. No cumulative impacts are anticipated: the Hangar Demolition Project's impacts do not escalate or augment the potential construction, air quality, or traffic impacts identified for the Terminal E Renovation and Enhancements Project.

5.4.3 Reasonably Foreseeable Projects

Several projects are in the process of being planned, one of which may undergo its environmental review in the same timeframe as the construction of the Terminal E Renovation and Enhancements Project. While the impacts of these projects are not yet determined, the cumulative impacts of the Terminal E Renovation and Enhancements Project will be addressed in those projects' environmental review.

5.4.3.1 Terminal E Modernization Project

To accommodate existing and long range forecasted demand in an efficient, environmentally-sound manner that also improves customer service, Massport is considering a phased extension of the existing Volpe International Terminal. As described below, the phased extension of Terminal E could add six to nine new aircraft contact gates, which would include three gates approved in 1996 as part of the International Gateway project, but never constructed. New passenger handling and gate areas are being considered, as well as additional customs and border patrol facilities to supplement the existing FIS areas in Terminal E. A new direct connection to the MBTA Blue Line Airport Station would be also be constructed.

Following permitting and design, the initial phase could begin construction in late 2018 and connect to and extend from existing Terminal E. This would occur as a separate project, after the Renovation and Enhancements is complete and in service in 2017.

The Terminal E Modernization Project is in the early conceptual design development phase. This EA does not identify potential direct or cumulative impacts of the Terminal E Modernization Project. As Massport moves past the early planning stage and begins to define the concept for the Terminal E Modernization Project, Massport will initiate the state environmental review process through submission of an Environmental Notification Form (ENF).

Massport is considering filing the ENF with the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) in the fall of 2015. This submission would initiate the environmental assessment process and will identify the scope of environmental analyses that will be conducted to comply with the Massachusetts Environmental Policy Act (MEPA). It is also expected that an EA would be prepared for the project to comply with NEPA and FAA's Orders 1050.1E, Change 1 and 5050.4B. Once that project is scoped, Massport anticipates a joint MEPA/NEPA project review process. Massport would prepare required state and/or federal environmental review documents for the proposed terminal improvements and would consider the Terminal E Renovation and Enhancements Project as part of the cumulative assessment

5.4.3.2 Airfield Improvements

Massport maintains and rehabilitates existing runways, taxiways, taxilanes, and ramp areas at Logan Airport on an as-needed basis to comply with FAA design standards. Airfield maintenance ensures that the airfield operates efficiently and reliably. Massport is continuously working with the FAA to improve safety through compliance with current FAA Advisory Circular 150/5300-13A on the airfield, including improvements such as runway, taxiway, and taxilane design enhancements. Taxiway and runway projects are phased to minimize disruption to aeronautical operations and to avoid cumulative impacts from other projects advancing at the same time.

In the next five years, Massport plans to replace the aging Runway 4R approach light pier. This will likely be a replacement of the existing wooden light pier with concrete pier/pilings similar to the design used for the 33L approach light pier in 2012. Implementation of this project will be scheduled to avoid or minimize overlap with other airside projects. The light pier improvements have not yet been scheduled but are likely to be implemented within the next five years, and will undergo required Federal and State environmental review and permitting, as appropriate.

Any potential grassland impacts from future airfield improvements required by FAA will have to comply with the requirements of the Massachusetts Endangered Species Act and would have to be reviewed by NHESP and mitigated appropriately. Massport will prepare required state and/or federal environmental review documents

for the proposed airfield improvements and will consider the Terminal E Renovation and Enhancements Project as part of the cumulative assessment.

5.5 Summary of Impacts and Mitigation Measures

Compared to the No-Action condition, the Proposed Action is not expected to result in any long-term direct or indirect impacts to the natural or built environments. The only long-term impact anticipated from the Proposed Action is to grasslands on the airfield that are designated as habitat for state-listed species. Impacts to grassland habitat are planned to be offset through pavement removal and are not expected to result in a significant impact on state-listed species. **Table 5.14** provides a summary of project impacts and mitigation measures.

Construction would result in minor increases to truck traffic, noise, and emissions of air quality pollutants; however, these temporary increases would not adversely affect the roadway system or local traffic conditions, would not exceed applicable noise impact criteria, and would not result in air quality impacts. Mitigation measures would be implemented to minimize the potential for any construction-related impacts. Appropriate construction mitigation measures would be incorporated into the contract documents and specifications governing the activities of contractors and subcontractors constructing elements of the Proposed Action. All construction activities would comply with FAA Advisory Circular 150/5370-10 (latest edition), Standards for Specifying Construction of Airports. On-site resident engineers and inspectors would monitor construction activities to ensure that mitigation measures are properly implemented. Time of year restrictions and coordination with NHESP, as outlined in the "no take" determination in Appendix D, will be incorporated into construction documents. These construction-period mitigation measures would be the responsibility of Massport.

Specific mitigation measures would be developed during the final design phase of the Terminal E Renovation and Enhancements Project. Construction-period mitigation requirements would be incorporated into the final plans and specifications that would serve as the basis for the construction contracts.

Table 5.14 Summary of Impacts and Mitigation Measures

Environmental Resource[1]	Significant Impact? (Yes/No)	Explanation
Air Quality	No	The Project does not involve increased aircraft operations or increased airport capacity and therefore is not expected to have a long term effect on Air Quality. Greater efficiency of new large aircraft such as the A380 may result in an overall decrease in emissions on a per passenger basis.
Coastal Resources	No	The Project is proposed within a previously developed/disturbed portion of the Airport. The limited airfield modifications would occur in upland areas within the Coastal Zone that are already in use for aeronautical operations. The Program would be consistent with the Coastal Zone Management Plan.
Compatible Land Use	No	The Project Area is restricted to activities and purposes compatible with existing airport operations. All work would take place within the airport boundary and would not alter the existing off-airport land use patterns. (See below for Surface Transportation). The project is not expected to have an effect on noise within the DNL 65 dB contour.
Construction	No	Short-term construction activities are analyzed in relation to traffic, air quality, noise, water quality, and solid and hazardous waste. Construction noise would conform to City of Boston requirements. Air quality impacts are below *de minimis* and would not violate NAAQS. Construction period erosion controls would be employed for airfield work to ensure that proposed work does not affect water quality during construction. Solid waste disposal would adhere to all state and federal requirements
Department of Transportation Act, Section 4(f) Properties	No	There are no Section 4(f) properties within the boundary of the Project Area. No impacts (use or constructive use) are anticipated.
Farmlands	No	Farmland of Statewide Importance, as defined by the *Farmland Protection Act Policy*, does not exist within the Airport boundaries or within the vicinity of the Airport.[2]
Fish, Wildlife, and Plants/ Threatened and Endangered Species	No	The Project is within mapped state Priority Habitat for upland sandpiper, a bird that is state-listed as an endangered species. NHESP has issued a "no take" determination with conditions, including design plan review prior to project initiation, no work during bird breeding season, and restoration of disturbed or areas of pavement removal with NHESP oversight on seed mixes. There are no federally-listed species that are likely to occur within the project area. Impacts to grassland habitat would be offset by removal of pavement on the airport.
Floodplains	No	The Project Area is not located within a 100-year flood zone.[3]
Hazardous Materials, Pollution Prevention, and Solid Waste[4]	No	The Project includes reconfiguring the jet fuel hydrant system, which would be conducted in compliance with Federal requirements. There are no National Priority List sites on Logan Airport. Solid Waste from construction activities would be handled in compliance with state and federal requirements.
Historical, Architectural, Archaeological and Cultural Resources	No	There are no known historical, archaeological, or cultural resources within the Project Area. No impacts are anticipated.
Light Emissions and Visual Impact	No	The Project is located on-Airport and not adjacent to the residential communities surrounding the Airport. The Project does not propose to increase the number of runway lights or approach lights. New lighting in the immediate areas if the renovated gates would be similar to existing conditions and not expected to create annoyance or interfere with normal activities. The Terminal E Renovation and Enhancements Project would be compatible with the visual setting of the existing land use.
Natural Resources and Energy Supply/ Sustainable Design	No	The Project construction, operation, and maintenance would cause additional demands on energy supplies that can be accommodated by current power suppliers. Impacts to natural resources are not anticipated as part of the terminal renovations and enhancements, since the landside portion of the project is built on paved land fully developed for airport uses. The conversion of mowed grass shoulders to pavement in selected locations is planned to be offset by areas of pavement removal. The new portions of the Project would meet LEED Silver and Massachusetts LEED Plus standards and renovated portions would follow Massport's Sustainable Design Standards and Guidelines.
Noise	No	There would be no change in aircraft operations activity levels as a result of the Project and, therefore, aircraft noise levels at or surrounding the Airport are not expected to change.

Table 5.14 Summary of Impacts/Continued.

Environmental Resource[1]	Significant Impact? (Yes/No)	Explanation
Socioeconomic Impacts and Secondary (Induced) Impacts/Environmental Justice Populations, and Children's Environmental Health and Safety	No	All work for the Project would take place within the Airport boundary and would not alter off-airport land use, surface transportation, noise, air quality, or otherwise adversely impact specific communities. Temporary job creation during the construction period is anticipated.
Surface Transportation[5]	No	The Project would not change the number of aircraft operations or passenger activity levels airport-wide, and is anticipated to have only temporary increases in traffic associated with construction.
Water Quality	No	The Project would require paved additions to selected areas adjacent to existing taxiways and runways. New pavement additions are planned to be offset by removing excess pavement elsewhere on the airport. The project is not expected to result in changes to stormwater management within the Project Area.
Wetlands	No	Wetlands are present on Logan Airport property; however, there are no wetland resources within the Project Area.
Wild and Scenic Rivers	No	There are no wild or scenic rivers within the vicinity of Logan Airport.[6]

1 Environmental resource categories as specified in FAA Order 1050.1E.
2 United States Department of Agriculture, *Farmland Protection Policy Act* (7 U.S.C. 4201-4209), 1981.
3 FEMA flood insurance mapping
4 There are several state-listed disposal sites on-Airport. Refer to the *Logan Airport 2012/2013 EDR* where they are listed and tracked in detail.
5 Surface transportation is called out as a separate section to provide a higher-resolution analysis due to the ongoing curb project at Terminal E.
6 As defined by the *Wild and Scenic Rivers Act of 1968*, 16 U.S.C. section 1271 et seq.

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6 Regulatory Compliance and Public/Agency Coordination

6.1 Introduction

This chapter discusses the state and federal permits that are anticipated to be required for the Terminal E Renovation and Enhancements Project, in addition to complying with the National Environmental Policy Act (NEPA). Massport's efforts to coordinate with local, state, and federal agencies as well as the public are also discussed.

6.2 Regulatory Compliance

Table 6-1 lists anticipated state and federal permits required for the Project and the current status of the permits and other approvals. Subsequent sections describe how the Project will comply with these regulatory requirements.

6.2.1 Airport Layout Plan Approval

This Environmental Assessment (EA) was prepared because Massport is seeking Federal Aviation Administration (FAA) approval for a modification of the Airport Layout Plan (ALP), which includes the components of the Proposed Action—the Terminal E Renovation and Enhancements Project. The ALP approval is a federal action that requires review pursuant to NEPA, as described in FAA Order 5050.4B. FAA's approval of the ALP will incorporate modifications to landside and airside facilities associated with the selected alternative.

6.2.2 National Environmental Policy Act

The FAA has determined that the Project proposed by Massport (as the Sponsor) requires an EA under NEPA due to changes to the Logan ALP necessitated by the Project. This EA identifies project alternatives and documents the potential environmental effects associated with the construction and operation of proposed terminal improvements at Logan Airport. The Project is not expected to result in significant environmental impacts, such as increased vehicle traffic, additional noise, or air emissions. Based on its review of the comments

on the EA or, if additional information is needed to make a determination, FAA may pursue further review under NEPA.

Table 6.1 Anticipated Required Permits and Approvals

Issuing Agency	Approval or Permit	Status
Federal Aviation Administration	Airport Layout Plan Approval	Approval to be issued
	Finding of No Significant Impact (FONSI)	Environmental Assessment (EA) submitted herein; determination will be made at the conclusion of the NEPA process
U.S. Environmental Protection Agency Region 1	National Pollutant Discharge Elimination System (NPDES) Individual Permit	The Project will meet the standards included in Logan Airport's individual NPDES permit (No. MA0000787)
	NPDES Construction General Permit	Construction-related; a stormwater pollution prevention plan (SWPPP) will be developed by Contractor
Massachusetts Contingency Plan (MCP)	Hazardous materials encountered during the development would be addressed in accordance with applicable MCP regulations	As required
Massachusetts Endangered Species Act	Coordination with Massachusetts Natural Heritage and Endangered Species Act (NHESP)	NHESP issued a "no take" determination on July 9, 2015. Massport will adhere to all construction period conditions and will continue to coordinate with NHESP as required by the determination.

6.2.3 National Pollutant Discharge Elimination System Permits

As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the U.S. Point sources are discrete conveyances such as pipes or man-made ditches. The NPDES program includes permitting for municipal, industrial, and construction-related sources of pollution under general or individual permits. The Project must meet the standards included in Logan Airport's individual NPDES permit (No. MA0000787), which allows Massport to discharge stormwater from outfalls on the Airport property. All project elements will be designed to meet the standards of Logan Airport's NPDES individual permit.

The Project would also require completion and submittal of a Stormwater Notice of Intent to the U.S. Environmental Protection Agency (EPA) for coverage under the NPDES Construction General Permit for stormwater discharge from construction activities because the Project will require disturbance of over one acre. The Permit requires the development and implementation of a Stormwater Pollution Prevention Plan (SWPPP) that includes specific sedimentation and erosion control measures that will be implemented for the entire duration of construction activities. Proper implementation of the SWPPP will ensure that no negative impacts would occur from construction-related runoff. Mitigation measures included in Logan Airport's existing SWPPP to minimize sedimentation and erosion are described in Chapter 5, *Environmental Consequences and Mitigation*.

6.2.4 Air Quality/General Conformity Determination

As part of this EA, future air quality conditions have been assessed to determine if the Proposed Action is in conformance with the Clean Air Act (CAA). The Proposed Action will not change the aircraft operational levels at Logan Airport nor will it alter ground-based aircraft movements (i.e., aircraft taxi and delay periods) or result in increased surface transportation traffic. Therefore, operational emissions (mobile and stationary source) will not change due to the Project. While construction activities are expected to generate short-term construction-related air emissions, including exhaust emissions from on-road construction vehicles, off-road construction equipment, evaporative emissions from asphalt placement and curing, and the generation of fugitive dust from disturbance of unpaved areas, these Project-related emissions would be substantially below federal General Conformity *de minimis* thresholds. In addition to generating Project-related emissions well below *de minimis* thresholds, the Project activities (e.g., routine maintenance and repair activities; terminal and concourse upgrades) fall under the list of activities "Presumed to Conform" by the FAA according to the July 30, 2007 Federal Register.[1]

As part of the Project approvals process and to minimize air emissions, Massport will require all contractors to comply with certain construction guidelines that relate to:

- Construction vehicle/equipment anti-idling;
- Retrofitting of appropriate diesel construction equipment with diesel oxidation catalyst and/or particulate filters; and
- Construction worker vehicle trip management, including requiring contractors to provide off-Airport parking, and use high-occupancy vehicle transportation modes for employees.

6.2.5 Massachusetts Environmental Policy Act

The Terminal E Renovation and Enhancements Project does not exceed thresholds for size or environmental impacts that would trigger a review under the Massachusetts Environmental Policy Act (MEPA). MEPA thresholds related to the Massachusetts Endangered Species Act under M.G.L. c. 131A require an environmental notification form (ENF) to be prepared if the Project is found to disturb more than two acres of designated priority habitat, as defined in 321 CMR 10.02, that results in a take of a state-listed endangered or threatened species or species of special concern. NHESP has issued a "no take" determination for the project. Pavement removal will provide grassland habitat equal to or greater than that impacted by new pavement areas on the airfield.

6.2.6 Massachusetts Contingency Plan

During construction, the soil and groundwater contamination issues surrounding the existing terminal facilities will be addressed, as needed, in compliance with the Massachusetts Contingency Plan (MCP). In compliance with the MCP, a Soil Management Plan may be required to determine whether any excavated soils which are generated through foundation construction or improvements to the fuel hydrant system can be reused onsite, and/or determine requirements for off-site reuse, recycling, or disposal. Soil will be disposed of in conformance with Massport's soil management policy. A Soils Management Plan will be developed under the supervision of a Massachusetts Licensed Site Professional (LSP), and will be integrated into the requirements of existing

1 Federal Register (72 FR 415), *Federal Presumed To Conform Actions Under General Conformity*, Federal Aviation Administration, July 30, 2007.

Response Action Outcomes for portions of the site covered by Release Tracking Numbers and/or Release Abatement Measures plans for any newly identified areas of contamination. The Soils Management Plan would be developed in concert with a groundwater management plan, which will address requirements for dewatering and collection, testing and/or treatment and disposal or discharge of water pumped from excavations, if required.

6.3 Public and Agency Involvement

During the preparation of this EA Massport has coordinated with the FAA and other state and federal agencies.

6.3.1 Public Involvement

As requested by FAA, an informational meeting on the Project was held on June 30, 2015 with invited participation by regulatory agencies, community groups interested in airport activity, and local residents. The goal of this meeting was to inform the nearby community about the Project, including construction schedule/activities, and to solicit input regarding potential neighborhood issues. Community and agency outreach and coordination will continue through permitting, design, and construction of the Project. Massport has also consulted directly with resource agencies regarding potential impacts, avoidance, and minimization of these impacts, and mitigation strategies.

The Project was included in Massport's *2012/2013 Environmental Data Report*, published December 2014 and available at the following URL: www.massport.com/environment/environmental-reporting/.

Massport posts information about key regulatory filings on its website. The most recent environmental filings, including this EA and all supporting documentation will be made available on its website at the following URL: www.massport.com/environment/environmental-reporting/environmental-filings/. A Notice of availability of the EA and the June 30, 2015 public meeting in both English and Spanish was placed in the East Boston Times – Free Press on June 24, 2015.

In response to the draft EA and public meeting, five public and agency comments were received, as follows:

- MA Division of Fisheries and Wildlife, Natural Heritage and Endangered Species Program
- Winthrop Resident, John Vitagliano
- Winthrop Resident, Dawn Quirk
- The Boston Harbor Association
- The Boston Transportation Department

6.3.2 Agency Consultation and Coordination

Massport will continue to coordinate with staff from NHESP through Project final design to ensure that the conditions outlined in the "no take" determination are fulfilled so that the Project will not result in an adverse impact on state-designated priority habitat.

The EA was distributed to local, state, and federal agencies for their review and comment (refer to Chapter 7, *Distribution List*). This final EA will be published on Massport's website at www.massport.com/environment/environmental-reporting/.

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7 Distribution List

Federal Aviation Administration (FAA) *Order 5050.4B* states that airport development will likely trigger public interest. Distributing an Environmental Assessment (EA) to the public is the best way to provide the public with the information needed to formulate an opinion. FAA *Order 5050.4B, Paragraph 804*, requires distribution to the federal agencies having jurisdiction by law or regulation over the action and to the public for review. The following is a list of recipients of this EA.

The list includes representatives of governmental agencies and community groups and/or local residents concerned with activities at Logan Airport. The 'C' indicates that a compact disc (CD) was sent and the 'P' indicates that a printed copy was sent.

This EA is available on Massport's website at www.massport.com and electronically on CD. Limited CD or printed copies of the EA may be requested from Lisa Carisella, Massport, Suite 200S, Logan Office Center, One Harborside Drive, East Boston, MA 02128, telephone (617) 568-3507, e mail: lcarisella@massport.com. Printed and electronic copies of this report are available for review at the following public libraries.

The following individuals represent the full distribution list.

	Library	Address
P,C	Boston Public Library Main Branch	666 Boylston Street Boston, MA 02117
P,C	Boston Public Library Connolly Branch	433 Centre Street Jamaica Plain, MA 02130
P,C	Boston Public Library Orient Heights Branch	18 Barnes Avenue East Boston, MA 02128
P,C	Chelsea Public Library	569 Broadway Chelsea, MA 02150
P,C	Winthrop Public Library	2 Metcalf Square Winthrop, MA 02151
P,C	Boston Public Library Charlestown Branch	179 Main Street Charlestown, MA 02129
P,C	Boston Public Library East Boston Branch	365 Bremen Street East Boston, MA 02128
P,C	Revere Public Library	179 Beach Street Revere, MA 02151
P,C	Everett Public Library	410 Broadway Everett, MA 02149
P,C	Cambridge Main Library	449 Broadway Cambridge, MA 02138

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Massachusetts State House, Room 134
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C Representative Daniel J. Ryan
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C Senator Thomas McGee
Chair, Joint Committee on Transportation
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C Senator Anthony Petruccelli
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C Senator Linda Dorcena Forry
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C East Boston Savings Bank
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Appendices

- Appendix A – Terminal Area Forecast
- Appendix B – Traffic Data Analysis
- Appendix C – Noise Data
- Appendix D – Agency Correspondence

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Appendix A
Terminal Area Forecast

- Boston Logan, 2013

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FAA Terminal Area Forecast: National Forecast 2013 (1) — Enplanements

LOCID: BOS — GENERAL EDWARD LAWRENCE LOGAN INTL

Year	F	Air Carrier	Air Taxi	Commuter	US Flag	Foreign Flag	Total International Enpl.	Total Enplanements
2009		9,306,118	383	1,367,114	519,253	1,179,362	1,698,615	12,371,847
2010		10,123,054	503	1,352,871	532,253	1,231,863	1,764,116	13,240,041
2011		10,914,408	232	1,429,607	605,947	1,177,976	1,783,923	14,127,938
2012		11,250,295	489	1,238,258	599,319	1,239,922	1,839,241	14,327,794
2013	*	11,509,644	489	1,153,050	567,687	1,301,609	1,869,296	14,531,990
2014	*	11,729,972	489	1,510,329	593,230	1,360,173	1,953,403	15,193,704
2015	*	12,021,856	489	1,542,703	618,299	1,417,653	2,035,952	15,600,511
2016	*	12,302,726	489	1,575,017	643,429	1,475,273	2,118,702	15,996,445
2017	*	12,606,627	489	1,609,737	668,566	1,532,907	2,201,473	16,417,837
2018	*	12,909,965	489	1,645,787	693,779	1,590,716	2,284,495	16,840,247
2019	*	13,210,350	489	1,684,658	719,088	1,648,746	2,367,834	17,262,842
2020	*	13,500,529	489	1,720,702	744,527	1,707,072	2,451,599	17,672,830
2021	*	13,746,093	489	1,750,217	770,183	1,765,896	2,536,079	18,032,389
2022	*	13,977,368	489	1,776,815	795,911	1,824,886	2,620,797	18,374,980
2023	*	14,220,893	489	1,804,537	821,848	1,884,355	2,706,203	18,731,633
2024	*	14,490,942	489	1,836,064	847,788	1,943,830	2,791,618	19,118,624
2025	*	14,759,377	489	1,865,597	873,727	2,003,304	2,877,031	19,502,005
2026	*	15,031,764	489	1,896,758	899,702	2,062,860	2,962,562	19,891,084
2027	*	15,309,039	489	1,926,516	925,772	2,122,634	3,048,406	20,283,961
2028	*	15,592,243	489	1,957,715	952,146	2,183,106	3,135,252	20,685,210
2029	*	15,881,574	489	1,989,883	978,520	2,243,578	3,222,098	21,093,555
2030	*	16,189,879	489	2,026,423	1,004,895	2,304,051	3,308,946	21,525,248
2031	*	16,500,721	489	2,063,675	1,031,270	2,364,524	3,395,794	21,960,190
2032	*	16,810,563	489	2,101,482	1,057,648	2,425,004	3,482,652	22,394,697
2033	*	17,122,739	489	2,139,031	1,084,024	2,485,479	3,569,503	22,831,273
2034	*	17,436,257	489	2,176,228	1,110,401	2,545,956	3,656,357	23,268,842
2035	*	17,755,005	489	2,214,137	1,136,857	2,606,614	3,743,471	23,712,613
2036	*	18,080,037	489	2,252,001	1,163,461	2,667,610	3,831,071	24,163,109

2037	*	18,397,228	489	2,286,754	1,190,190	2,728,894	3,919,084	24,603,066
2038	*	18,714,622	489	2,319,936	1,216,981	2,790,322	4,007,303	25,041,861
2039	*	19,023,741	489	2,352,375	1,243,904	2,852,052	4,095,956	25,472,072
2040	*	19,320,547	489	2,382,928	1,270,994	2,914,162	4,185,156	25,888,631

Report created 2/2/2015 16:08

Appendix B
Traffic Data Analysis

- Existing Conditions Data Collection
- Existing Conditions Analysis Inputs
- Existing Conditions Analysis Results

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AFFECTED ENVIRONMENT

- Existing Conditions Data Collection
- Existing Conditions Analysis Inputs
- Existing Conditions Analysis Results

Existing Conditions Data Collection

	Number of Vehicles at Curbside	Second Curbside		Dwell Time (min)	Vehicle Type	Notes	
		Percent Parking/Dwelling	Percent Passing Through				
4:30	17 autos 1 auto (2nd Lane) 2 SV/CB	90	10				
4:35							
4:40							
4:45				2	Auto		
4:50		70	30	2	Auto	2nd Lane Impacts	
4:55	13 Autos 4 Autos (2nd Lane)	60	40	1 1.72	Auto Auto		
5:00		60	40	10 + 3	Auto Auto		
5:05		90	10			Plenty (80%) of Open Curbside	
5:10		10	90	1.5	Auto	Officer keeping vehicles moving, vehicles aren't given a chance to park	
5:15	11 Autos 4 SV/CB 1 SV/CB (2nd Lane)	10	90	0.85	Auto		
5:20		50	50	1.93 10 +	SV/CB Auto		
5:25		55	45	10 +	Auto		
5:30	9 Autos 2 Autos (2nd Lane) 3 SV/CB	40	60				
5:35		70	30	1	Auto		
5:40		40	60	.97 1.33 9.06	Auto* Auto Auto	* Moved by officer, recirculated and parked again	
5:45		50	50				
5:50	9 Autos 1 SV/CB	50	50	6.92 .68	Auto NP SV/CB		
5:55							
6:00	13 Autos 1 Auto (2nd Lane) 1 SV/CB 1 SV/CB (2nd Lane)		100	3.63	Auto		
6:05	1 Auto 1 SV/CB	25	75	1.9	Auto		
6:10		25	75				
6:15	5 Autos 1 Auto (2nd Lane) 1 SV/CB	30	70	0.92	Auto NP		
6:20		20	80	1.3 1.87	SV/CB Auto		
6:25		30	70				
6:30	15 Autos 2 Autos (2nd Lane) 4 SV/CB	20	80	1.18	Auto	2nd Lane Impacts	
6:35						No Passing Through second lane, All Vehicle waiting in second lane 7 + vehicles waiting on recirculating roadway till merge	
6:40						3rd Lane queuing 2nd or 3rd aren't moving	Accident on Terminal Airport Roadway
6:45							
6:50							
6:55							
7:00						queue/stopped traffic clearing out	
7:05		20	80	1.83 1.27	Auto Auto	2nd Lane Impacts	
7:10						2nd Lane Impacts Slow rolling queue in 2nd lane and pulling into to see person at the curbside otherwise they keep moving	
7:15		10	90			Note, when passenger is already waiting loading takes less then 2	
7:20	10 Autos 6 Auto (2nd Lane) 2 SV/CB	10	90	2.3 10 +	Auto SV/CB	Shared Vans/Courtesy Bus parking and waiting	

	Number of Vehicles at Curbside	Second Curbside		Dwell Time (min)	Vehicle Type	Notes
		Percent Parking/Dwelling	Percent Passing Through			
7:25		20	80			3rd Lane queuing 2nd or 3rd aren't moving
7:30	12 Autos 4 Auto (2nd Lane) 4 SV/CB 2 SV/CB (2nd Lane)					2 of the SV/CB parking in passenger pick up area, impacting passenger loading
7:35		10	90			Recirculation Roadway back to Lot E pay booth Spill back onto Airport Roadway
7:40		15	85	10 +	SV/CB	
7:45						
7:50						
7:55	7 Autos 2 SV/CB	10	90	0.95	SV/CB	
8:00		25	75	4.13 3.97	Auto NP Auto	
8:05	15 Autos 6 Auto (2nd Lane) 3 SV/CB	35	65			Full second lane waiting in queue, Most of the 1st lane vehicles were active
8:10				1.55	Auto	
8:15		35	65			2nd lane queueing
8:20	10 Autos 1 Auto (2nd Lane)					Large open gaps in curbside 2nd lane rolling queue looking for passengers
8:25						
8:30						
				85.9		

Average 10.5 Average # of Autos at Curbside
3 Average # of Autos causing 2nd Lane impacts
2 SV/CB 2nd Lane Impacts only Three Times

3.30 Auto Dwell Time
4.14 SV/BC Dwell Time

35% Parking/Picking Up
65% Recirculating
3.3 min auto average dwell time
4.14 SV/CB average dwell time

	Entering on Departure Level					
	Taxi	**Auto**	**Limo**	**Bus**	***Total***	
4:45	14	48	11	13	86	
5:00	14	63	2	9	88	
5:15	19	58	3	8	88	
5:30	22	55	3	10	90	352
5:45	17	45	3	13	78	344
6:00	17	69	3	14	103	359
6:15	18	64	6	10	98	369
6:30	20	90	6	9	125	404
6:45	16	78	3	9	106	432
7:00	31	115	4	13	163	492
7:15	23	93	4	8	128	522
7:30	20	88	5	10	123	520
7:45	15	82		8	105	519
8:00	15	84	1	7	107	463
8:15	9	71	5	7	92	427
8:30						

Logan Terminal E

Arrivals

Existing Conditions

	Arrivals
Existing Conditions Peak Hour:	**19:00-19:59**
Peak Hour Passengers[1]:	**1,562**
Originating Passenger Factor :	**1.00**
Peak Hour Originating Passengers:	**1,562**

Mode Share Type	Mode Split		Occupancy [3]	Vehicles based on Occupancy	Comparison Counts[15]	2014 Adjusted Vehicles [10]
	Percentage [2]	PAX				
Private Vehicle Pick-Up[14]	33%	515	1.8	258	677	—
Parked at Airport [16]	10%	156	n/a	—	—	—
Taxicabs [17]	18%	287	1.7	169	103	—
Airport Operated Shuttles:						
Economy Parking [4]	0%	21	2.6	n/a	—	8
MPA Employee[11]	—	—	—	—	—	—
Water Taxi & Water Ferry[12]	0%	0	n/a	—	—	8
Interterminal[13]	0%	0	n/a	—	—	10
Rental Car and MBTA Blue Line Shuttle [18]	9%	141	12	—	—	12
Car Service ("black car", executive sedan, private limo, etc.)	6%	94	2.2	43	50	—
Other Shared Ride or Limo[6]	5%	78	3.5	22	—	—
Free Hotel or Other Courtesy Shuttles[5]	4%	62	4.8	13	—	—
MBTA Silver Line [7]	5%	122	20.3	n/a	—	6
Logan Express [8]	5%	78	11.2	n/a	—	7
Scheduled Bus Service [9]	4%	62	8.8	7	—	—
Charter Bus	0%	0	8.8	0	—	—
Other	2%	31		—	—	—
Total	**101%**	**1,648**	**7.0**	**512**		**51**

Notes:

1/ Based on 2014 AECOM passenger projections.

2/ Based on mode-split data from 2013 Logan Airport Passenger Survey, Massport. Weekday percentages.

3/ Based on Long Range Ground Access Policy Plan: Phase 1 Report unless otherwise noted. The report was prepared by Ricondo & Associates, Inc., in October 2008.

4/ Economy Parking Airport Operated Shuttle operates on arrival level with a fixed number of vehicles based on percentage of private vehicles that parked in the airport economy lot. The departure passenger volumes were added to the arrival passenger volumes. Occupancy for this mode is based on the number of passengers divided by its fixed number of vehicles.

5/ Other Courtesy Shuttles consist of hotel shuttles and Other Shuttles.

6/ Other Shared Ride or Limos consists of van or limo by reservation, van or limo running on fixed schedules, and other HOV and non-automobile modes.

7/ MBTA Silverline operates on arrival level only with a fixed number of vehicles based on a headway of 8 minutes. The departure passenger volumes where added to the arrival passenger volumes. Occupancy for this mode is based on the number of passengers divided by its fixed number of vehicles.

8/ Logan Express operates with a fixed number of vehicles on half hour headways for three routes and one hour headways for one route. Occupancy for this mode is based on the number of passengers divided by its fixed number of vehicles.

9/ Other Scheduled Bus Service consists of MBTA buses, regional transit buses and Other Buses.

10/ Adjusted vehicle numbers based on published or planned operational service levels, when applicable.

11/ MPA Employee Airport Operated Shuttle operates on the departure level.

12/ Water Taxi and Water Ferry Airport operated shuttle operates on the arrival level with a fixed number of vehicles based on a 8 minute headway. The departure passenger volumes where added to the arrival passenger volumes.

13/ Interterminal Airport Operates Shuttle operates with a fixed number of vehicles based on a 6 minute headway.

14/ Occupancy for this mode is based on question eight from the 2013 Logan Airport Passenger Survey. Assumed 10% of total vehicles park Terminal E Lot 1, therefore 90% use the Passenger Pick-Up curbside. Private vehicles recirculate approximately 2.6 circulations per vehicle.

15/ Comparison Counts are based on Terminal E roadway counts from August 2014. The arrival peak hour is 7:00-8:00 PM. The total curb 1 roadway volumes is 154 vehicles consisting of 103 taxis, 32 buses, and 19 automobiles. The total curb 2 roadway volume is 808 vehicles consisting of 56 buses, 50 limos, 8 taxis, and 677 automobiles.

16/ Assumed passenger would walk if parked on the airport at Central, Terminal B, or Terminal E parking.

17/ Occupancy for this mode is based on question eight from the 2013 Logan Airport Passenger Survey.

18/Occupancy for this mode is based on the number of passengers divided by its fixed number of vehicles.

Logan Terminal E

Departures

Existing Conditions

	Departure
Existing Conditions Peak Hour:	**18:00-18:59**
Peak Hour Passengers:	**1091**
Originating Passenger Factor [1]:	**1**
Peak Hour Originating Passengers:	**1091**

Mode Share Type	Mode Split Percentage [2]	PAX	Occupancy [3]	Vehicles based on Occupancy	Comparison Counts [14]	2014 Adjusted Vehicles [10]
Private Vehicle Drop-Off	30%	327	1.8	182	343	—
Parked at Airport [16]	7.0%	76	n/a	—	—	—
Rental Car Drop-Off [15]	4%	44	1.4	31	—	—
Taxicabs [17]	18%	196	1.7	116	90	—
Airport Operated Shuttles:		0		—	—	—
Economy Parking [4]	2%	21	n/a	—	—	—
MPA Employee [11]	n/a	n/a	n/a	—	—	10
Water Taxi & Water Ferry [12]	n/a	n/a	n/a	—	—	—
Interterminal [13]	n/a	n/a	n/a	—	—	—
Rental Car and MBTA Blue Line Shuttle [19]	9%	98	8.2	—	—	12
Car service ("black car", executive sedan, private limo, etc.)	7%	76	2.2	35	50	—
Other shared ride or limo [6]	3%	33	3.5	9	—	—
Free Hotel or Other Courtesy Shuttles [5]	6%	65	4.8	14	—	—
Off Airport Parking Shuttles (Park-Shuttle-Fly, PreFlight, Thrifty Parking, etc.)	2%	22	n/a	—	—	##
MBTA Silver Line [7]	4%	44	n/a	—	—	—
Logan Express [8]	4%	44	6.2	—	—	7
Scheduled Bus Service [9]	5%	55	8.8	6	—	—
Charter Bus	2%	22	8.8	2	—	—
Total	**103%**	**1,123**	**4.7**	**395**	**483**	**29**
			Total [18]	**373**	**483**	

Notes:

1/ Based on 2014 AECOM passenger projections.

2/ Based on mode-split data from 2013 Logan Airport Passenger Survey, Massport. Weekday percentages.

3/ Based on Long Range Ground Access Policy Plan: Phase 1 Report unless otherwise noted. The report was prepared by Ricondo & Associates, Inc., in October 2008.

4/ Economy Parking Airport Operated Shuttle operates on arrival level with a fixed number of vehicles based on percentage of private vehicles that parked in the airport economy lot. The departure passenger volumes were added to the arrival passenger volumes. Occupancy for this mode is based on the number of passengers divided by its fixed number of vehicles.

5/ Other Courtesy Shuttles consist of hotel shuttles and Other Shuttles.

6/ Other Shared Ride or Limos consists of van or limo by reservation, van or limo running on fixed schedules, and other HOV and non-automobile modes.

7/ MBTA Silverline operates on arrival level only with a fixed number of vehicles based on a headway of 8 minutes. The departure passenger volumes where added to the arrival passenger volumes. Occupancy for this mode is based on the number of passengers divided by its fixed number of vehicles.

8/ Logan Express operates with a fixed number of vehicles on half hour headways for three routes and one hour headways for one route. Occupancy for this mode is based on the number of passengers divided by its fixed number of vehicles.

9/ Other Scheduled Bus Service consists of MBTA buses, regional transit buses and Other Buses.

10/ Adjusted vehicle numbers based on published or planned operational service levels, when applicable.

11/ MPA Employee Airport Operated Shuttle operates on the departure level.

12/ Water Taxi and Water Ferry Airport operated shuttle operates on the arrival level with a fixed number of vehicles based on a 8 minute headway. The departure passenger volumes where added to the arrival passenger volumes.

13/ Interterminal Airport Operates Shuttle operates with a fixed number of vehicles based on a 6 minute headway.

14/ Comparison Counts are based on Terminal E roadway counts from August 2014. The departure peak hour is 6:30-7:30 PM with a total roadway volume of 522 vehicles consisting of 39 buses, 50 limos, 90 taxis, and 376 automobiles.

15/ Rental Car Drop-Off is based on the assumption some percentage of all rental car users will drop additional passenger at the curbside before returning the rental car.

16/ Assumed passenger walked if parked at the airport at Central, Terminal B, or Terminal E parking.

17/ Occupancy for this mode is based on question eight from the 2013 Logan Airport Passenger Survey.

18/ These totals include vehicle volumes for Private Vehicle Drop-Off, Rental Car Drop-off, Taxicabs, Car service, and other shared ride or limo.

19/ Occupancy for this mode is based on the number of passengers divided by its fixed number of vehicles.

Terminal E - Arrivals Curb 1 Existing Conditions

Airport	BOSTON
Roadway Location	Terminal E
Scenario	Alternative 1
Level/Type of Roadway	Arrivals - Curb 1
Total Lanes/Approach Lanes	4 / 2
Number of Curbside Zones	
% of 1st Lane Full when Next Vehicle Double Parks	80
% of 2nd Lane Full when Next Vehicle Triple Parks	50
Crosswalk Adjustment Factor	100
Reginal Adjustment Factor	95

Frontage and Dwell Time per Curbside Operation				**Name**	**Zone 1** CW1 xwalk	**Zone 2** Airport Shuttles active	**Zone 3** CW2 xwalk	**Zone 4** Rental Car & MBTA Blue Line active	**Zone 5** CW3 xwalk	**Zone 6** Silver Line active	**Zone 7** CW4 xwalk	**Zone 8** LE active	**Zone 9** CW5 xwalk	**Zone 10** SchBus active	**Zone 11**	**Zone 12**
				Type												
Mode Share Type[2]	**Vehicle Parking Length (ft)**	**Average Dwell Time (minutes)**[1]	**Volume of Vehicle Using Road Way (vph)**[3]	**Curbside Frontage**	20	115	20	115	20	115	20	115	20	75		
				Volume of Vehicles using the Curbside (vph)												
Private Vehicle Pick-Up	25	4.6														
Parked at Airport	25															
Taxicabs	25	3.9	169													
Airport Operated Shuttles:																
Economy Parking	40	0.6	8	8		8										
MPA Employee[13]	40	0.6	—	0		0										
Water Taxi & Water Ferry	40	0.6	8	8		8										
Interterminal	40	0.6	10	10		10										
Rental Car and MBTA Blue Line Shuttle	70	0.9	12	12				12								
Car Service ("black car", executive sedan, private limo, etc.)	30	5														
Other Shared Ride or Limo	30	5														
Free Hotel or Other Courtesy Shuttles	40	1.5														
MBTA Silver Line	70	0.9	6	6						6						
Logan Express	50	0.8	7	7								7				
Scheduled Bus Service	50	2.4	7	7										7		
Charter Bus	50	3														
Other																

Notes:

1 - Used Table 3-8 in the LALRGAPP 2008 Report

2- Mode Share Type from sheet Terminal E- Arrivals

3- Values from sheet Terminal E-Arrivals (Vehicles Based on Occupancy)

Terminal E - Arrivals Curb 2 Existing Conditions

Airport	BOSTON
Roadway Location	Terminal E
Scenario	Alternative 1
Level/Type of Roadway	Arrivals - Curb 2
Total Lanes/Approach Lanes	3 / 2
Number of Curbside Zones	
% of 1st Lane Full when Next Vehicle Double Parks	80
% of 2nd Lane Full when Next Vehicle Triple Parks	50
Crosswalk Adjustment Factor	100
Reginal Adjustment Factor	95

Frontage and Dwell Time per Curbside Operation				**Name**	**Zone 1**	**Zone 2**	**Zone 3**	**Zone 4**	**Zone 5**	**Zone 6**	**Zone 7**	**Zone 8**	**Zone 9**	**Zone 10**	**Zone 11**	**Zone 12**
				Type	Pax Pickup	CW1	Pax Pickup	CW2	Pax Pickup	CW3	SV/CB	CW4	Charter Bus			
				Curbside Frontage	active	xwalk	active	xwalk	active	xwalk	active	xwalk	active			
					190	20	115	20	115	20	115	20	50			
Mode Share Type[2]	**Vehicle Parking Length (ft)**	**Average Dwell Time (minutes)[1]**	**Volume of Vehicle Using Road Way (vph)[3]**	**Volume of Vehicles using the Curbside (vph)**												
Private Vehicle Pick-Up	25	4.6	677	258	117		71		71							
Parked at Airport	25															
Taxicabs	25	3.9														
Airport Operated Shuttles:																
Economy Parking	40	0.6														
MPA Employee[13]	40	0.6														
Water Taxi & Water Ferry	40	0.6														
Interterminal	40	0.6														
Rental Car and MBTA Blue Line Shuttle	70	0.9														
Car Service ("black car", executive sedan, private limo, etc.)	30	5	43													
Other Shared Ride or Limo	30	5	22	22							22					
Free Hotel or Other Courtesy Shuttles	40	1.5	13	13							13					
MBTA Silver Line	70	0.9														
Logan Express	50	0.8														
Scheduled Bus Service	50	2.4														
Charter Bus	50	3	0	0									0			
Other																

Notes:

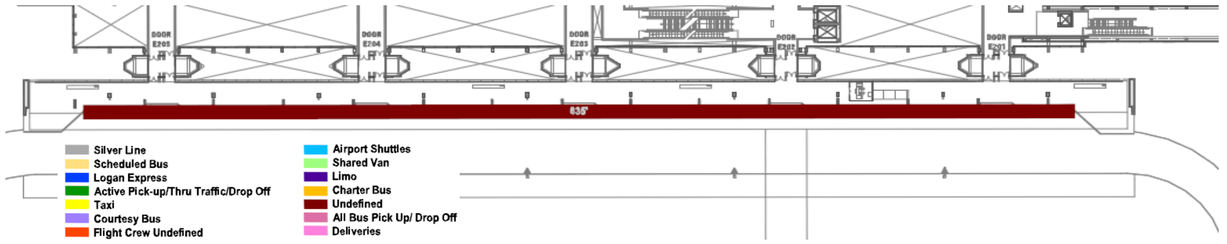
1 - Used Table 3-8 in the LALRGAPP 2008 Report

2- Mode Share Type from sheet Terminal E- Arrivals

3- Values from sheet Terminal E-Arrivals (Vehicles Based on Occupancy)

Terminal E - Departure

Airport	BOSTON
Roadway Location	Terminal E
Scenario	Existing Conditions
Level/Type of Roadway	Departure
Total Lanes/Approach Lanes	4/2
Number of Curbside Zones	
% of 1st Lane Full when Next Vehicle Double Parks	80
% of 2nd Lane Full when Next Vehicle Triple Parks	50
Crosswalk Adjustment Factor	100
Reginal Adjustment Factor	95



Frontage and Dwell Time per Curbside Operation

Mode Share Type[2]	Vehicle Parking Length (ft)	Average Dwell Time (minutes)[1]	Volume of Vehicle Using Road Way (vph)[3]	Volume of Vehicles using the Curbside (vph)	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10	Zone 11	Zone 12	
Name					All active												
Type																	
Curbside Frontage					635												
Private Vehicle Drop-Off	25	1.7	182	182	182												
Parked at Airport	25																
Rental Car Drop-Off	25	1.7	31	31	31												
Taxicabs	25	1.3	116	116	116												
Airport Operated Shuttles:																	
Economy Parking	40	0.6	—														
MPA Employee[13]	40	0.6	##														
Water Taxi & Water Ferry	40	0.6	—														
Interterminal	40	0.6	—														
Rental Car and MBTA Blue Line Shuttle	70	0.9	12	12	12												
Car Service ("black car", executive sedan, private limo, etc.)	30	2	35	35	35												
Other Shared Ride or Limo	30	0.9	9	9	9												
Free Hotel or Other Courtesy Shuttles	40	1.5	14	14	14												
MBTA Silver Line	70	0.9	—														
Logan Express	50	0.8	7	7	7												
Scheduled Bus Service	50	2.4	6	6	6												
Charter Bus	50	2.4	2	2	2												

Notes:

1 - Used Table 3-8 in the LALRGAPP 2008 Report

2- Mode Share Type from sheet Terminal E- Arrivals

3- Values from sheet Terminal E-Arrivals (Vehicles Based on Occupancy)

Quick Analysis Tool for Airport Roadways

QATAR v0.6 developed by LeighFisher in association with Dowling Associates, Inc.

Summary of Inputs and Assumptions

Model run by: Vhunt on 10/1/2014

Airport	BOS
Roadway location	Terminal E
Scenario	2014 Existing, Curb 1
Level / type of roadway	Arrivals
Total lanes / approach lanes	4 / 2
Number of curbside zones	10
% of 1st lane full when next vehicle double parks	80%
% of 2nd lane full when next vehicle triple parks	50%
Crosswalk adjustment factor	100%
Regional adjustment factor	95%

Frontage and dwell time per curbside operation

Vehicle class	Vehicle parking length (feet)	Average dwell time (minutes)
Private Vehicle Pick-Up	25.0	4.6
Taxicabs	25.0	3.9
Economy Parking	40.0	0.6
MPA Employee	40.0	0.6
Water Taxi & Water Ferry	40.0	0.6
Interterminal	40.0	0.6
Rental Car and MBTA BL	70.0	0.9
Car Service	30.0	5.0
Other Shared Ride or Limo	30.0	5.0
Free Hotel or Other CS	40.0	1.5
MBTA Silver Line	70.0	0.9
Logan Express	50	1
Scheduled Bus Service	50	2
Charter Bus	50	3

Assumptions by zone

Zone ID	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10
Name	CW1	AS	CW2	RC & BL	CW3	SL	CW4	LE	CW5	SchBus
Type	xwalk	active	xwalk	active	xwalk	active	xwalk	active	xwalk	active
Curbside frontage (feet)	20	115	20	115	20	115	20	115	20	75
Number of lanes	4	4	4	4	4	4	4	4	4	4
Number of approach lanes	2	2	2	2	2	2	2	2	2	2
Volume of vehicles using roadway (vph)										
Private Vehicle Pick-Up	-	-	-	-	-	-	-	-	-	-
Taxicabs	169	169	169	169	169	169	169	169	169	169
Economy Parking	8	8	8	8	8	8	8	8	8	8
MPA Employee	-	-	-	-	-	-	-	-	-	-
Water Taxi & Water Ferry	8	8	8	8	8	8	8	8	8	8
Interterminal	10	10	10	10	10	10	10	10	10	10
Rental Car and MBTA BL	12	12	12	12	12	12	12	12	12	12
Car Service	-	-	-	-	-	-	-	-	-	-
Other Shared Ride or Limo	-	-	-	-	-	-	-	-	-	-
Free Hotel or Other CS	-	-	-	-	-	-	-	-	-	-
MBTA Silver Line	6	6	6	6	6	6	6	6	6	6
Logan Express	7	7	7	7	7	7	7	7	7	7
Scheduled Bus Service	7	7	7	7	7	7	7	7	7	7
Charter Bus	-	-	-	-	-	-	-	-	-	-
Volume of vehicles using curbside (vph)										
Private Vehicle Pick-Up	-	-	-	-	-	-	-	-	-	-
Taxicabs	-	-	-	-	-	-	-	-	-	-
Economy Parking	-	8	-	-	-	-	-	-	-	-
MPA Employee	-	-	-	-	-	-	-	-	-	-
Water Taxi & Water Ferry	-	8	-	-	-	-	-	-	-	-
Interterminal	-	10	-	-	-	-	-	-	-	-
Rental Car and MBTA BL	-	-	-	12	-	-	-	-	-	-
Car Service	-	-	-	-	-	-	-	-	-	-
Other Shared Ride or Limo	-	-	-	-	-	-	-	-	-	-
Free Hotel or Other CS	-	-	-	-	-	-	-	-	-	-
MBTA Silver Line	-	-	-	-	-	6	-	-	-	-
Logan Express	-	-	-	-	-	-	-	7	-	-
Scheduled Bus Service	-	-	-	-	-	-	-	-	-	7
Charter Bus	-	-	-	-	-	-	-	-	-	-

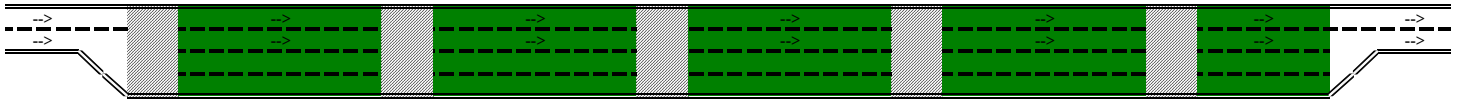
Quick Analysis Tool for Airport Roadways

QATAR v0.6 developed by LeighFisher in association with Dowling Associates, Inc.

Results: Level-of-Service by Zone

Model run by: Vhunt on 10/1/2014

Airport	BOS
Roadway location	Terminal E
Scenario	2014 Existing, Curb 1
Level / type of roadway	Arrivals
Total lanes / approach lanes	4 / 2
Number of curbside zones	10



Zone ID	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10
Name/description	CW1	AS	CW2	RC & BL	CW3	SL	CW4	LE	CW5	SchBus
Curb length (feet)	20	115	20	115	20	115	20	115	20	75
Zone type	xwalk	active	xwalk	active	xwalk	active	xwalk	active	xwalk	active
Roadway volume (vph)	227	227	227	227	227	227	227	227	227	227
Roadway capacity (vph)	2,708	2,706	2,708	2,710	2,708	2,710	2,708	2,710	2,708	2,710
Roadway V/C ratio	0.084	0.084	0.084	0.084	0.084	0.084	0.084	0.084	0.084	0.084
Roadway LOS	A	A	A	A	A	A	A	A	A	A
Curb demand (# in sys 95% of time)	N/A	1.0	N/A	1.0	N/A	1.0	N/A	1.0	N/A	1.0
Curb capacity per lane (vehicles)	N/A	3.0	N/A	2.0	N/A	2.0	N/A	2.0	N/A	2.0
Curb utilization ratio	N/A	0.333	N/A	0.500	N/A	0.500	N/A	0.500	N/A	0.500
Curb LOS	N/A	A	N/A	A	N/A	A	N/A	A	N/A	A

Level-of-service (LOS) key:

A
B
C
D
E
F

Quick Analysis Tool for Airport Roadways

QATAR v0.6 developed by LeighFisher in association with Dowling Associates, Inc.

Results: Detailed Report By Zone

Model run by: Vhunt on 10/1/2014

ID	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10
Name	CW1	AS	CW2	RC & BL	CW3	SL	CW4	LE	CW5	SchBus
Type of zone	xwalk	active	xwalk	active	xwalk	active	xwalk	active	xwalk	active
Curbside length (feet)	20	115	20	115	20	115	20	115	20	75
Number of lanes	4	4	4	4	4	4	4	4	4	4
Number of approach lanes	2	2	2	2	2	2	2	2	2	2
Roadway volume (vph)	227	227	227	227	227	227	227	227	227	227
Curbside demand (vph)	-	26	-	12	-	6	-	7	-	7
Average dwell time (minutes)	-	0.60	-	0.90	-	0.90	-	0.80	-	2.40
Average vehicle length (feet)	-	40.00	-	70.00	-	70.00	-	50.00	-	50.00
Average vehicle arrival rate (vph)	-	26.00	-	12.00	-	6.00	-	7.00	-	7.00
Crosswalk adjustment factor	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Regional adjustment factor	95.0%	95.0%	95.0%	95.0%	95.0%	95.0%	95.0%	95.0%	95.0%	95.0%
Through lane roadway capacity	2,850	2,850	2,850	2,854	2,850	2,854	2,850	2,854	2,850	2,854
Adjusted through lane roadway capacity	2,708	2,706	2,708	2,710	2,708	2,710	2,708	2,710	2,708	2,710
Estimated roadway V/C ratio	0.084	0.084	0.084	0.084	0.084	0.084	0.084	0.084	0.084	0.084
Curb capacity per lane (vehicles)	-	3.00	-	2.00	-	2.00	-	2.00	-	2.00
Curb utilization ratio	-	0.333	-	0.500	-	0.500	-	0.500	-	0.500
% occupancy in lane 1	-	0.330	-	0.490	-	0.490	-	0.490	-	0.490
% occupancy in lane 2	-	-	-	-	-	-	-	-	-	-
% occupancy in lane 3	-	-	-	-	-	-	-	-	-	-
# of cars in curbside lane	-	0.99	-	0.98	-	0.98	-	0.98	-	0.98
# of double-parked cars	-	-	-	-	-	-	-	-	-	-
# of triple-parked cars	-	-	-	-	-	-	-	-	-	-
Curbside LOS		A		A		A		A		A
Roadway LOS	A	A	A	A	A	A	A	A	A	A

Quick Analysis Tool for Airport Roadways

QATAR v0.6 developed by LeighFisher in association with Dowling Associates, Inc.

Summary of Inputs and Assumptions

Model run by: Vhunt on 4/3/2015

Airport	BOS
Roadway location	Terminal E
Scenario	2014 Existing, Curb 2
Level / type of roadway	Arrivals
Total lanes / approach lanes	3 / 2
Number of curbside zones	9
% of 1st lane full when next vehicle double parks	80%
% of 2nd lane full when next vehicle triple parks	50%
Crosswalk adjustment factor	100%
Regional adjustment factor	95%

Frontage and dwell time per curbside operation

Vehicle class	Vehicle parking length (feet)	Average dwell time (minutes)
Private Vehicle Pick-Up	25.0	4.6
Taxicabs	25.0	3.9
Economy Parking	40.0	0.6
MPA Employee	40.0	0.6
Water Taxi & Water Ferry	40.0	0.6
Interterminal	40.0	0.6
Rental Car and MBTA BL	70.0	0.9
Car Service	30.0	5.0
Other Shared Ride or Limo	30.0	5.0
Free Hotel or Other CS	40.0	1.5
MBTA Silver Line	70.0	0.9
Logan Express	50	1
Scheduled Bus Service	50	2
Charter Bus	50	3

Assumptions by zone

Zone ID	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9
Name	Pax Pickup	CW1	Pax Pickup	CW2	Pax Pickup	CW3	SV/CB	CW4	CharterBus
Type	active	xwalk	active	xwalk	active	xwalk	active	xwalk	active
Curbside frontage (feet)	190	20	115	20	115	20	115	20	50
Number of lanes	3	3	3	3	3	3	3	3	3
Number of approach lanes	2	2	2	2	2	2	2	2	2
Volume of vehicles using roadway (vph)									
Private Vehicle Pick-Up	677	677	677	677	677	677	677	677	677
Taxicabs	-	-	-	-	-	-	-	-	-
Economy Parking	-	-	-	-	-	-	-	-	-
MPA Employee	-	-	-	-	-	-	-	-	-
Water Taxi & Water Ferry	-	-	-	-	-	-	-	-	-
Interterminal	-	-	-	-	-	-	-	-	-
Rental Car and MBTA BL	-	-	-	-	-	-	-	-	-
Car Service	43	43	43	43	43	43	43	43	43
Other Shared Ride or Limo	22	22	22	22	22	22	22	22	22
Free Hotel or Other CS	13	13	13	13	13	13	13	13	13
MBTA Silver Line	-	-	-	-	-	-	-	-	-
Logan Express	-	-	-	-	-	-	-	-	-
Scheduled Bus Service	-	-	-	-	-	-	-	-	-
Charter Bus	-	-	-	-	-	-	-	-	-
Volume of vehicles using curbside (vph)									
Private Vehicle Pick-Up	117	-	71	-	71	-	-	-	-
Taxicabs	-	-	-	-	-	-	-	-	-
Economy Parking	-	-	-	-	-	-	-	-	-
MPA Employee	-	-	-	-	-	-	-	-	-
Water Taxi & Water Ferry	-	-	-	-	-	-	-	-	-
Interterminal	-	-	-	-	-	-	-	-	-
Rental Car and MBTA BL	-	-	-	-	-	-	-	-	-
Car Service	-	-	-	-	-	-	-	-	-
Other Shared Ride or Limo	-	-	-	-	-	-	22	-	-
Free Hotel or Other CS	-	-	-	-	-	-	13	-	-
MBTA Silver Line	-	-	-	-	-	-	-	-	-
Logan Express	-	-	-	-	-	-	-	-	-
Scheduled Bus Service	-	-	-	-	-	-	-	-	-
Charter Bus	-	-	-	-	-	-	-	-	-

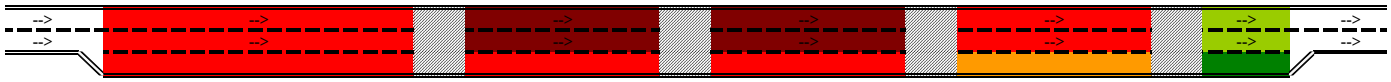
Quick Analysis Tool for Airport Roadways

QATAR v0.6 developed by LeighFisher in association with Dowling Associates, Inc.

Results: Level-of-Service by Zone

Model run by: Vhunt on 4/3/2015

Airport	BOS
Roadway location	Terminal E
Scenario	2014 Existing, Curb 2
Level / type of roadway	Arrivals
Total lanes / approach lanes	3 / 2
Number of curbside zones	9



Zone ID	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9
Name/description	Pax Pickup	CW1	Pax Pickup	CW2	Pax Pickup	CW3	SV/CB	CW4	CharterBus
Curb length (feet)	190	20	115	20	115	20	115	20	50
Zone type	active	xwalk	active	xwalk	active	xwalk	active	xwalk	active
Roadway volume (vph)	755	755	755	755	755	755	755	755	755
Roadway capacity (vph)	785	2,657	722	2,657	722	2,657	888	2,657	2,655
Roadway V/C ratio	0.961	0.284	1.046	0.284	1.046	0.284	0.850	0.284	0.284
Roadway LOS	E	B	F	B	F	B	E	B	B
Curb demand (# in sys 95% of time)	14.0	N/A	10.0	N/A	10.0	N/A	5.0	N/A	0.0
Curb capacity per lane (vehicles)	8.0	N/A	5.0	N/A	5.0	N/A	3.0	N/A	0.0
Curb utilization ratio	1.750	N/A	2.000	N/A	2.000	N/A	1.667	N/A	0.000
Curb LOS	E	N/A	E	N/A	E	N/A	D	N/A	A

Level-of-service (LOS) key:

A
B
C
D
E
F

Quick Analysis Tool for Airport Roadways

QATAR v0.6 developed by LeighFisher in association with Dowling Associates, Inc.

Results: Detailed Report By Zone

Model run by: Vhunt on 4/3/2015

ID	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9
Name	Pax Pickup	CW1	Pax Pickup	CW2	Pax Pickup	CW3	SV/CB	CW4	CharterBus
Type of zone	active	xwalk	active	xwalk	active	xwalk	active	xwalk	active
Curbside length (feet)	190	20	115	20	115	20	115	20	50
Number of lanes	3	3	3	3	3	3	3	3	3
Number of approach lanes	2	2	2	2	2	2	2	2	2
Roadway volume (vph)	755	755	755	755	755	755	755	755	755
Curbside demand (vph)	117	-	71	-	71	-	35	-	-
Average dwell time (minutes)	4.60	-	4.60	-	4.60	-	3.70	-	-
Average vehicle length (feet)	25.00	-	25.00	-	25.00	-	33.71	-	-
Average vehicle arrival rate (vph)	117.00	-	71.00	-	71.00	-	35.00	-	-
Crosswalk adjustment factor	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Regional adjustment factor	95.0%	95.0%	95.0%	95.0%	95.0%	95.0%	95.0%	95.0%	95.0%
Through lane roadway capacity	827	2,797	760	2,797	760	2,797	935	2,797	2,797
Adjusted through lane roadway capacity	785	2,657	722	2,657	722	2,657	888	2,657	2,655
Estimated roadway V/C ratio	0.961	0.284	1.046	0.284	1.046	0.284	0.850	0.284	0.284
Curb capacity per lane (vehicles)	8.00	-	5.00	-	5.00	-	3.00	-	-
Curb utilization ratio	1.750	-	2.000	-	2.000	-	1.667	-	-
% occupancy in lane 1	1.000	-	1.000	-	1.000	-	1.000	-	-
% occupancy in lane 2	0.620	-	0.745	-	0.745	-	0.580	-	-
% occupancy in lane 3	0.12	-	0.25	-	0.25	-	0.08	-	-
# of cars in curbside lane	8.00	-	5.00	-	5.00	-	3.00	-	-
# of double-parked cars	4.96	-	3.73	-	3.73	-	1.74	-	-
# of triple-parked cars	0.960	-	1.225	-	1.225	-	0.240	-	-
Curbside LOS	E		E		E		D		A
Roadway LOS	E	B	F	B	F	B	E	B	B

Quick Analysis Tool for Airport Roadways

QATAR v0.6 developed by LeighFisher in association with Dowling Associates, Inc.

Summary of Inputs and Assumptions

Model run by: Vhunt on 10/1/2014

Airport	BOS
Roadway location	Terminal E
Scenario	2014 Existing, Departures
Level / type of roadway	Departures
Total lanes / approach lanes	4 / 2
Number of curbside zones	1
% of 1st lane full when next vehicle double parks	80%
% of 2nd lane full when next vehicle triple parks	50%
Crosswalk adjustment factor	100%
Regional adjustment factor	95%

Frontage and dwell time per curbside operation

Vehicle class	Vehicle parking length (feet)	Average dwell time (minutes)
Private Vehicle Drop-Off	25.0	1.7
Rental Car Drop-Off	25.0	1.7
Taxicabs	25.0	1.3
Economy Parking	40.0	0.6
MPA Employee	40.0	0.6
Water Taxi & Water Ferry	40.0	0.6
Interterminal	40.0	0.6
Rental Car and MBTA BL	70.0	0.9
Car Service	30.0	2.0
Other Shared Ride or Limo	30.0	0.9
Free Hotel or Other CS	40.0	1.5
MBTA Silver Line	70	1
Logan Express	50	1
Scheduled Bus Service	50	2
Charter Bus	50	2

Assumptions by zone

Zone ID	Zone 1
Name	All
Type	active
Curbside frontage (feet)	635
Number of lanes	4
Number of approach lanes	2

Volume of vehicles using roadway (vph)

Private Vehicle Drop-Off	182
Rental Car Drop-Off	31
Taxicabs	116
Economy Parking	-
MPA Employee	-
Water Taxi & Water Ferry	-
Interterminal	-
Rental Car and MBTA BL	12
Car Service	35
Other Shared Ride or Limo	9
Free Hotel or Other CS	14
MBTA Silver Line	-
Logan Express	7
Scheduled Bus Service	6
Charter Bus	2

Volume of vehicles using curbside (vph)

Private Vehicle Drop-Off	182
Rental Car Drop-Off	31
Taxicabs	116
Economy Parking	-
MPA Employee	-
Water Taxi & Water Ferry	-
Interterminal	-
Rental Car and MBTA BL	12
Car Service	35
Other Shared Ride or Limo	9
Free Hotel or Other CS	14
MBTA Silver Line	-
Logan Express	7
Scheduled Bus Service	6
Charter Bus	2

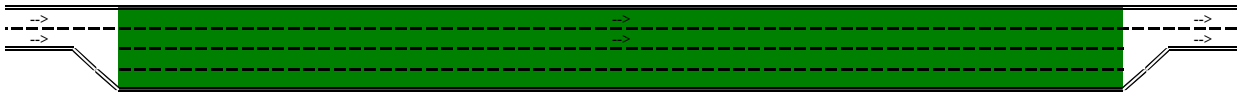
Quick Analysis Tool for Airport Roadways

QATAR v0.6 developed by LeighFisher in association with Dowling Associates, Inc.

Results: Level-of-Service by Zone

Model run by: Vhunt on 10/1/2014

Airport	BOS
Roadway location	Terminal E
Scenario	2014 Existing, Departures
Level / type of roadway	Departures
Total lanes / approach lanes	4 / 2
Number of curbside zones	1



Zone ID	**Zone 1**
Name/description	All
Curb length (feet)	635
Zone type	active
Roadway volume (vph)	414
Roadway capacity (vph)	2,721
Roadway V/C ratio	0.152
Roadway LOS	A
Curb demand (# in sys 95% of time)	16.0
Curb capacity per lane (vehicles)	22.0
Curb utilization ratio	0.727
Curb LOS	A

Level-of-service (LOS) key:

A
B
C
D
E
F

Quick Analysis Tool for Airport Roadways

QATAR v0.6 developed by LeighFisher in association with Dowling Associates, Inc.

Results: Detailed Report By Zone

Model run by: Vhunt on 10/1/2014

ID	Zone 1
Name	All
Type of zone	active
Curbside length (feet)	635
Number of lanes	4
Number of approach lanes	2
Roadway volume (vph)	414
Curbside demand (vph)	414
Average dwell time (minutes)	1.56
Average vehicle length (feet)	28.25
Average vehicle arrival rate (vph)	414.00
Crosswalk adjustment factor	100.0%
Regional adjustment factor	95.0%
Through lane roadway capacity	2,866
Adjusted through lane roadway capacity	2,721
Estimated roadway V/C ratio	0.152
Curb capacity per lane (vehicles)	22.00
Curb utilization ratio	0.727
% occupancy in lane 1	0.720
% occupancy in lane 2	-
% occupancy in lane 3	-
# of cars in curbside lane	15.84
# of double-parked cars	-
# of triple-parked cars	-
Curbside LOS	A
Roadway LOS	A

Environmental Consequences

- 2017 Recirculation Factor Calculation
- 2017 QATAR Analysis Inputs
- 2017 QATAR Analysis Results

2017 Recirculation Factor Calculation

VHB *Computations*

Project: Logan-TerME Project # 12848.00
Location: Sheet of
Calculated by: AIC Date: 3/5/2015
Checked by: Date:
Title Recirculation Calcs

2017

Passenger Pick-Up Volume = V_{pp} = 252 veh

Short-term parking = 234 spaces (NOT including handicap spaces)

- assume 30% of vehs park
  - → 20% park @ new-short-term parking @ E
  - → 10% park elsewhere (economy, central, etc.)

20% of 252 = 50 veh
10% of 252 = 25 veh

252 - 25 veh = 227 veh at TerME
↳ never shows @ term E

50 veh park @ E * 2.0 recirc to access/egress short-term lot
= 100 veh on rdwy due to short-term parking

- Remaing 177 veh using curbside to pick-up (227 - 50 = 177)

assume 1/3 doesn't recirculate (1.0)
1/3 recirculates once (2.0)
1/3 recirculates 2+ (3.0)

average recirc of = 2.0 (1 + 2 + 3 = 6/3)

177 * 2.0 = 354 veh using rdwy due to curbside parking

TOTAL on Rdwy = 354 + 100 = 454

∴ 454 / 227 = 2.0 overall recirc Rate

2017 QATAR Analysis Inputs

Logan Terminal E
Arrivals
2017

	Arrivals
2017 Peak Hour:	**15:00-16:00**
Peak Hour Passengers:	**1,377**
Originating Passenger Factor [1]:	**1.00**
Peak Hour Originating Passengers:	**1,377**

Mode Share Type	Mode Split			Vehicles based on Occupancy	2017
	Percentage [2]	PAX	Occupancy [3]		Adjusted Vehicles [10]
Private Vehicle Pick-Up [14,18]	33%	454	1.8	252	—
Parked at Airport [15]	10%	138	n/a	—	—
Taxicabs [16]	18%	253	1.7	149	—
Airport Operated Shuttles:		0		—	—
Economy Parking [4]	0%	0	n/a	—	8
MPA Employee Shuttle) [11]	—	—	—	—	—
Water Taxi & Water Ferry [12]	0.0%	0	n/a	—	8
Interterminal [13]	0.0%	0	n/a	—	10
Rental Car and MBTA Blue Line Shuttle [17]	9%	124	10.3	—	12
Car Service ("black car", executive sedan, private limo, etc.)	6%	83	2.2	38	—
Other Shared Ride or Limo [6]	5%	69	3.5	20	—
Free Hotel or Other Courtesy Shuttles [5]	4%	55	4.8	13	—
MBTA Silver Line [7]	5%	69	11.5	n/a	6
Logan Express [8]	5%	69	9.8	n/a	7
Scheduled Bus Service [9]	4%	55	8.8	6	—
Charter Bus	0%	0	8.8	0	—
Other	2%	28		—	—
Total	**101%**	**1,396**	**6.3**	**478**	**51**

*departure level

Notes:

1/ Based on 2014 AECOM passenger projections.

2/ Based on mode-split data from 2013 Logan Airport Passenger Survey, Massport. Weekday percentages.

3/ Based on Long Range Ground Access Policy Plan: Phase 1 Report unless otherwise noted. The report was prepared by Ricondo & Associates, Inc., in October 2008.

4/ Economy Parking Airport Operated Shuttle operates on arrival level with a fixed number of vehicles based on percentage of private vehicles that parked in the airport economy lot. The departure passenger volumes were added to the arrival passenger volumes. Occupancy for this mode is based on the number of passengers divided by its fixed number of vehicles.

5/ Other Courtesy Shuttles consist of hotel shuttles and Other Shuttles.

6/ Other Shared Ride or Limos consists of van or limo by reservation, van or limo running on fixed schedules, and other HOV and non-automobile modes.

7/ MBTA Silverline operates on arrival level only with a fixed number of vehicles based on a headway of 8 minutes. The departure passenger volumes where added to the arrival passenger volumes. Occupancy for this mode is based on the number of passengers divided by its fixed number of vehicles.
8/ Logan Express operates with a fixed number of vehicles on half hour headways for three routes and one hour headways for one route. Occupancy for this mode is based on the number of passengers divided by its fixed number of vehicles.

9/ Other Scheduled Bus Service consists of MBTA buses, regional transit buses and Other Buses.

10/ Adjusted vehicle numbers based on published or planned operational service levels, when applicable.

11/ MPA Employee Airport Operated Shuttle operates on the departure level.

12/ Water Taxi and Water Ferry Airport operated shuttle operates on the arrival level with a fixed number of vehicles based on a 8 minute headway. The departure passenger volumes where added to the arrival passenger volumes.

13/ Interterminal Airport Operates Shuttle operates with a fixed number of vehicles based on a 6 minute headway.

14/ Occupancy for this mode is based on question eight from the 2013 Logan Airport Passenger Survey. Assumed 30% of total vehicles park Terminal E Lot 1 (new short-term parking) therefore 70% use the Passenger Pick-Up curbside.

15/ Assumed passenger would walk if parked on the airport at Central, Terminal B, or Terminal E parking.

16/ Occupancy for this mode is based on question eight from the 2013 Logan Airport Passenger Survey.
17/Occupancy for this mode is based on the number of passengers divided by its fixed number of vehicles
18/Of the 454 vehicles using the roadway, 30% park. Of the 30%, 10% park elsewhere at the airport and 20% park at Terminal E in the new short turn parking. The remaining vehicles use the curbside for passenger pickup. The shift in parking and few vehciles using the curbside for pick up result in a recirculation factor of 2.(

Logan Terminal E

Departures

2017

	Departure
2017 Peak Hour:	**18:00-19:00**
Peak Hour Passengers:	**1059**
Originating Passenger Factor [1]:	**1**
Peak Hour Originating Passengers:	**1059**

Mode Share Type	Mode Split Percentage [2]	PAX	Occupancy [3]	Vehicles based on Occupancy	2017 Adjusted Vehicles [10]	
Private Vehicle Drop-Off	30%	318	1.8	177	—	
Parked at Airport[15]	7%	74	n/a	—	—	
Rental Car Drop-Off [14]	2%	21	1.4	15	—	
Taxicabs [16]	18%	191	1.7	112	—	
Airport Operated Shuttles:		0		—	—	
Economy Parking [4]	2%	20	n/a	—	—	*arrival level
MPA Employee Shuttle[11]	n/a	n/a	n/a	—	10	
Water Taxi & Water Ferry [12]	0.0%	0	n/a	—	—	*arrival level
Interterminal[13]	0.0%	0	n/a	—	—	
Rental Car and MBTA Blue Line Shuttle[17]	9%	95	7.9	—	12	
Car service ("black car", executive sedan, private limo, etc.)	7%	74	2.2	34	—	
Other shared ride or limo[6]	3%	32	3.5	9	—	
Free Hotel or Other Courtesy Shuttles[5]	6%	64	4.8	13	—	
Off Airport Parking Shuttles (Park-Shuttle-Fly, PreFlight, Thrifty Parking, etc.)	2%	21	n/a	—	##	
MBTA Silver Line [7]	4%	42	n/a	—	—	*arrival level
Logan Express [8]	4%	42	6.1	7	7	
Scheduled Bus Service [9]	5%	53	8.8	6	—	
Charter Bus	2%	21	8.8	2	—	
Total	**101%**	**1,069**	**4.7**	**375**	**29**	

Notes:

1/ Based on 2014 AECOM passenger projections.

2/ Based on mode-split data from 2013 Logan Airport Passenger Survey, Massport. Weekday percentages.

3/ Based on Long Range Ground Access Policy Plan: Phase 1 Report unless otherwise noted. The report was prepared by Ricondo & Associates, Inc., in October 2008.

4/ Economy Parking Airport Operated Shuttle operates on arrival level with a fixed number of vehicles based on percentage of private vehicles that parked in the airport economy lot. The departure passenger volumes were added to the arrival passenger volumes. Occupancy for this mode is based on the number of passengers divided by its fixed number of vehicles.

5/ Other Courtesy Shuttles consist of hotel shuttles and Other Shuttles.

6/ Other Shared Ride or Limos consists of van or limo by reservation, van or limo running on fixed schedules, and other HOV and non-automobile modes.

7/ MBTA Silverline operates on arrival level only with a fixed number of vehicles based on a headway of 8 minutes. The departure passenger volumes where added to the arrival passenger volumes. Occupancy for this mode is based on the number of passengers divided by its fixed number of vehicles.

8/ Logan Express operates with a fixed number of vehicles on half hour headways for three routes and one hour headways for one route. Occupancy for this mode is based on the number of passengers divided by its fixed number of vehicles.

9/ Other Scheduled Bus Service consists of MBTA buses, regional transit buses and Other Buses.

10/ Adjusted vehicle numbers based on published or planned operational service levels, when applicable

11/ MPA Employee Airport Operated Shuttle operates on the departure level.

12/ Water Taxi and Water Ferry Airport operated shuttle operates on the arrival level with a fixed number of vehicles based on a 8 minute headway. The departure passenger volumes where added to the arrival passenger volumes.

13/ Interterminal Airport Operates Shuttle operates with a fixed number of vehicles based on a 6 minute headway.

14/ Rental Car Drop-Off is based on the assumption some percentage of all rental car users will drop additional passenger at the curbside before returning the rental car.

15/ Assumed passenger walked if parked at the airport at Central, Terminal B, or Terminal E parking.

16/ Occupancy for this mode is based on question eight from the 2013 Logan Airport Passenger Survey.

17/ Occupancy for this mode is based on the number of passengers divided by its fixed number of vehicles.

Terminal E - Arrivals Curb 1 (2017)

Airport	BOSTON
Roadway Location	Terminal E
Scenario	Alternative 1
Level/Type of Roadway	Arrivals - Curb 1
Total Lanes/Approach Lanes	4 / 2
Number of Curbside Zones	
% of 1st Lane Full when Next Vehicle Double Parks	80
% of 2nd Lane Full when Next Vehicle Triple Parks	50
Crosswalk Adjustment Factor	100
Reginal Adjustment Factor	95

Frontage and Dwell Time per Curbside Operation

Mode Share Type[2]	Vehicle Parking Length (ft)	Average Dwell Time (minutes)[1]	Volume of Vehicle Using Road Way (vph)[3]	Volume of Vehicles using the Curbside (vph)
Private Vehicle Pick-Up	25	4.6		
Parked at Airport	25			
Taxicabs	25	3.9	149	
Airport Operated Shuttles:				
Economy Parking	40	0.6	8	8
MPA Employee	40	0.6	—	
Water Taxi & Water Ferry	40	0.6	8	8
Interterminal	40	0.6	10	10
Rental Car and MBTA Blue Line Shuttle	70	0.9	12	12
Car Service ("black car", executive sedan, private limo, etc.)	30	5	38	
Other Shared Ride or Limo	30	5	20	
Free Hotel or Other Courtesy Shuttles	40	1.5		
MBTA Silver Line	70	0.9	6	6
Logan Express	50	0.8	7	7
Scheduled Bus Service	50	2.4	6	6
Charter Bus	50	3	0	0
Other				

	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10	Zone 11	Zone 12
Name	CW1 xwalk	Airport Shuttles active	CW2 xwalk	Rental Car & MBTA Blue Line active	CW3 xwalk	Silver Line active	CW4 xwalk	LE active	CW5 xwalk	SchBus active	CharterBus active	
Type												
Curbside Frontage	20	115	20	115	20	115	20	115	20	75	50	

Notes:

1 - Used Table 3-8 in the LALRGAPP 2008 Report

2- Mode Share Type from sheet Terminal E- Arrivals

3- Values from sheet Terminal E-Arrivals (Vehicles Based on Occupancy)

Terminal E - Arrivals Curb 2 (2017)

Airport	BOSTON
Roadway Location	Terminal E
Scenario	Alternative 1
Level/Type of Roadway	Arrivals - Curb 2
Total Lanes/Approach Lanes	3 / 2
Number of Curbside Zones	
% of 1st Lane Full when Next Vehicle Double Parks	80
% of 2nd Lane Full when Next Vehicle Triple Parks	50
Crosswalk Adjustment Factor	100
Reginal Adjustment Factor	95

Frontage and Dwell Time per Curbside Operation

Mode Share Type[2]	Vehicle Parking Length (ft)	Average Dwell Time (minutes)[1]	Volume of Vehicle Using Road Way (vph)[3]	Volume of Vehicles using the Curbside (vph)	Zone 1 Pax Pickup active	Zone 2 CW1 xwalk	Zone 3 Pax Pickup active	Zone 4 CW2 xwalk	Zone 5 Pax Pickup active	Zone 6 CW3 xwalk	Zone 7 Pax Pickup active	Zone 8 CW4 xwalk	Zone 9 CourtesyBus active	Zone 10	Zone 11	Zone 12
Name																
Type																
Curbside Frontage					190	20	115	20	115	20	115	20	50			
Private Vehicle Pick-Up[4]	25	4.6	454	177	63		38		38		38					
Parked at Airport	25															
Taxicabs	25	3.9														
Airport Operated Shuttles:																
Economy Parking	40	0.6														
MPA Employee	40	0.6														
Water Taxi & Water Ferry	40	0.6														
Interterminal	40	0.6														
Rental Car and MBTA Blue Line Shuttle	70	0.9														
Car Service ("black car", executive sedan, private limo, etc.)	30	5														
Other Shared Ride or Limo	30	5														
Free Hotel or Other Courtesy Shuttles	40	1.5	13	13									13			
MBTA Silver Line	70	0.9														
Logan Express	50	0.8														
Scheduled Bus Service	50	2.4														
Charter Bus	50	3														
Other																

Notes:

1 - Used Table 3-8 in the LALRGAPP 2008 Report

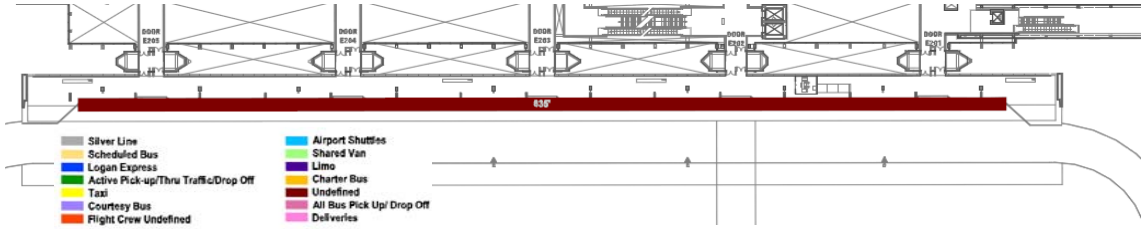
2- Mode Share Type from sheet Terminal E- Arrivals

3- Refer to Recirculation Calcs sheet - \\mawatr\EV\12848.00 AECOM-Terminal E\ssheets\Traffic

18/Of the 454 vehicles using the roadway, 40% park. Of the 40%, 10% park elsewhere at the airport and 30% park at Terminal E in the new short term parking. The remaining vehicles use the curbside for passenger pickup. The shift in parking and fewer vehicles using the curbside for pick up result in a recirculation factor of 2.0.

Terminal E - Departure

Airport	BOSTON
Roadway Location	Terminal E
Scenario	2017 Conditions
Level/Type of Roadway	Departure
Total Lanes/Approach Lanes	4/2
Number of Curbside Zones	
% of 1st Lane Full when Next Vehicle Double Parks	80
% of 2nd Lane Full when Next Vehicle Triple Parks	50
Crosswalk Adjustment Factor	100
Reginal Adjustment Factor	95



Frontage and Dwell Time per Curbside Operation

					Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10	Zone 11	Zone 12
				Name	All active											
				Type												
				Curbside Frontage	635											
Mode Share Type[2]	**Vehicle Parking Length (ft)**	**Average Dwell Time (minutes)[1]**	**Volume of Vehicle Using Road Way (vph)[3]**	**Volume of Vehicles using the Curbside (vph)**												
Private Vehicle Drop-Off	25	1.7	177	177	177											
Parked at Airport	25															
Rental Car Drop-Off	25	1.7	15	15	15											
Taxicabs	25	1.3	112	112	112											
Airport Operated Shuttles:																
Economy Parking	40	0.6	—													
MPA Employee	40	0.6	##	##	##											
Water Taxi & Water Ferry	40	0.6	—													
Interterminal	40	0.6	—													
Rental Car and MBTA Blue Line Shuttle	70	0.9	12	12	12											
Car Service ("black car", executive sedan, private limo, etc.)	30	2	34	34	34											
Other Shared Ride or Limo	30	0.9	9	9	9											
Free Hotel or Other Courtesy Shuttles	40	1.5	13	13	13											
MBTA Silver Line	70	0.9	—													
Logan Express	50	0.8	7	7	7											
Scheduled Bus Service	50	2.4	6	6	6											
Charter Bus	50	2.4	2	2	2											

Notes:

1 - Used Table 3-8 in the LALRGAPP 2008 Report

2- Mode Share Type from sheet Terminal E- Arrivals

3- Values from sheet Terminal E-Arrivals (Vehicles Based on Occupancy)

2017 QATAR Analysis Results

Quick Analysis Tool for Airport Roadways

QATAR v0.6 developed by LeighFisher in association with Dowling Associates, Inc.

Summary of Inputs and Assumptions

Model run by: Vhunt on 2/2/2015

Airport	BOS
Roadway location	Terminal E
Scenario	2017 Future, Curb 1
Level / type of roadway	Arrivals
Total lanes / approach lanes	4 / 2
Number of curbside zones	11
% of 1st lane full when next vehicle double parks	80%
% of 2nd lane full when next vehicle triple parks	50%
Crosswalk adjustment factor	100%
Regional adjustment factor	95%

Frontage and dwell time per curbside operation

Vehicle class	Vehicle parking length (feet)	Average dwell time (minutes)
Private Vehicle Pick-Up	25.0	4.6
Taxicabs	25.0	3.9
Economy Parking	40.0	0.6
MPA Employee	40.0	0.6
Water Taxi & Water Ferry	40.0	0.6
Interterminal	40.0	0.6
Rental Car and MBTA BL	70.0	0.9
Car Service	30.0	5.0
Other Shared Ride or Limo	30.0	5.0
Free Hotel or Other CS	40.0	1.5
MBTA Silver Line	70.0	0.9
Logan Express	50	1
Scheduled Bus Service	50	2
Charter Bus	50	3

Assumptions by zone

Zone ID	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10	Zone 11
Name	CW1	AS	CW2	RC and BL	CW3	SL	CW4	LE	CW5	SchBus	CharterBus
Type	xwalk	active	xwalk	active	xwalk	active	xwalk	active	xwalk	active	active
Curbside frontage (feet)	20	115	20	115	20	115	20	115	20	75	50
Number of lanes	4	4	4	4	4	4	4	4	4	4	4
Number of approach lanes	2	2	2	2	2	2	2	2	2	2	2
Volume of vehicles using roadway (vph)											
Private Vehicle Pick-Up	-	-	-	-	-	-	-	-	-	-	-
Taxicabs	149	149	149	149	149	149	149	149	149	149	149
Economy Parking	8	8	8	8	8	8	8	8	8	8	8
MPA Employee	-	-	-	-	-	-	-	-	-	-	-
Water Taxi & Water Ferry	8	8	8	8	8	8	8	8	8	8	8
Interterminal	10	10	10	10	10	10	10	10	10	10	10
Rental Car and MBTA BL	12	12	12	12	12	12	12	12	12	12	12
Car Service	38	38	38	38	38	38	38	38	38	38	38
Other Shared Ride or Limo	20	20	20	20	20	20	20	20	20	20	20
Free Hotel or Other CS	-	-	-	-	-	-	-	-	-	-	-
MBTA Silver Line	6	6	6	6	6	6	6	6	6	6	6
Logan Express	7	7	7	7	7	7	7	7	7	7	7
Scheduled Bus Service	6	6	6	6	6	6	6	6	6	6	6
Charter Bus	-	-	-	-	-	-	-	-	-	-	-
Volume of vehicles using curbside (vph)											
Private Vehicle Pick-Up	-	-	-	-	-	-	-	-	-	-	-
Taxicabs	-	-	-	-	-	-	-	-	-	-	-
Economy Parking	-	8	-	-	-	-	-	-	-	-	-
MPA Employee	-	-	-	-	-	-	-	-	-	-	-
Water Taxi & Water Ferry	-	8	-	-	-	-	-	-	-	-	-
Interterminal	-	10	-	-	-	-	-	-	-	-	-
Rental Car and MBTA BL	-	-	-	12	-	-	-	-	-	-	-
Car Service	-	-	-	-	-	-	-	-	-	-	-
Other Shared Ride or Limo	-	-	-	-	-	-	-	-	-	-	-
Free Hotel or Other CS	-	-	-	-	-	-	-	-	-	-	-
MBTA Silver Line	-	-	-	-	-	6	-	-	-	-	-
Logan Express	-	-	-	-	-	-	-	7	-	-	-
Scheduled Bus Service	-	-	-	-	-	-	-	-	-	6	-
Charter Bus	-	-	-	-	-	-	-	-	-	-	-

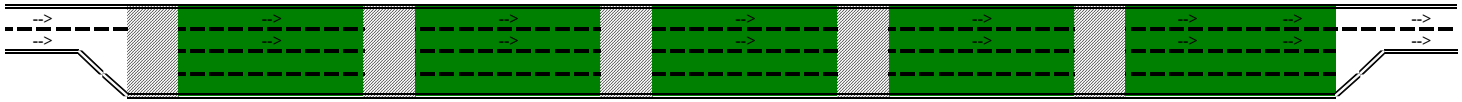
Quick Analysis Tool for Airport Roadways

QATAR v0.6 developed by LeighFisher in association with Dowling Associates, Inc.

Results: Level-of-Service by Zone

Model run by: Vhunt on 2/2/2015

Airport	BOS
Roadway location	Terminal E
Scenario	2017 Future, Curb 1
Level / type of roadway	Arrivals
Total lanes / approach lanes	4 / 2
Number of curbside zones	11



Zone ID	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10	Zone 11
Name/description	CW1	AS	CW2	RC and BL	CW3	SL	CW4	LE	CW5	SchBus	CharterBus
Curb length (feet)	20	115	20	115	20	115	20	115	20	75	50
Zone type	xwalk	active	xwalk	active	xwalk	active	xwalk	active	xwalk	active	active
Roadway volume (vph)	264	264	264	264	264	264	264	264	264	264	264
Roadway capacity (vph)	2,708	2,706	2,708	2,710	2,708	2,710	2,708	2,710	2,708	2,710	2,706
Roadway V/C ratio	0.098	0.098	0.098	0.097	0.098	0.097	0.098	0.097	0.098	0.097	0.098
Roadway LOS	A	A	A	A	A	A	A	A	A	A	A
Curb demand (# in sys 95% of time)	N/A	1.0	N/A	1.0	N/A	1.0	N/A	1.0	N/A	1.0	0.0
Curb capacity per lane (vehicles)	N/A	3.0	N/A	2.0	N/A	2.0	N/A	2.0	N/A	2.0	0.0
Curb utilization ratio	N/A	0.333	N/A	0.500	N/A	0.500	N/A	0.500	N/A	0.500	0.000
Curb LOS	N/A	A	N/A	A	N/A	A	N/A	A	N/A	A	A

Level-of-service (LOS) key:

A
B
C
D
E
F

Quick Analysis Tool for Airport Roadways

QATAR v0.6 developed by LeighFisher in association with Dowling Associates, Inc.

Results: Detailed Report By Zone

Model run by: Vhunt on 2/2/2015

ID	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10	Zone 11
Name	CW1	AS	CW2	RC and BL	CW3	SL	CW4	LE	CW5	SchBus	CharterBus
Type of zone	xwalk	active	xwalk	active	xwalk	active	xwalk	active	xwalk	active	active
Curbside length (feet)	20	115	20	115	20	115	20	115	20	75	50
Number of lanes	4	4	4	4	4	4	4	4	4	4	4
Number of approach lanes	2	2	2	2	2	2	2	2	2	2	2
Roadway volume (vph)	264	264	264	264	264	264	264	264	264	264	264
Curbside demand (vph)	-	26	-	12	-	6	-	7	-	6	-
Average dwell time (minutes)	-	0.60	-	0.90	-	0.90	-	0.80	-	2.40	-
Average vehicle length (feet)	-	40.00	-	70.00	-	70.00	-	50.00	-	50.00	-
Average vehicle arrival rate (vph)	-	26.00	-	12.00	-	6.00	-	7.00	-	6.00	-
Crosswalk adjustment factor	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Regional adjustment factor	95.0%	95.0%	95.0%	95.0%	95.0%	95.0%	95.0%	95.0%	95.0%	95.0%	95.0%
Through lane roadway capacity	2,850	2,850	2,850	2,854	2,850	2,854	2,850	2,854	2,850	2,854	2,850
Adjusted through lane roadway capacity	2,708	2,706	2,708	2,710	2,708	2,710	2,708	2,710	2,708	2,710	2,706
Estimated roadway V/C ratio	0.098	0.098	0.098	0.097	0.098	0.097	0.098	0.097	0.098	0.097	0.098
Curb capacity per lane (vehicles)	-	3.00	-	2.00	-	2.00	-	2.00	-	2.00	-
Curb utilization ratio	-	0.333	-	0.500	-	0.500	-	0.500	-	0.500	-
% occupancy in lane 1	-	0.330	-	0.490	-	0.490	-	0.490	-	0.490	-
% occupancy in lane 2	-	-	-	-	-	-	-	-	-	-	-
% occupancy in lane 3	-	-	-	-	-	-	-	-	-	-	-
# of cars in curbside lane	-	0.99	-	0.98	-	0.98	-	0.98	-	0.98	-
# of double-parked cars	-	-	-	-	-	-	-	-	-	-	-
# of triple-parked cars	-	-	-	-	-	-	-	-	-	-	-
Curbside LOS		A		A		A		A		A	A
Roadway LOS	A	A	A	A	A	A	A	A	A	A	A

Quick Analysis Tool for Airport Roadways

QATAR v0.6 developed by LeighFisher in association with Dowling Associates, Inc.

Summary of Inputs and Assumptions

Model run by: Vhunt on 4/3/2015

Airport	BOS
Roadway location	Terminal E
Scenario	2017 Future, Curb 2
Level / type of roadway	Arrivals
Total lanes / approach lanes	3 / 2
Number of curbside zones	9
% of 1st lane full when next vehicle double parks	80%
% of 2nd lane full when next vehicle triple parks	50%
Crosswalk adjustment factor	100%
Regional adjustment factor	95%

Frontage and dwell time per curbside operation

Vehicle class	Vehicle parking length (feet)	Average dwell time (minutes)
Private Vehicle Pick-Up	25.0	4.6
Taxicabs	25.0	3.9
Economy Parking	40.0	0.6
MPA Employee	40.0	0.6
Water Taxi & Water Ferry	40.0	0.6
Interterminal	40.0	0.6
Rental Car and MBTA BL	70.0	0.9
Car Service	30.0	5.0
Other Shared Ride or Limo	30.0	5.0
Free Hotel or Other CS	40.0	1.5
MBTA Silver Line	70.0	0.9
Logan Express	50	1
Scheduled Bus Service	50	2
Charter Bus	50	3

Assumptions by zone

Zone ID	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9
Name	Pax Pickup	CW1	Pax Pickup	CW2	Pax Pickup	CW3	Pax Pickup	CW4	CourtesyBus
Type	active	xwalk	active	xwalk	active	xwalk	active	xwalk	active
Curbside frontage (feet)	190	20	115	20	115	20	115	20	50
Number of lanes	3	3	3	3	3	3	3	3	3
Number of approach lanes	2	2	2	2	2	2	2	2	2
Volume of vehicles using roadway (vph)									
Private Vehicle Pick-Up	454	454	454	454	454	454	454	454	454
Taxicabs	-	-	-	-	-	-	-	-	-
Economy Parking	-	-	-	-	-	-	-	-	-
MPA Employee	-	-	-	-	-	-	-	-	-
Water Taxi & Water Ferry	-	-	-	-	-	-	-	-	-
Interterminal	-	-	-	-	-	-	-	-	-
Rental Car and MBTA BL	-	-	-	-	-	-	-	-	-
Car Service	-	-	-	-	-	-	-	-	-
Other Shared Ride or Limo	-	-	-	-	-	-	-	-	-
Free Hotel or Other CS	13	13	13	13	13	13	13	13	13
MBTA Silver Line	-	-	-	-	-	-	-	-	-
Logan Express	-	-	-	-	-	-	-	-	-
Scheduled Bus Service	-	-	-	-	-	-	-	-	-
Charter Bus	-	-	-	-	-	-	-	-	-
Volume of vehicles using curbside (vph)									
Private Vehicle Pick-Up	63	-	38	-	38	-	38	-	-
Taxicabs	-	-	-	-	-	-	-	-	-
Economy Parking	-	-	-	-	-	-	-	-	-
MPA Employee	-	-	-	-	-	-	-	-	-
Water Taxi & Water Ferry	-	-	-	-	-	-	-	-	-
Interterminal	-	-	-	-	-	-	-	-	-
Rental Car and MBTA BL	-	-	-	-	-	-	-	-	-
Car Service	-	-	-	-	-	-	-	-	-
Other Shared Ride or Limo	-	-	-	-	-	-	-	-	-
Free Hotel or Other CS	-	-	-	-	-	-	-	-	13
MBTA Silver Line	-	-	-	-	-	-	-	-	-
Logan Express	-	-	-	-	-	-	-	-	-
Scheduled Bus Service	-	-	-	-	-	-	-	-	-
Charter Bus	-	-	-	-	-	-	-	-	-

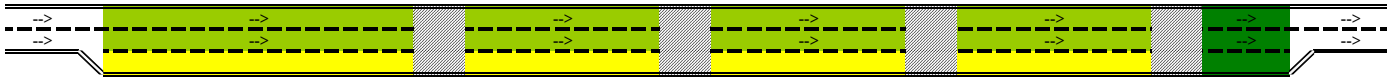
Quick Analysis Tool for Airport Roadways

QATAR v0.6 developed by LeighFisher in association with Dowling Associates, Inc.

Results: Level-of-Service by Zone

Model run by: Vhunt on 4/3/2015

Airport	BOS
Roadway location	Terminal E
Scenario	2017 Future, Curb 2
Level / type of roadway	Arrivals
Total lanes / approach lanes	3 / 2
Number of curbside zones	9



Zone ID	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9
Name/description	Pax Pickup	CW1	Pax Pickup	CW2	Pax Pickup	CW3	Pax Pickup	CW4	CourtesyBus
Curb length (feet)	190	20	115	20	115	20	115	20	50
Zone type	active	xwalk	active	xwalk	active	xwalk	active	xwalk	active
Roadway volume (vph)	467	467	467	467	467	467	467	467	467
Roadway capacity (vph)	1,805	2,657	1,676	2,657	1,676	2,657	1,676	2,657	1,976
Roadway V/C ratio	0.259	0.176	0.279	0.176	0.279	0.176	0.279	0.176	0.236
Roadway LOS	B	A	B	A	B	A	B	A	A
Curb demand (# in sys 95% of time)	9.0	N/A	6.0	N/A	6.0	N/A	6.0	N/A	1.0
Curb capacity per lane (vehicles)	8.0	N/A	5.0	N/A	5.0	N/A	5.0	N/A	1.0
Curb utilization ratio	1.125	N/A	1.200	N/A	1.200	N/A	1.200	N/A	1.000
Curb LOS	C	N/A	C	N/A	C	N/A	C	N/A	A

Level-of-service (LOS) key:

A
B
C
D
E
F

Quick Analysis Tool for Airport Roadways

QATAR v0.6 developed by LeighFisher in association with Dowling Associates, Inc.

Results: Detailed Report By Zone

Model run by: Vhunt on 4/3/2015

ID	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9
Name	Pax Pickup	CW1	Pax Pickup	CW2	Pax Pickup	CW3	Pax Pickup	CW4	CourtesyBus
Type of zone	active	xwalk	active	xwalk	active	xwalk	active	xwalk	active
Curbside length (feet)	190	20	115	20	115	20	115	20	50
Number of lanes	3	3	3	3	3	3	3	3	3
Number of approach lanes	2	2	2	2	2	2	2	2	2
Roadway volume (vph)	467	467	467	467	467	467	467	467	467
Curbside demand (vph)	63	-	38	-	38	-	38	-	13
Average dwell time (minutes)	4.60	-	4.60	-	4.60	-	4.60	-	1.50
Average vehicle length (feet)	25.00	-	25.00	-	25.00	-	25.00	-	40.00
Average vehicle arrival rate (vph)	63.00	-	38.00	-	38.00	-	38.00	-	13.00
Crosswalk adjustment factor	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Regional adjustment factor	95.0%	95.0%	95.0%	95.0%	95.0%	95.0%	95.0%	95.0%	95.0%
Through lane roadway capacity	1,901	2,797	1,765	2,797	1,765	2,797	1,765	2,797	2,082
Adjusted through lane roadway capacity	1,805	2,657	1,676	2,657	1,676	2,657	1,676	2,657	1,976
Estimated roadway V/C ratio	0.259	0.176	0.279	0.176	0.279	0.176	0.279	0.176	0.236
Curb capacity per lane (vehicles)	8.00	-	5.00	-	5.00	-	5.00	-	1.00
Curb utilization ratio	1.125	-	1.200	-	1.200	-	1.200	-	1.000
% occupancy in lane 1	0.960	-	0.995	-	0.995	-	0.995	-	0.895
% occupancy in lane 2	0.160	-	0.195	-	0.195	-	0.195	-	0.095
% occupancy in lane 3	-	-	-	-	-	-	-	-	-
# of cars in curbside lane	7.68	-	4.98	-	4.98	-	4.98	-	0.90
# of double-parked cars	1.28	-	0.98	-	0.98	-	0.98	-	0.10
# of triple-parked cars	-	-	-	-	-	-	-	-	-
Curbside LOS	C		C		C		C		A
Roadway LOS	B	A	B	A	B	A	B	A	A

Quick Analysis Tool for Airport Roadways

QATAR v0.6 developed by LeighFisher in association with Dowling Associates, Inc.

Summary of Inputs and Assumptions

Model run by: Vhunt on 1/28/2015

Airport	BOS
Roadway location	Terminal E
Scenario	2017 Future, Departures
Level / type of roadway	Departures
Total lanes / approach lanes	4 / 2
Number of curbside zones	1
% of 1st lane full when next vehicle double parks	80%
% of 2nd lane full when next vehicle triple parks	50%
Crosswalk adjustment factor	100%
Regional adjustment factor	95%

Frontage and dwell time per curbside operation

Vehicle class	Vehicle parking length (feet)	Average dwell time (minutes)
Private Vehicle Drop-Off	25.0	1.7
Rental Car Drop-Off	25.0	1.7
Taxicabs	25.0	1.3
Economy Parking	40.0	0.6
MPA Employee	40.0	0.6
Water Taxi & Water Ferry	40.0	0.6
Interterminal	40.0	0.6
Rental Car and MBTA BL	70.0	0.9
Car Service	30.0	2.0
Other Shared Ride or Limo	30.0	0.9
Free Hotel or Other CS	40.0	1.5
MBTA Silver Line	70	1
Logan Express	50	1
Scheduled Bus Service	50	2
Charter Bus	50	2

Assumptions by zone

Zone ID	Zone 1
Name	All
Type	active
Curbside frontage (feet)	635
Number of lanes	4
Number of approach lanes	2

Volume of vehicles using roadway (vph)

Private Vehicle Drop-Off	177
Rental Car Drop-Off	15
Taxicabs	112
Economy Parking	-
MPA Employee	-
Water Taxi & Water Ferry	-
Interterminal	-
Rental Car and MBTA BL	12
Car Service	34
Other Shared Ride or Limo	9
Free Hotel or Other CS	13
MBTA Silver Line	-
Logan Express	7
Scheduled Bus Service	6
Charter Bus	2

Volume of vehicles using curbside (vph)

Private Vehicle Drop-Off	177
Rental Car Drop-Off	15
Taxicabs	112
Economy Parking	-
MPA Employee	-
Water Taxi & Water Ferry	-
Interterminal	-
Rental Car and MBTA BL	12
Car Service	34
Other Shared Ride or Limo	9
Free Hotel or Other CS	13
MBTA Silver Line	-
Logan Express	7
Scheduled Bus Service	6
Charter Bus	2

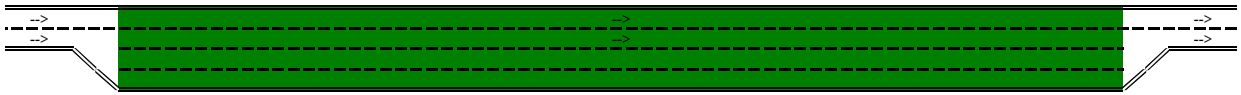
Quick Analysis Tool for Airport Roadways

QATAR v0.6 developed by LeighFisher in association with Dowling Associates, Inc.

Results: Level-of-Service by Zone

Model run by: Vhunt on 1/28/2015

Airport	BOS
Roadway location	Terminal E
Scenario	2017 Future, Departures
Level / type of roadway	Departures
Total lanes / approach lanes	4 / 2
Number of curbside zones	1



Zone ID	**Zone 1**
Name/description	All
Curb length (feet)	635
Zone type	active
Roadway volume (vph)	387
Roadway capacity (vph)	2,721
Roadway V/C ratio	0.142
Roadway LOS	A
Curb demand (# in sys 95% of time)	16.0
Curb capacity per lane (vehicles)	22.0
Curb utilization ratio	0.727
Curb LOS	A

Level-of-service (LOS) key:

A
B
C
D
E
F

Quick Analysis Tool for Airport Roadways

QATAR v0.6 developed by LeighFisher in association with Dowling Associates, Inc.

Results: Detailed Report By Zone

Model run by: Vhunt on 1/28/2015

ID	Zone 1
Name	All
Type of zone	active
Curbside length (feet)	635
Number of lanes	4
Number of approach lanes	2
Roadway volume (vph)	387
Curbside demand (vph)	387
Average dwell time (minutes)	1.56
Average vehicle length (feet)	28.42
Average vehicle arrival rate (vph)	387.00
Crosswalk adjustment factor	100.0%
Regional adjustment factor	95.0%
Through lane roadway capacity	2,866
Adjusted through lane roadway capacity	2,721
Estimated roadway V/C ratio	0.142
Curb capacity per lane (vehicles)	22.00
Curb utilization ratio	0.727
% occupancy in lane 1	0.720
% occupancy in lane 2	-
% occupancy in lane 3	-
# of cars in curbside lane	15.84
# of double-parked cars	-
# of triple-parked cars	-
Curbside LOS	A
Roadway LOS	A

Appendix C
Noise Data

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HMMH
77 South Bedford Street
Burlington, Massachusetts 01803
781.229.0707
www.hmmh.com

TECHNICAL MEMORANDUM

To:	Massport
From:	Robert Mentzer Jr., HMMH
Date:	May 19, 2015
Subject:	Terminal E Enhancements Project - Aircraft Noise
Reference:	Project #307290

1. AIRCRAFT UPGRADES

The Terminal E Renovations and Enhancement Project proposed action includes upgrading three gates at Terminal E to handle Group VI aircraft such as the A380 and the B747-8. By 2017, some international carriers have proposed switching current Group V aircraft to Group VI aircraft. These larger aircraft need modifications at the Terminal in order to ensure efficient boarding and exiting the aircraft. The Terminal E Enhancement Project addresses these changes. The 2017 aircraft types on certain routes have been up-gaged and are proposed to use Terminal E. These Group VI aircraft are certificated Stage 4[1] and overall generate lower noise levels on a per flight basis (in addition to carrying additional passengers) than the aircraft operating on those routes today. The following Airlines and routes would be upgraded to Group VI aircraft.

Table 1 Current and Future Airlines and Aircraft Types

	Arrivals		
Air Carrier	Origin	2014 Aircraft Type	2017 Aircraft Type
British Airways	London	B747-400	A380-841
Emirates	Dubai	B777-300ER	A380-861
Lufthansa	Frankfurt	B747-400	B747-8
	Departures		
Air Carrier	Destination	2014 Aircraft Type	2017 Aircraft Type
British Airways	London	B747-400	A380-841
Emirates	Dubai	B777-300ER	A380-861
Lufthansa	Frankfurt	B747-400	B747-8

Source: AECOM, 2015
Note: BA currently has two flights per day between Logan Airport and London and may reduce to one flight per day in the future.

There are four arrivals and departures which will be upgraded to Group VI aircraft, two flights to and from London on British Airways, one flight to and from Dubai on Emirates and one flight to and from Frankfurt on Lufthansa.

1.1 Certification Data

Table 2 provides the aircraft certification values for each aircraft type operating in 2014 and expected to be operating in 2017. For lateral (sideline) and arrivals all of the Group VI aircraft have lower certificated values than the aircraft operating today with the lateral reduction greater than 4 dB and the arrival reduction between 3 to 5 dB. For departures the A380-841 and the B747-8 have reductions compared to today with the

[1] Stage 4 Aircraft are certificated with a cumulative 10 dB reduction below Stage 3 standards.

A380-841 2.4.dB less and the B747-8 3.5 dB less. Only the A380-641 shows a 2.6 dB increase compared to the B777-300ER operating today.

Table 2 Certificated Noise Levels for Aircraft

			NOISE LEVELS (EPNdB)			Difference in Noise Level Compared to 2014		
	MTOW	MLW	Lateral	Departure	Arrival	Lateral	Departure	Arrival
Aircraft Types	(kg)	(kg)	LEVEL	LEVEL	LEVEL	LEVEL	LEVEL	LEVEL
2014								
B747-400	396,893	285,763	98.8	98.0	103.4		-	-
B777-300ER	351,534	251,290	98.7	92.8	100.5		-	-
B747-400	396,893	285,763	98.8	98.0	103.4		-	-
2017								
A380-841	569,000	391,000	94.2	95.6	98.0	-4.6	-2.4	-5.4
A380-861	569,000	391,000	94.4	95.4	97.2	-4.3	2.6	-3.3
B747-8	447,696	312,072	94.0	94.5	100.4	-4.8	-3.5	-3.0

Source: EASA Type-Certificate Data Sheets for Noise (TCDSN), 2015
Note: MTOW – Maximum Takeoff Weight and MLW – Maximum Landing Weight

1.2 Single Event Level Graphics

Single Event Level (SEL) contours were developed using the Federal Aviation Administration (FAA) Integrated Noise Model (INM) using a 10,000' runway and Boston Logan annual weather conditions. These were developed for each route so that the aircraft Stagelength (which is a surrogate for weight) was included in the results. The SEL contour includes an arrival to the runway and a departure. The SEL contours used INM standard profiles for arrival and departure. For arrivals, most of the profiles include a level segment at 3,000' Above Field Elevation (AFE) which is a typical average arrival profile at an airport.

Figure 1 displays the SEL contours for one daily British Airways (BA) flights to and from London (Stagelength 6) each day. BA currently operates this round trip flight twice a day.

The A380-841 aircraft is quieter on approach and on departure compared to the current B747-400 aircraft affecting a smaller region around the airport with aircraft noise. The reductions also on sideline during takeoff will be a benefit to nearby communities to the airport.

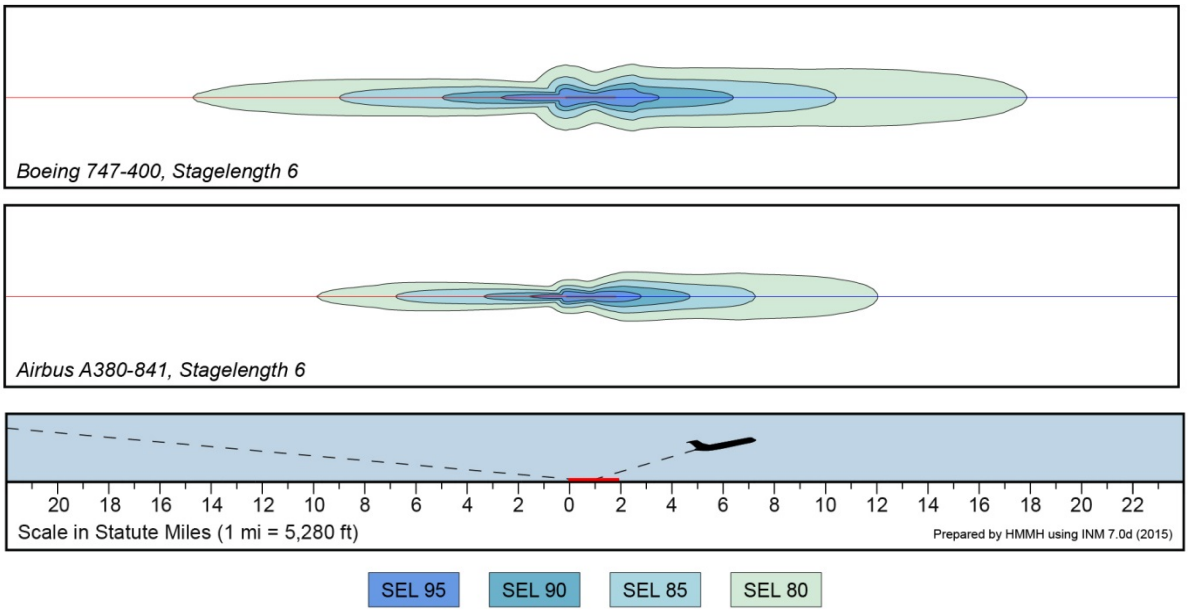

Figure 1. British Airways Aircraft To and From London.

Figure 2 displays the SEL contours for one daily Emirates flight to and from Dubai (Stagelength 8) each day.

The A380-861 aircraft is quieter on approach and while the initial climb is slightly louder on departure, the departure length of the SEL 80 dB contour is no longer than the current B777-300ER aircraft. In addition the large reductions on sideline during takeoff will be a benefit to nearby communities to the airport resulting in an overall lower noise footprint than today.

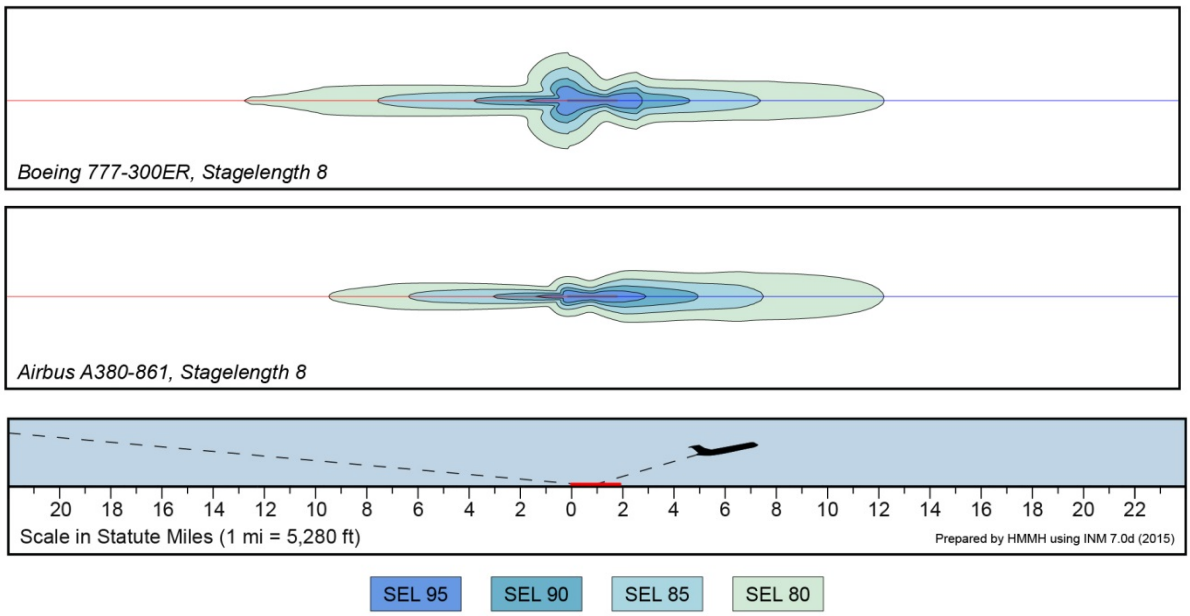

Figure 2. Emirates Aircraft To and From Dubai.

Figure 3 displays the SEL contours for one daily Lufthansa flight to and from Frankfurt (Stagelength 6) each day.

The B747-8 aircraft is quieter on departure compared to the current B747-400 aircraft affecting a smaller region around the airport with aircraft noise. The arrival SEL 85 – 95 dB contours are similar between the two aircraft types however the B747-8 has a small extended area in the SEL 80 dB contour due to the level approach part of the profile for that aircraft. The reductions also on sideline during takeoff will be a benefit to nearby communities to the airport.

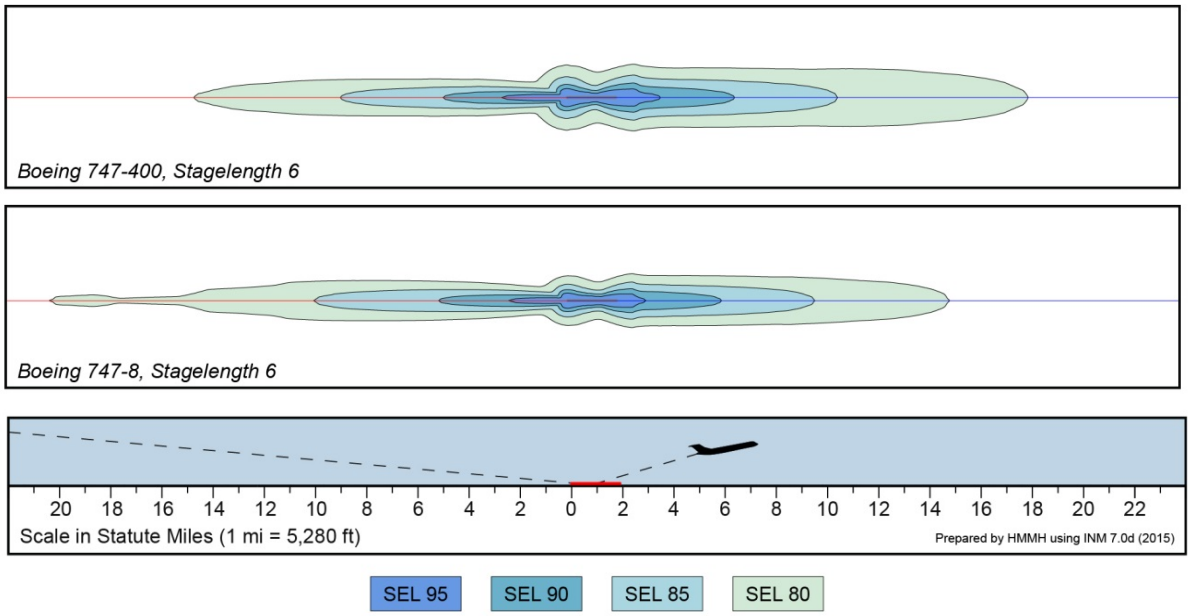

Figure 3. Lufthansa Aircraft To and From Frankfurt.

2. CONCLUSION

These SEL contours and the certificated data demonstrate that the replacement in 2017 by the efficient Group VI aircraft will not increase the noise levels around Boston Logan Airport and will most likely reduce average levels in the community and will as shown here result in reductions on a single event basis. The use of these aircraft is consistent with the broader, long-term industry trend of more passengers per flight. Over the long run, when compared to 15 to 20 years ago, for example, new engine technology, improved aircraft design and more passengers per flight has resulted in significant noise reductions while still accommodation passenger growth and not increasing airport capacity

Appendix D
Agency Correspondence

- Massachusetts Division of Fisheries & Wildlife, Natural Heritage & Endangered Species Program (NHESP)
July 9, 2015

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Commonwealth of Massachusetts

Division of Fisheries & Wildlife

MassWildlife

Jack Buckley, *Director*

July 9, 2015

Stewart Dalzell
Massachusetts Port Authority
One Harborside Drive
East Boston, MA 02128

RE: Applicant: Massachusetts Port Authority
Project Location: Logan International Airport, BOSTON
Project Description: Airfield improvements including stabilization of runway and taxiway shoulders
NHESP File No.: 15-34379

Dear Applicant:

The Natural Heritage & Endangered Species Program of the Massachusetts Division of Fisheries & Wildlife (the "Division") received the MESA Project Review Checklist and other required materials for review pursuant to the Massachusetts Endangered Species Act (MESA) (MGL c.131A) and its implementing regulations (321 CMR 10.00). The proposed airfield changes include the conversion of approximately 4.2 acres of mowed grass shoulders to pavement and the restoration of 4.8 acres of pavement to grassland habitat.

The MESA is administered by the Division, and prohibits the "take" of state-listed species. The "take" of state-listed species is defined as "in reference to animals, means to harass, harm, pursue, hunt, shoot, hound, kill, trap, capture, collect, process, disrupt the nesting, breeding, feeding or migratory activity or attempt to engage in any such conduct, or to assist such conduct….Disruption of nesting, breeding, feeding or migratory activity may result from, but is not limited to, the modification, degradation or destruction of Habitat." (321 CMR 10.02).

Based on the information provided and the information contained in our database, the Division finds that a portion of this project, as currently proposed, **must be conditioned** (321 CMR 10.18(2)(a)) in order to avoid a prohibited "take" of Grasshopper Sparrow (*Ammodramus savannarum*) and Upland Sandpiper (*Bartramia longicauda*) pursuant to the MESA. These species are protected pursuant to the MESA and are listed as "Threatened" and "Endangered", respectively. To avoid a prohibited "take" of state-listed species, the following conditions must be met:

1. Prior to the start of work, final project design plans shall be submitted to the Division for review and approval.

2. No work, including any site preparation and/or staging/stockpiling of materials shall occur during the bird breeding season (May 1 to July 31).

Division of Fisheries and Wildlife
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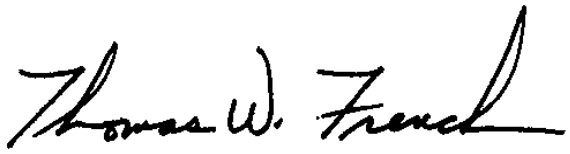
An Agency of the Department of Fish and Game

3. All grassland areas temporarily disturbed by construction activities and any pavement removal areas shall be restored to grasslands upon completion of the project. Proposed seed mixes shall be submitted to the Division for review and approval prior to use.

Provided the above-noted conditions are fully implemented and there are no changes to the project plans, this project will not result in a "take" of state-listed species. We note that all work is subject to the anti-segmentation provisions (321 CMR 10.16) of the MESA. This determination is a final decision of the Division of Fisheries and Wildlife pursuant to 321 CMR 10.18. Any changes to the proposed project or any additional work beyond that shown on the site plans may require an additional filing with the Division pursuant to the MESA. This project may be subject to further review if no physical work is commenced within five years from the date of issuance of this determination, or if there is a change to the project.

Please note that this determination addresses only the matter of state-listed species and their habitats. If you have any questions regarding this letter please contact Eve Schlüter, Ph.D., Chief of Regulatory Review, at 508-389-6346 or eve.schluter@state.ma.us.

Sincerely,



Thomas W. French, Ph.D.
Assistant Director

cc: Lisa Standley, VHB Inc.