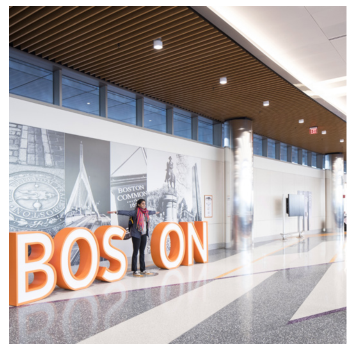
Boston-Logan International Airport



EDR

2016 Environmental Data Report

May 2018
EOEA #3247

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

SUBMITTED BY
Massachusetts Port Authority
Strategic & Business Planning

PREPARED BY
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May 15, 2018

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

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

Dear Secretary Beaton and Director Buckley:

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

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

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

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

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

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

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

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

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

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

EDR Content and Structure

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

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

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

Review Period, Distribution, and Consultation

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

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

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

Sincerely,

Massachusetts Port Authority

Stewart Dalzell

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

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

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Introduction/Executive Summary

Introduction

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

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

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

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

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

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

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

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

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

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

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

EEA # 3247

Submitted By

Massachusetts Port Authority
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Logan Airport Planning Context

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

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

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

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

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

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

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

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

FIGURE 1-1 Aerial View of Logan Airport

2016 Environmental Data Report

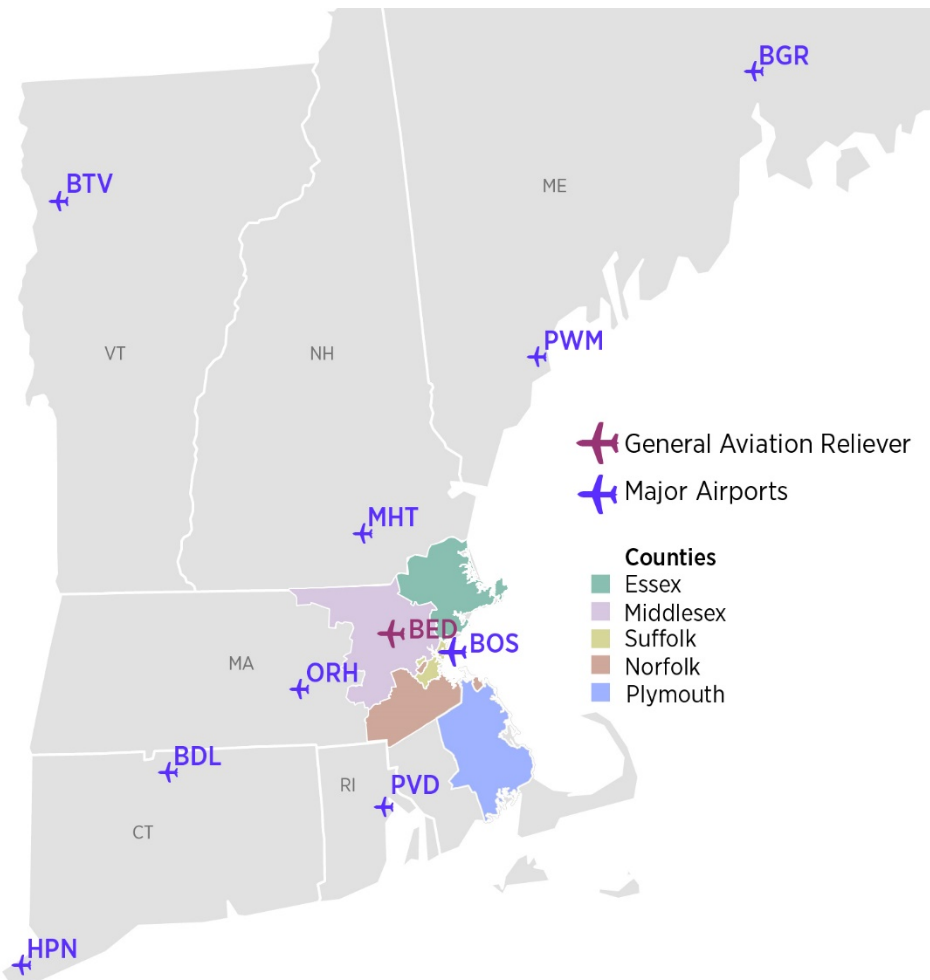
Source: USGS 2015

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

Logan Airport is a Regional Economic Driver

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

Figure 1-3 Boston Logan International Airport Catchment Area



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

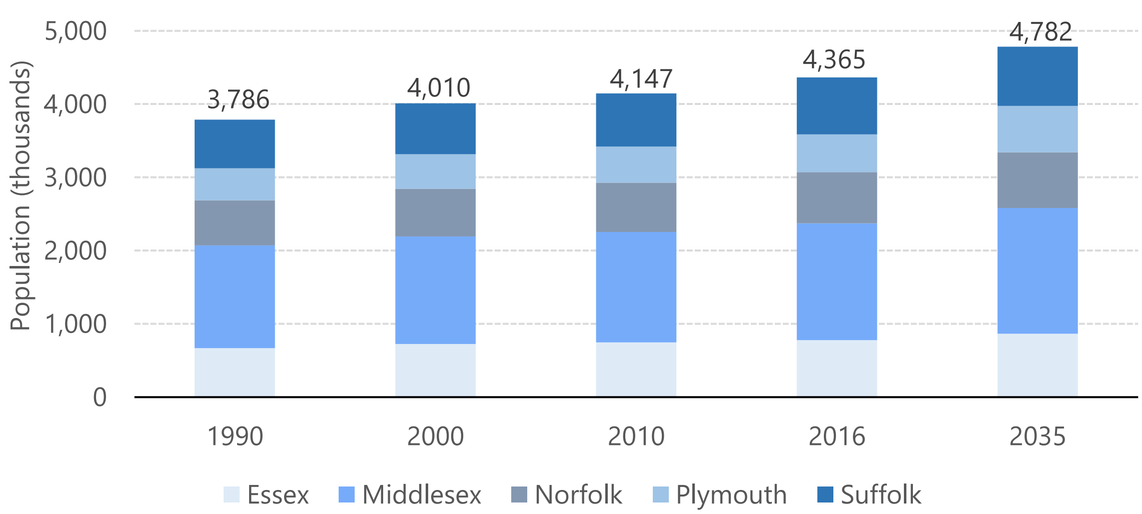
Table 1-1 Population of Logan Airport Primary Catchment Area, 1990, 2000, 2010, 2016

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

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

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

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



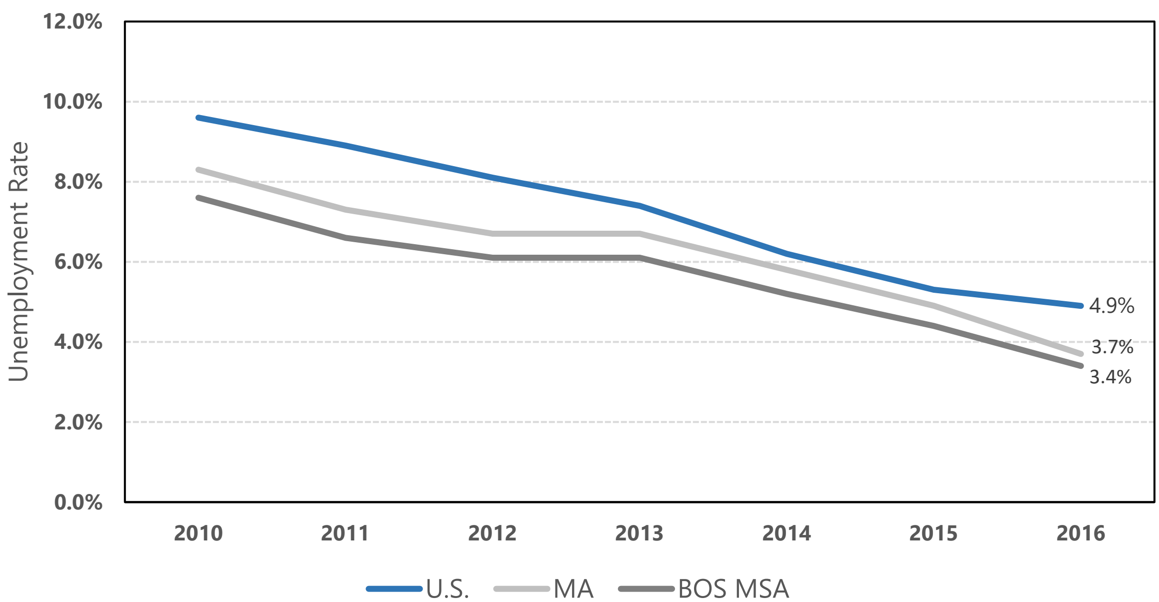
Source: Complete Economic and Demographic Data Source (CEDDS), Woods & Poole Economics, Inc., 2017.

Logan Airport's Regional Market

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

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

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



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

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

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

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

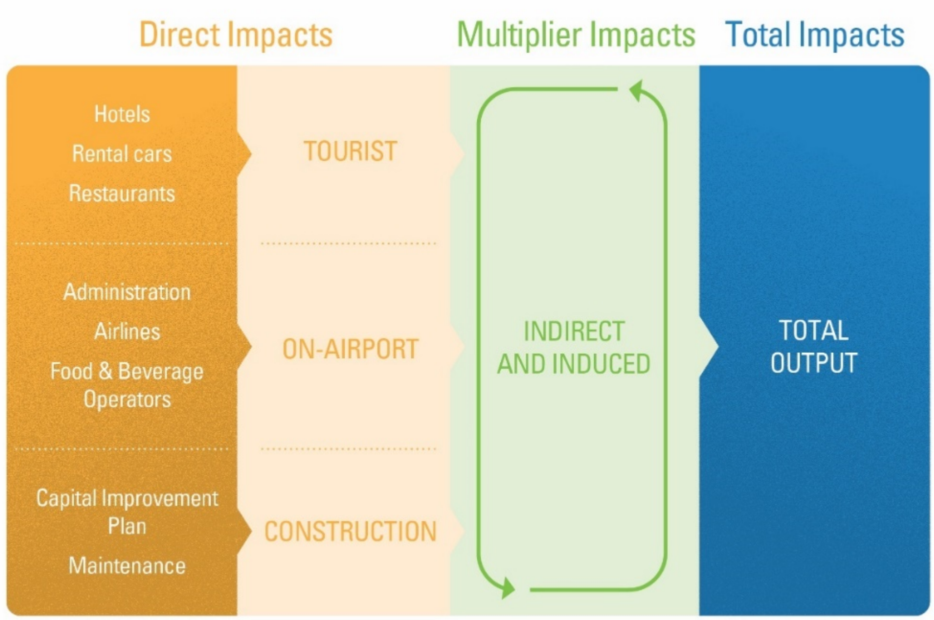
Another reflection of the strength of the Airport's regional market is its relatively low unemployment rate. The Boston metropolitan area has consistently maintained a lower unemployment rate than that of the Commonwealth and the entire country (see **Figure 1-5**). In 2016, the Boston MSA had an unemployment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

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

Logan Airport's Regional Economic Impacts

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

Figure 1-6 Airport Economic Impacts



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

9 *Ibid*.

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

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

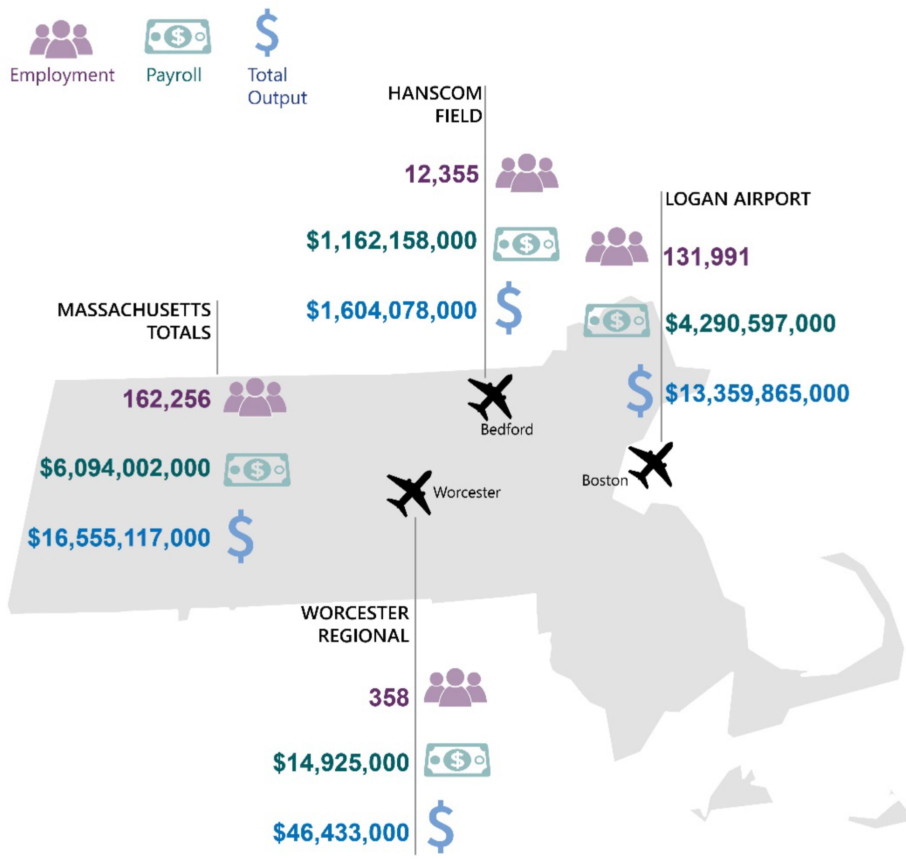
In addition to direct effects, Logan Airport generates multiplier effects in the surrounding region that consist of two categories: 1) the expenditure of Airport tenants; and 2) the re-spending of wages by Airport employees. As a result, money spent at the Airport is re-circulated in the local economy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

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

11 Includes residents and non-residents.

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

Figure 1-7 Total Economic Impact of Massachusetts Airports



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

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

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

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

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

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

Table 1-3 International Travel Impact on Massachusetts

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

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

Massport Partnerships

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

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

13 Latest available published information.

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

East Boston Foundation

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

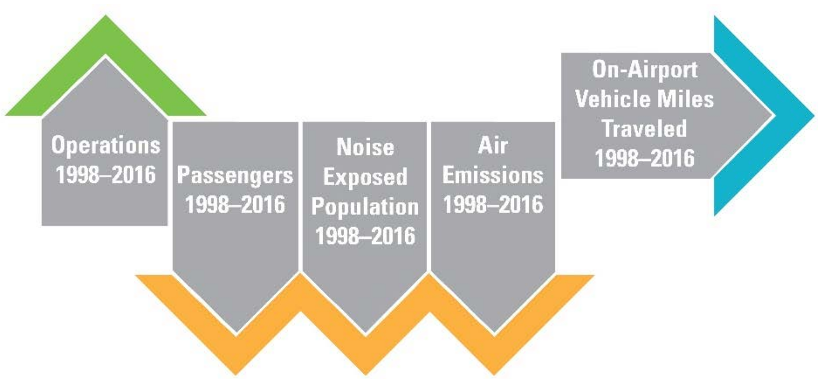
Massport Means Business

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

2016 Highlights and Key Findings

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

Figure 1-8 Summary of 2016 EDR Key Findings



Activity Levels

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

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

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

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

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

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

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

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

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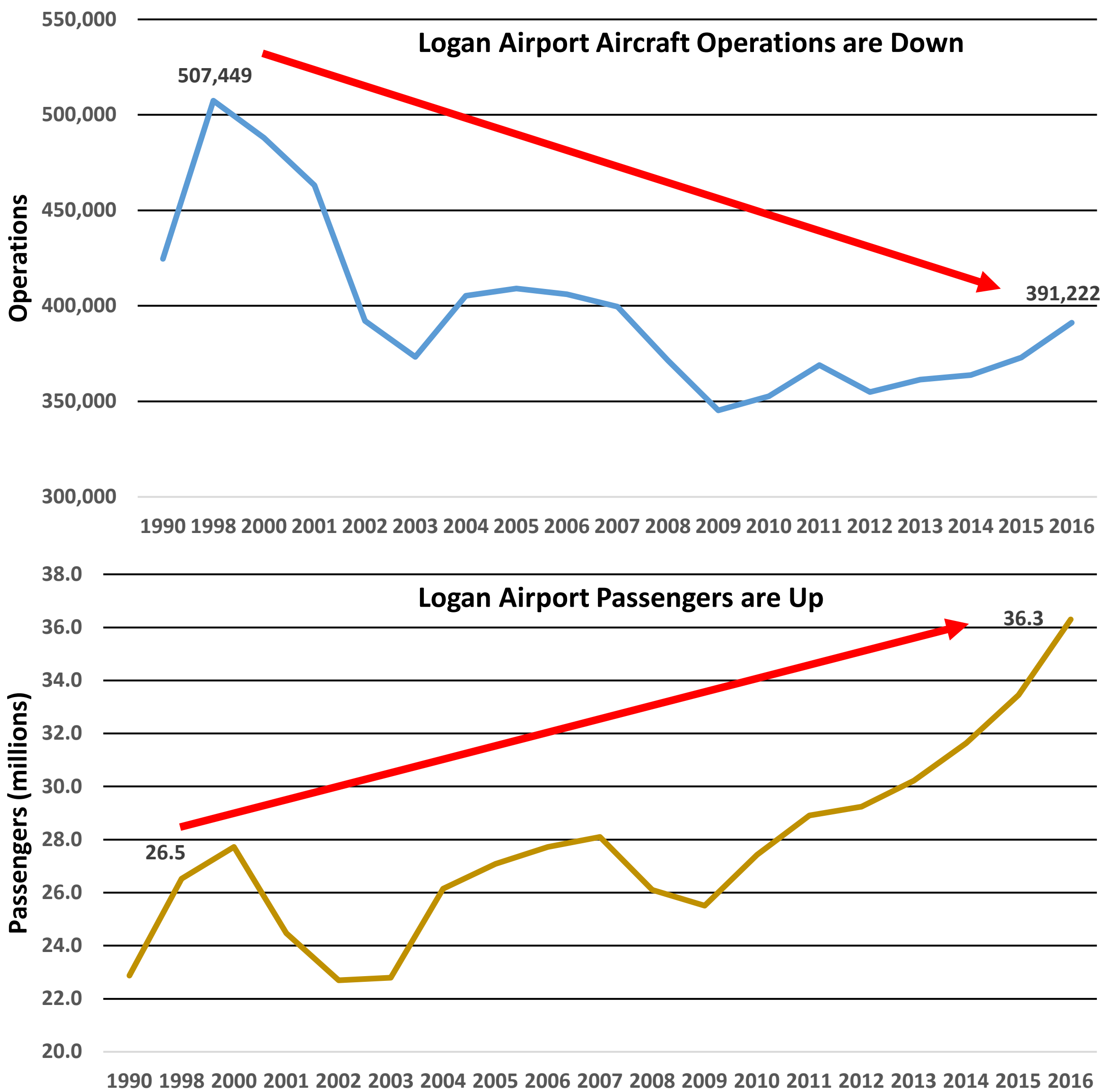
18 Excluding GA passengers.

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



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

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

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

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

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

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

Airport Planning

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

Terminal and Airside Projects

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

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

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

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

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

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

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

Enhanced Ground Access

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

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

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

24 310 Code of Massachusetts Regulations and 40 CFR 52.1120

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

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

Community Park and Open Space Projects

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

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

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

Planning Initiatives

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

Regional Transportation

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

Figure 1-11 New England Regional Transportation System

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

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

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

27 Based on airport passenger statistics from 1985 to 2016.

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

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

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

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

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

Ground Access to and from Logan Airport

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

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

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

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

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

Key findings on ground access conditions and activity levels include:

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

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

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

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

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

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

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

Noise Abatement

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

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

36 Diversions are the operational practice of sending vehicles desiring to park at a specific facility to another facility (on- or off-Airport) due to the initial facility being full.
37 Valeting is an operational practice where attendants park vehicles for travelers, typically due to the desire of maximizing the number of vehicles parked at a facility or on-Airport.
38 Nighttime hours are defined as 10:00 PM to 7:00 AM.
39 Note that 2016 was a leap year and has 366 days.

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

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

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

Operations, Fleet Mix, and Runway Use

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

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

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

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

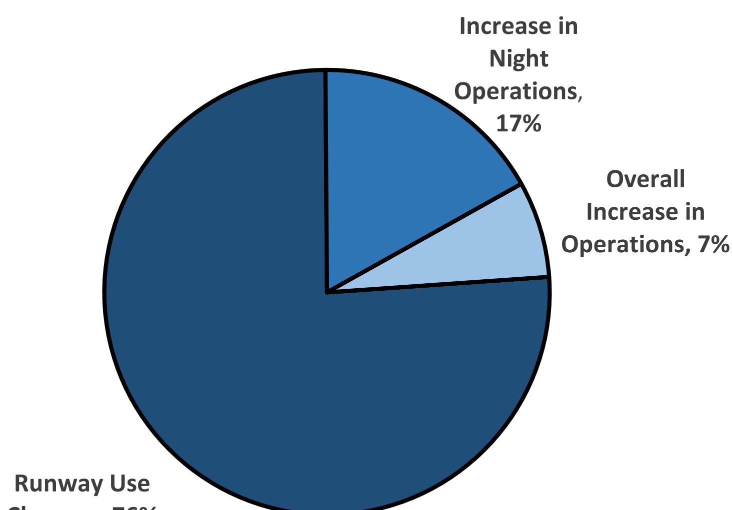
- The 2016 Flight Track Monitoring reports in Appendix H, *Noise Abatement,* show that 99 percent of shoreline crossings (locations where aircraft which have departed over the water pass back over land) were by aircraft flying above 6,000 feet, the same percentage as 2015. This results in lower day-night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

Noise Levels and Population

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

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

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

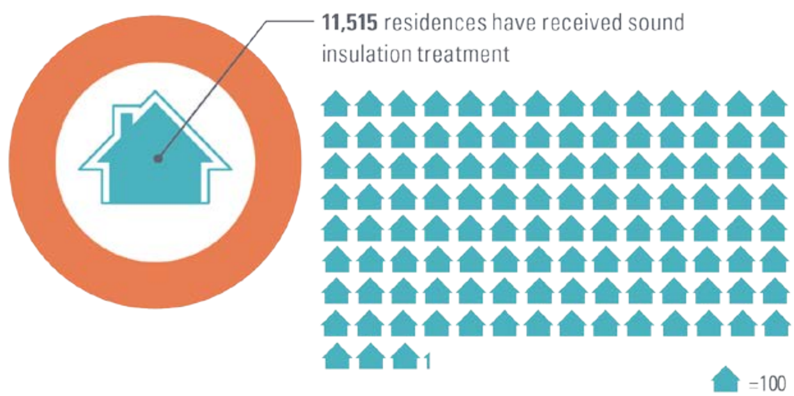


Note: When comparing the 2015 INM contour to the 2016 INM contour, there is an increase in noise exposed population. However, when comparing 2015 INM (the official 2015 model) and 2016 AEDT (the official 2016 model) there is a decrease in the noise exposed population.

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

- East Boston is affected by start-of-takeoff roll (SOTR) noise from Runway 15R and departure overflights from Runway 33L, both of which had increases in departures;
- Increases in departures from Runway 9 and Runway 27 had the effect of expanding the noise contour over Winthrop near Deer Island; and
- Other changes in the contour were in nonresidential or offshore areas, but these were similarly affected by runway use changes.

- An additional factor influencing noise contour changes in 2016 was an increase in nighttime operations, from 50,786 in 2015 to 55,499 in 2016. Due to the 10-dB penalty applied to modeled nighttime operations, these operations have a disproportionate effect on the contour.
- Noise exposed population in 2016 was below the peak levels reached in 1990 and was less than in the year 2000 when 17,745 people were exposed to DNL levels greater than or equal to DNL 65 dB. Population exposed to these noise levels for 2016 was calculated to be 16,985 using the legacy INM model, and 7,450 using the next-generation AEDT model.
- Massport is a national leader in sound insulation mitigation. To date, in the vicinity of Logan Airport, Massport has provided sound insulation for a total of 11,515 residential units, and will continue to seek funding for sound insulation for properties that are eligible and whose owners have chosen to participate.
- Almost all residences exposed to levels greater than or equal to DNL 65 dB in 2016 have been eligible in the past to participate in Massport's residential sound insulation program (RSIP).



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

FAA Reporting and Update

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

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

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

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

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

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

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

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

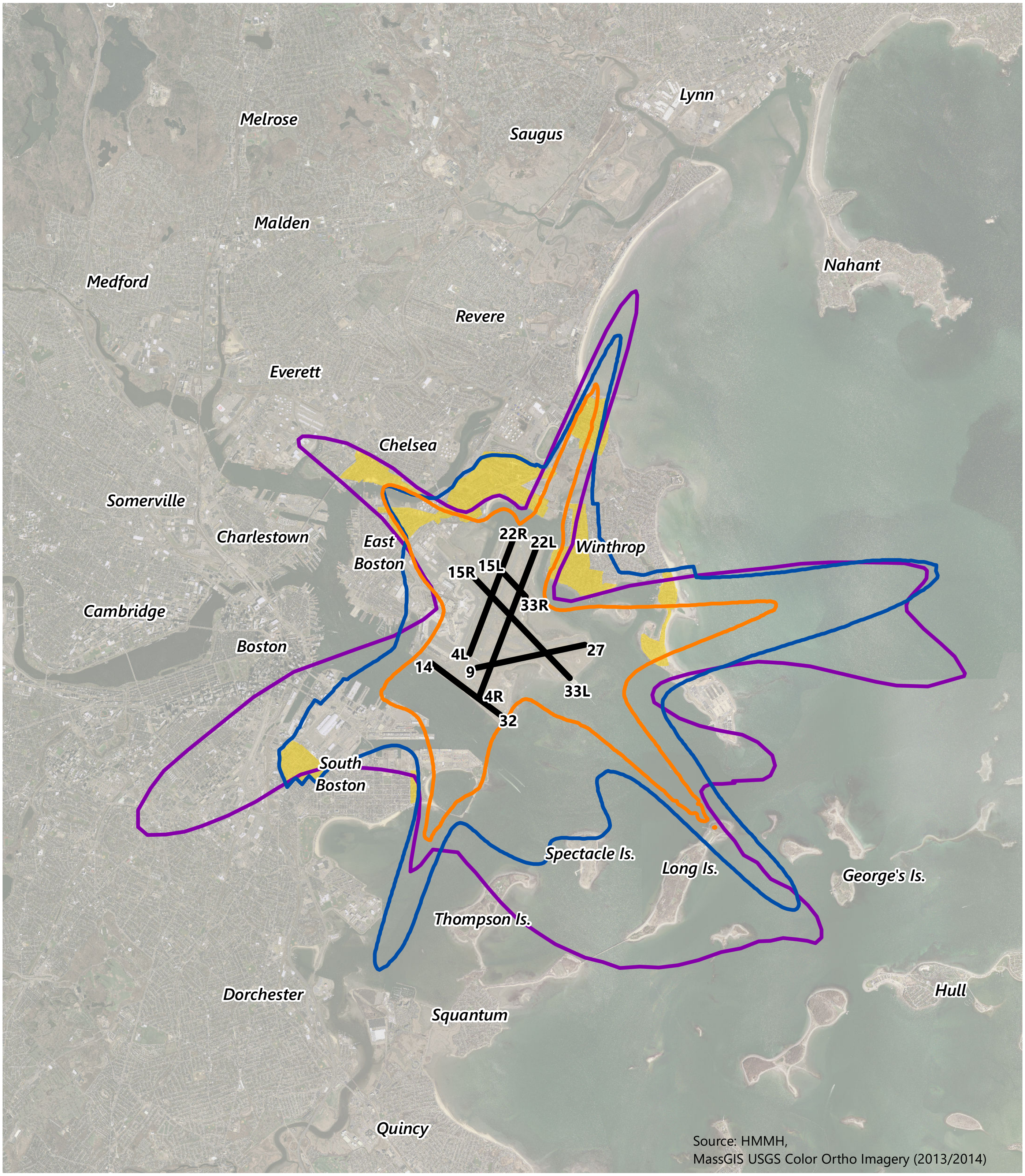


FIGURE 1-13 DNL 65 dB Contour Comparison with Historical Contour

2016 Environmental Data Report

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

0 2500 5000 10000 Feet

Air Quality/Emissions Reduction

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

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

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

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

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

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

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

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

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

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

Table 1-4 AEDT/EDMS Total Emissions Inventory Comparison

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

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

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

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

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

Water Quality/Environmental Compliance and Management

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

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

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

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

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

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

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

Sustainability and Resiliency at Logan Airport

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

Figure 1-14 EONS Approach to Sustainability

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

Figure 1-15 Recent Sustainability Highlights

- ✓ Five Leadership in Energy and Environmental Design (LEED) Certified Facilities at Logan Airport
- ✓ Sustainability Management Plan and Annual Reporting
- ✓ Sustainable Design Standards and Guidelines
- ✓ Climate Change and Resiliency Planning – 60% of Critical Assets Enhanced
- ✓ Rooftop Solar at Economy Garage, Rental Car Center, and Terminals A, B, and E
- ✓ Alternative Fuel Bus Shuttle Fleet
- ✓ Compressed Natural Gas Station
- ✓ Commitment to Community Park and Open Space - Over 33 Acres of Green Space in East Boston

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

Logan Airport Sustainability Management Plan (SMP)

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

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

Logan Airport Sustainability Goals

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

Table 1-5 Logan Airport Sustainability Goals and Descriptions

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

Sustainability in Planning, Design, and Construction

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

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

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

Figure 1-16 LEED-Certified Facilities at Logan Airport

- Signature Flight Support General Aviation Facility, LEED Certified (2008)
- Terminal A, LEED Certified (2006)
- Rental Car Center, LEED Gold Certified (2015)
- Green Bus Depot, LEED Silver Certified (2014)
- Terminal E New Large Aircraft Wing, LEED Gold Certified (2017)

Sustainable Design Standards and Guidelines and LEED Certification

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

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

Terminal A (LEED Certified) Completed 2005/2006

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

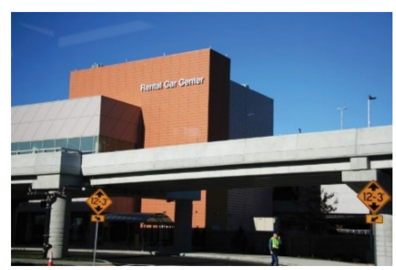
Signature Flight Support General Aviation Facility (LEED Certified) Completed 2007/2008

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

Green Bus Depot (LEED Silver) Completed 2014

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

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



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

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

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

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

Climate Change and Resiliency Planning

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

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

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

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

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

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

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

Logan Airport Environmental Review Process

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

Historical Context for the Logan Airport EDR/ESPR

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

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

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

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

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

Project-Specific Review

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

Organization of the *2016 EDR*

The remainder of this *2016 EDR* includes:

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

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

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

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

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

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

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

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

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

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

2

Activity Levels

Introduction

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

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

2016 Logan Airport Rankings

18th Busiest commercial airport in the U.S. by number of operations

17th Busiest commercial airport in the U.S. by number of passengers

11th Largest U.S. passenger gateway to the world

Source: ACI, 2017; USDOT, 2016

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

1 Refer to Appendix E, *Activity Levels* for available information dating back to 1980.

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

3 Between 2011 and 2016, Logan Airport was the 8th fastest growing airport in the U.S. in terms of domestic O&D traffic (U.S. DOT O&D Survey).

4 2016 ACI North American Airport Traffic Summary. http://www.aci-na.org/content/airport-traffic-reports.

5 An aircraft operation is defined as one arrival or one departure.

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

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

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

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

Air Passenger Levels in 2016

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

Logan Airport Passengers

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

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

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

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

6 Airports Council International. September 2017 *Worldwide Airport Traffic Report*.
7 U.S. DOT, T100 Database, YE 2016.
8 Massachusetts Aeronautics Commission. 2014. *Massachusetts Statewide Airport Economic Impact Study*. https://www.massdot.state.ma.us/portals/7/docs/airportEconomicImpactSummary.pdf.

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

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

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

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

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

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

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

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

14 U.S. DOT, T100 Database

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

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

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

Source: Massport

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

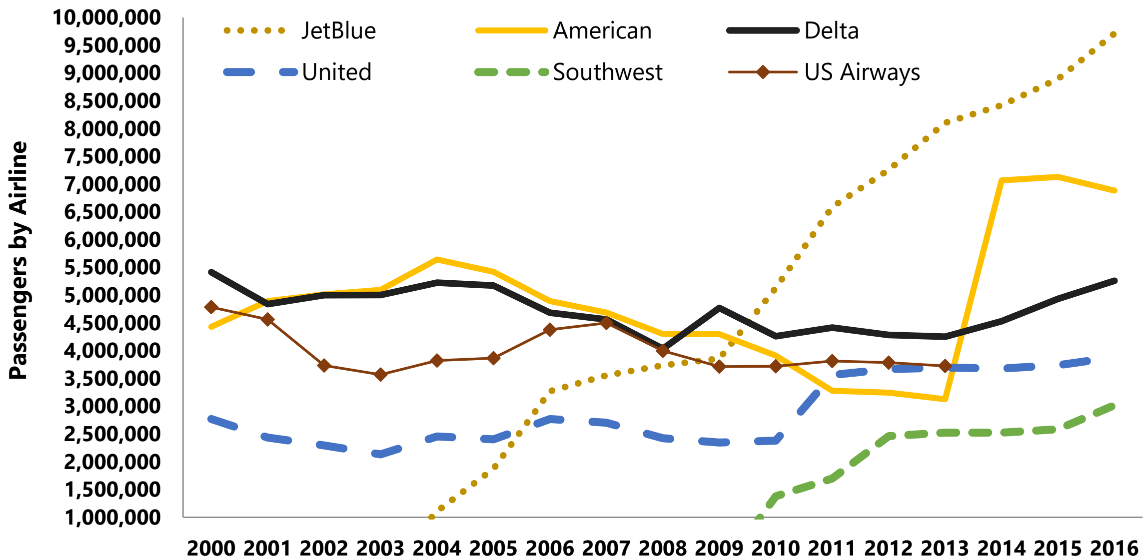
N/A Not available.

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

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

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

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



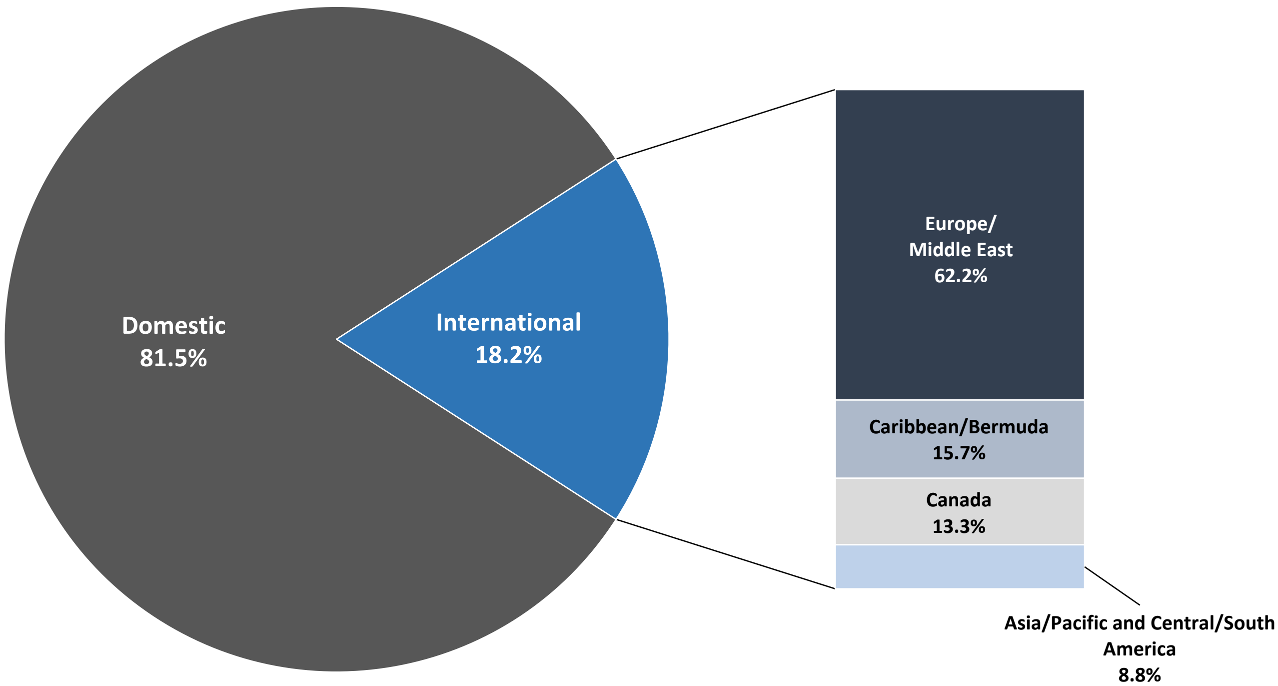
Source: Massport

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

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

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

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



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

Aircraft Operation Levels in 2016

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

Logan Airport Aircraft Operations

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

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

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

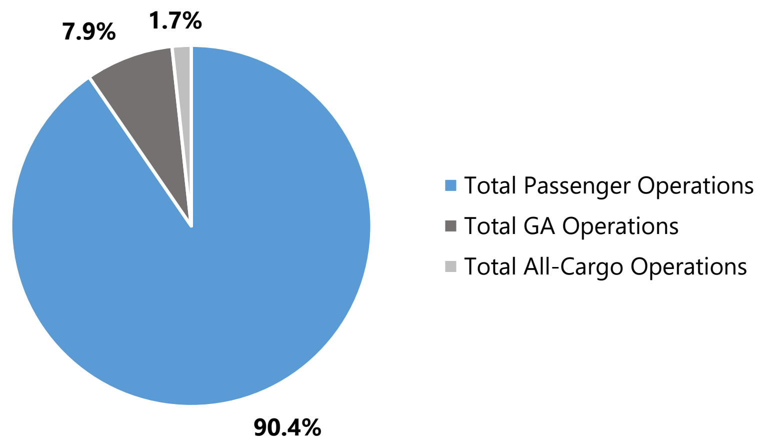
Source: Massport

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

N/A Not Available.

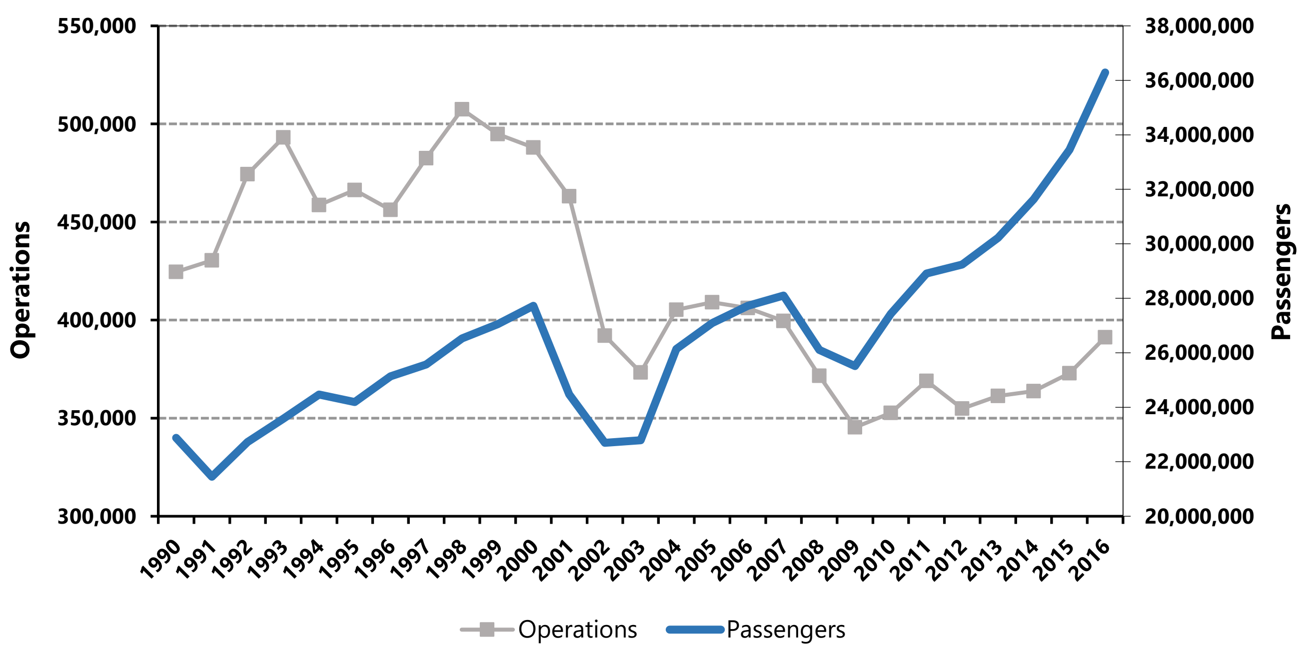
1 1998 represents the historic peak in terms of aircraft operations for Logan Airport.

Figure 2-4 Logan Airport 2016 Aircraft Operations by Type



Source: Massport

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



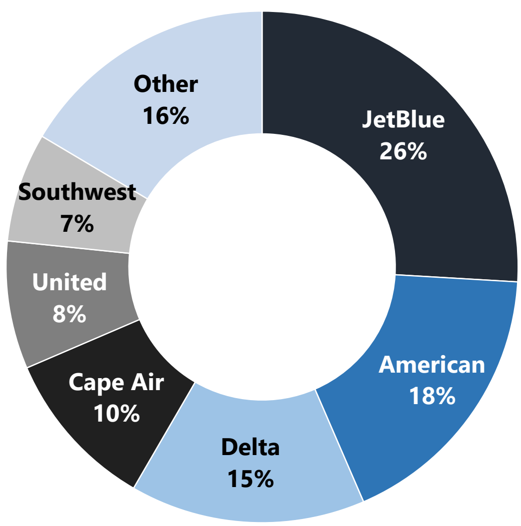
Source: Massport

Passenger Operations

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

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

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



Source: Massport

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

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

16 Aircraft operation numbers for airlines include regional partners and subsidiaries.

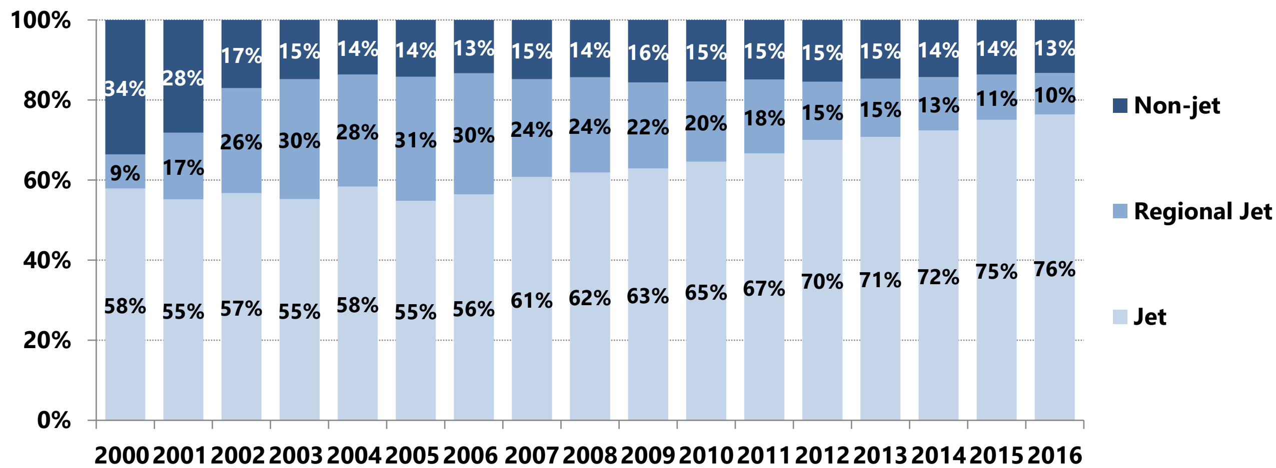
17 Totals aircraft operations for American Airlines, Delta Air Lines, and United Airlines include regional affiliates and contract carriers.

18 In this report, the term regional jet refers to small jet aircraft with fewer than 90 seats. The Embraer-190, operated by jetBlue Airways at Logan Airport, carries up to 100 passengers and is considered a jet.

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

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

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



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

Passengers per Aircraft and Load Factors

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

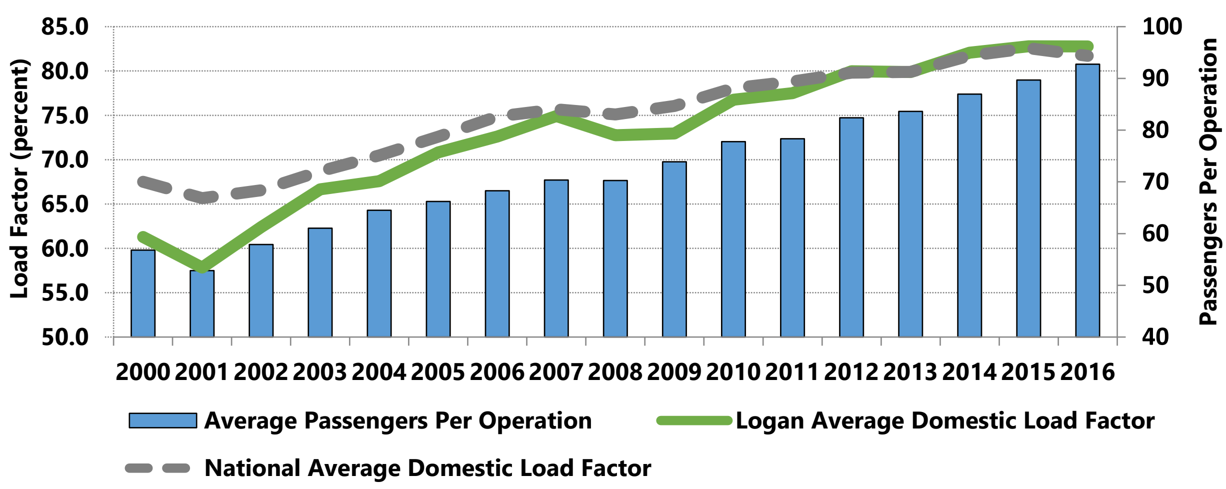
19 The number of passengers as a percentage of total seats operated at the airport.
20 U.S. DOT, T100 Database; includes scheduled passenger service only.

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

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

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

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



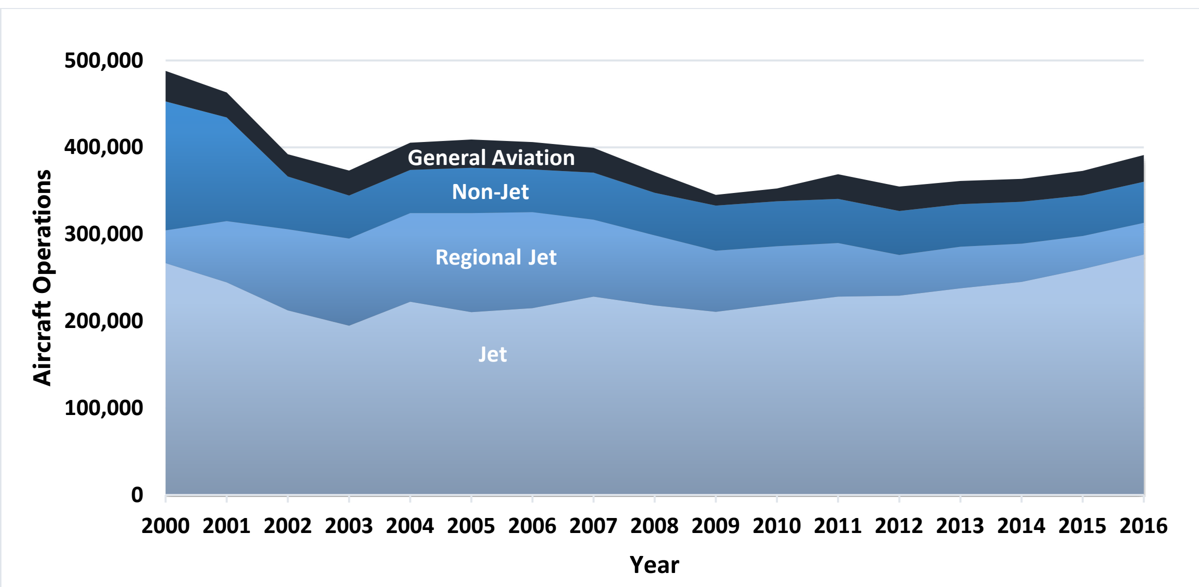
Source: Massport; U.S. Department of Transportation (DOT), T100 Database
Note: Includes scheduled passenger service only.

General Aviation Operations

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

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

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



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

All-Cargo Operations

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

Airline Passenger Service in 2016

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

Service Developments at Logan Airport

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

Changes in Domestic Passenger Service

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

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

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

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

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

22 Based on OAG Schedules.

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

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

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

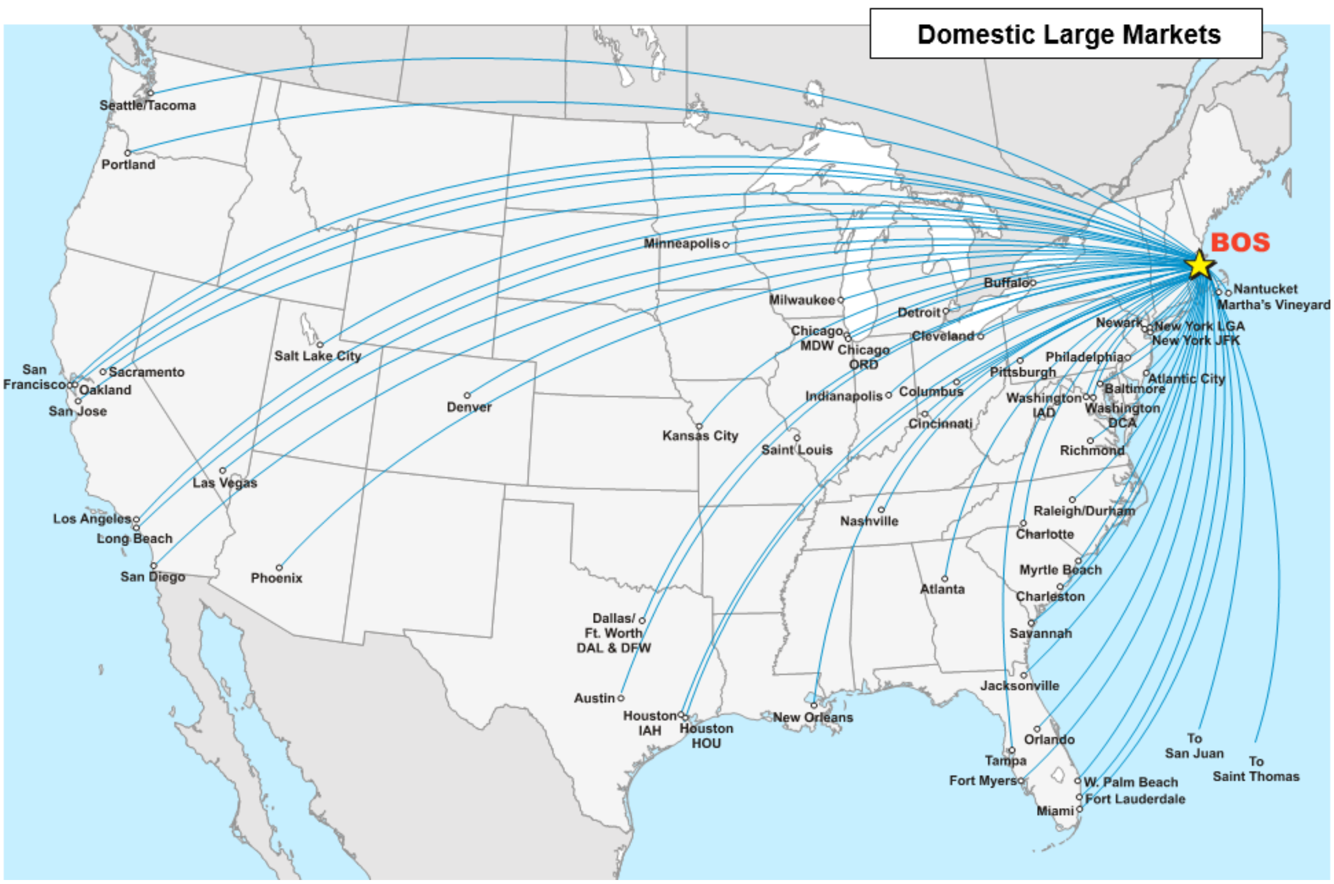
Highlights of key domestic airline service changes at Logan Airport in 2016 include:

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

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

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

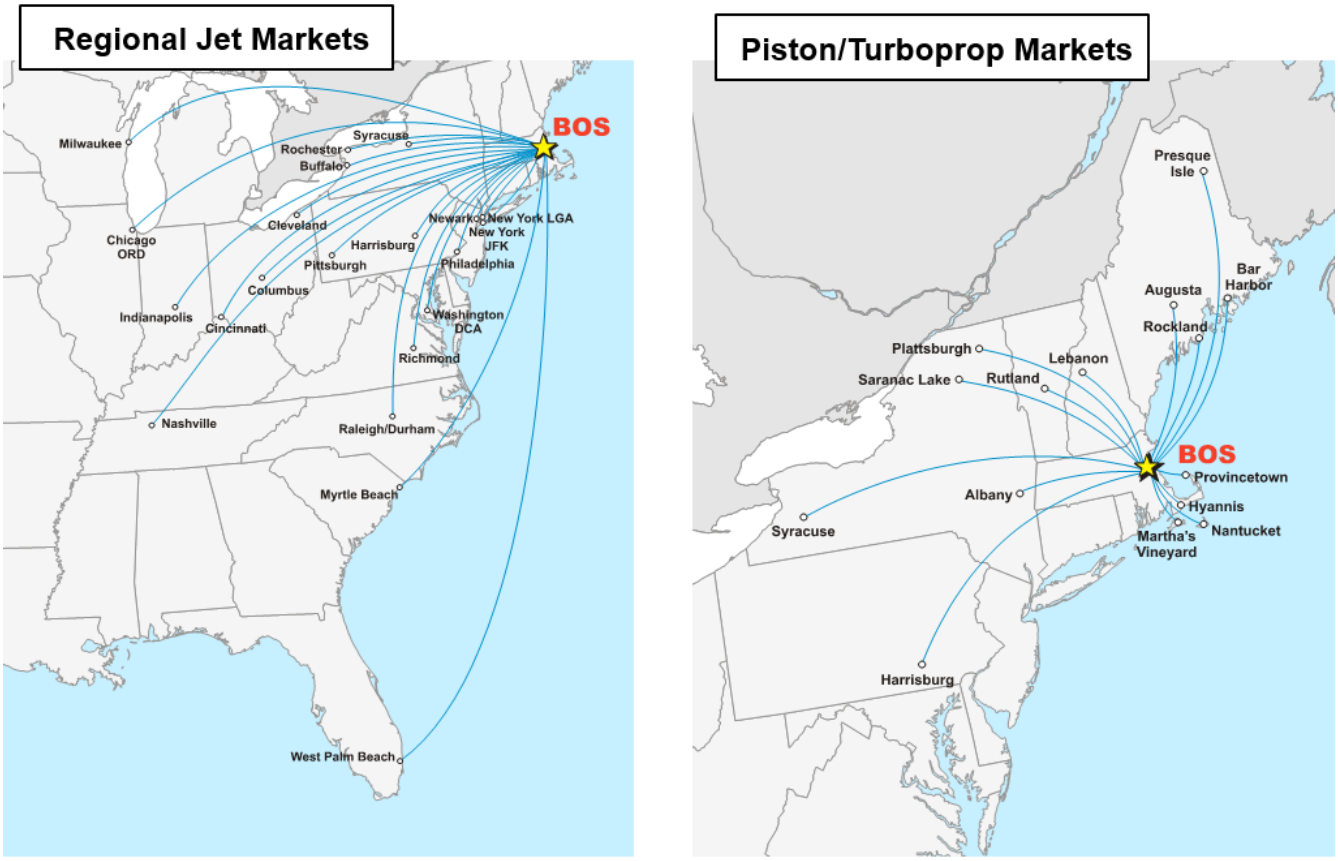
Figure 2-10 Domestic Non-stop Large Jet Markets Served from Logan Airport, July 2017



Source: Official Airline Guide Market Files

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

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



Source: Official Airline Guide Market Files

Changes in International Passenger Service

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

23 IATA Innovata Schedules

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

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

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

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

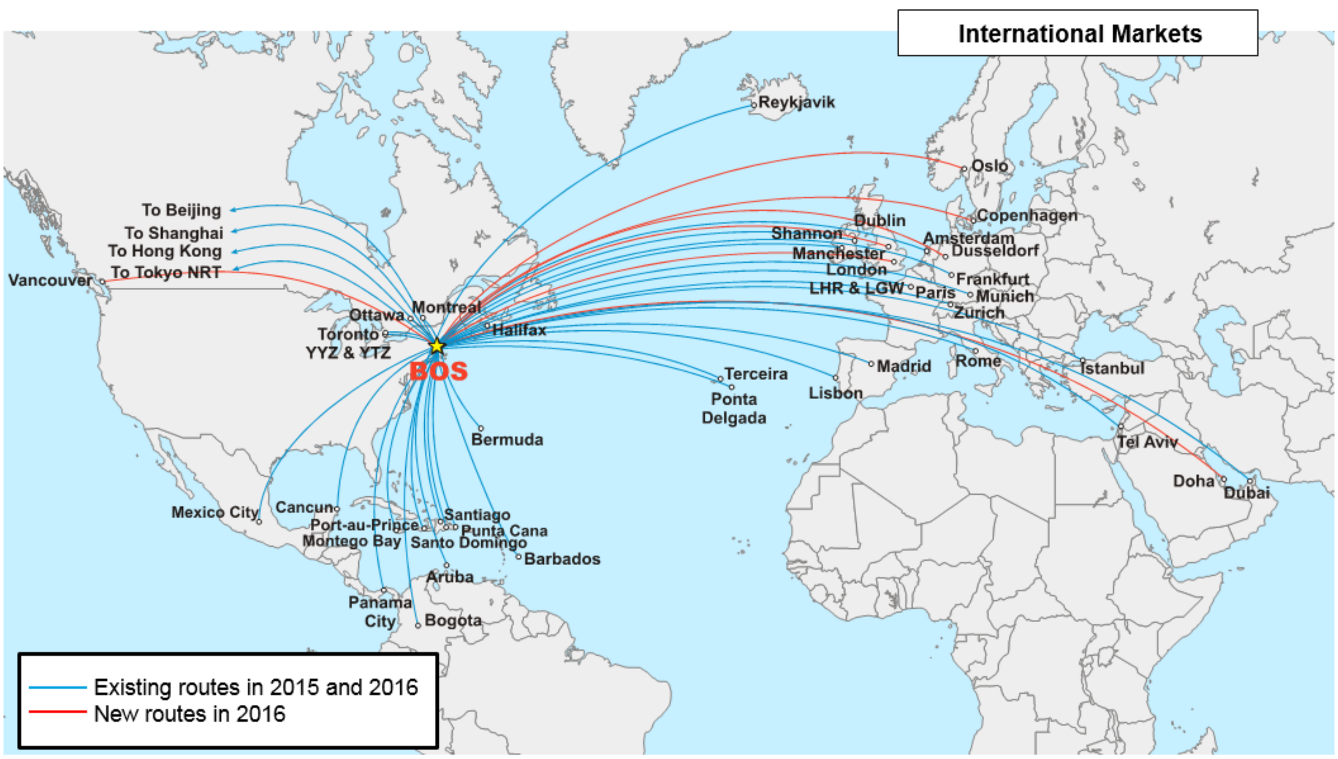
- Air Berlin launched service at Logan Airport in May 2016, providing four weekly non-stop services to Dusseldorf. The flights were offered seasonally through October 2016.
- Eurowings, a subsidiary of the Lufthansa Group, launched seasonal service at Logan Airport in June 2016 with three times weekly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

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

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

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

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



Source: Official Airline Guide Market Files

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

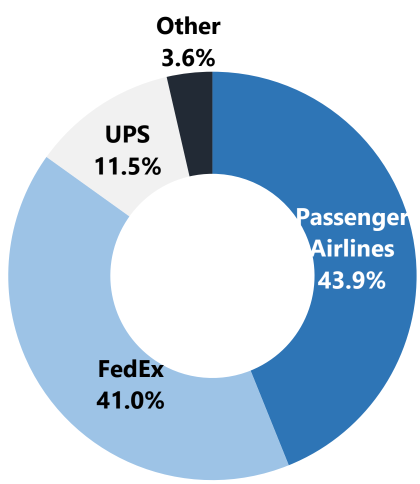
Cargo Activity Levels in 2016

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

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

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

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



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

24 U.S. DOT, T100 Database, YE 3Q 2016. Total cargo volume includes mail.

25 Air cargo includes express/small packages, freight, and mail.

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

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

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

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

Aviation Activity Forecasts

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

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

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

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

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

3

Airport Planning

Introduction

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

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

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

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

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

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

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

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

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

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

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

Terminal Area Projects/Planning Concepts

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

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

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

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

1. Terminal E Renovation and Enhancements
2. Terminal E Modernization
3a. Relocated Convenience and Filling Station
3b. Relocated Taxi Pool Lot
3c. Relocated TNC Lot
4. Terminal B Optimization Project
5. Terminal C to E Airside Connector
6. Terminal C, Pier B Optimization
7. Terminal C Building, Roadway, and Curb Enchancements
8. Terminal A to B Landside Connector
9. Terminal A to B Airside Connector

0 500 1000 2000 Feet

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

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

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

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

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

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

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

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

Service Area Projects/Planning Concepts

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

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

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

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

FIGURE 3-2 Logan Airport Service Areas

2016 Environmental Data Report

Service Areas

0 500 1000 2000 Feet

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

2016 Environmental Data Report

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

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

Locations To Be Determined

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

0 500 1000 2000 Feet

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

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

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

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

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

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

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

Airside Area Projects/Planning Concepts

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

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

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

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

Airport-wide

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

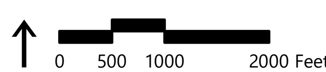


Table 3-4 Description and Status of Projects/Planning Concepts on the Airside (December 31, 2017)

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

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

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

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

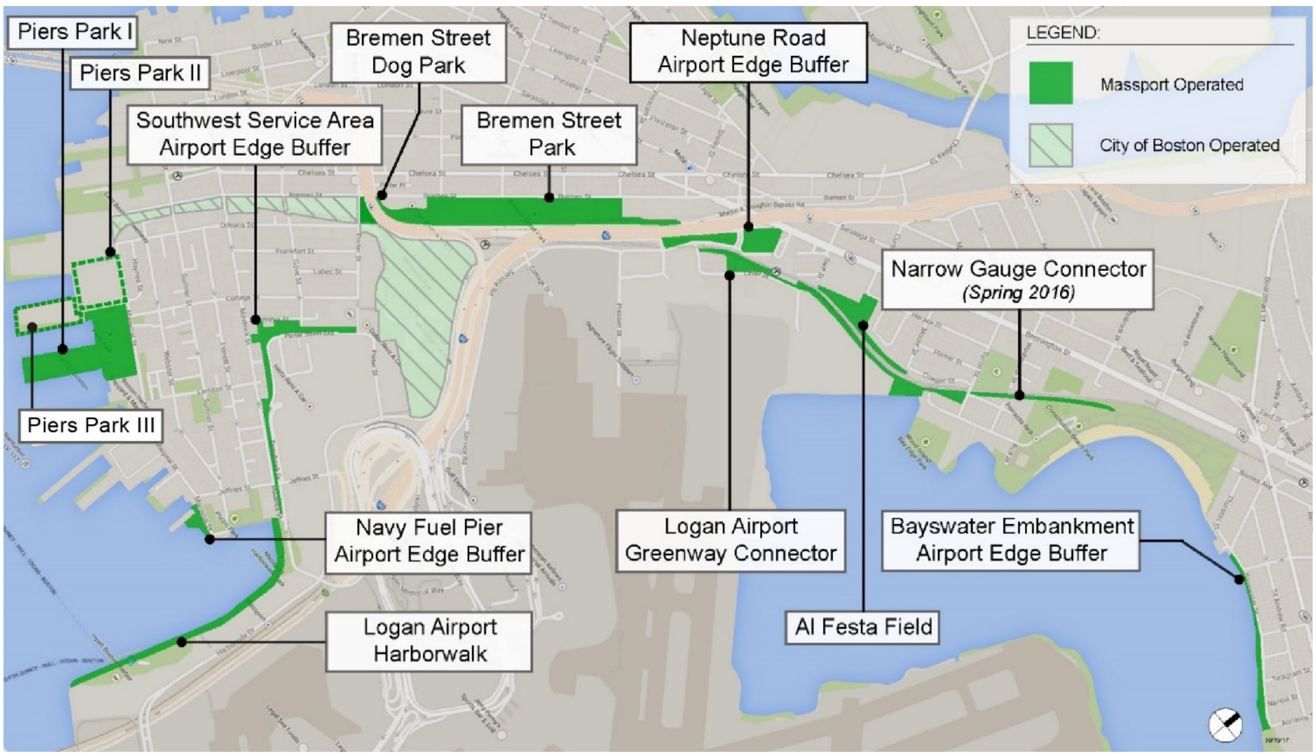
Airport Buffer Areas and Other Open Space

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

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

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

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



Source: Massport

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

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

2016 Environmental Data Report

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

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

0 500 1000 2000 Feet

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

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

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

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

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

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

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

Airport Parking Projects/Planning Concepts

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

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

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

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

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

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

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

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

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

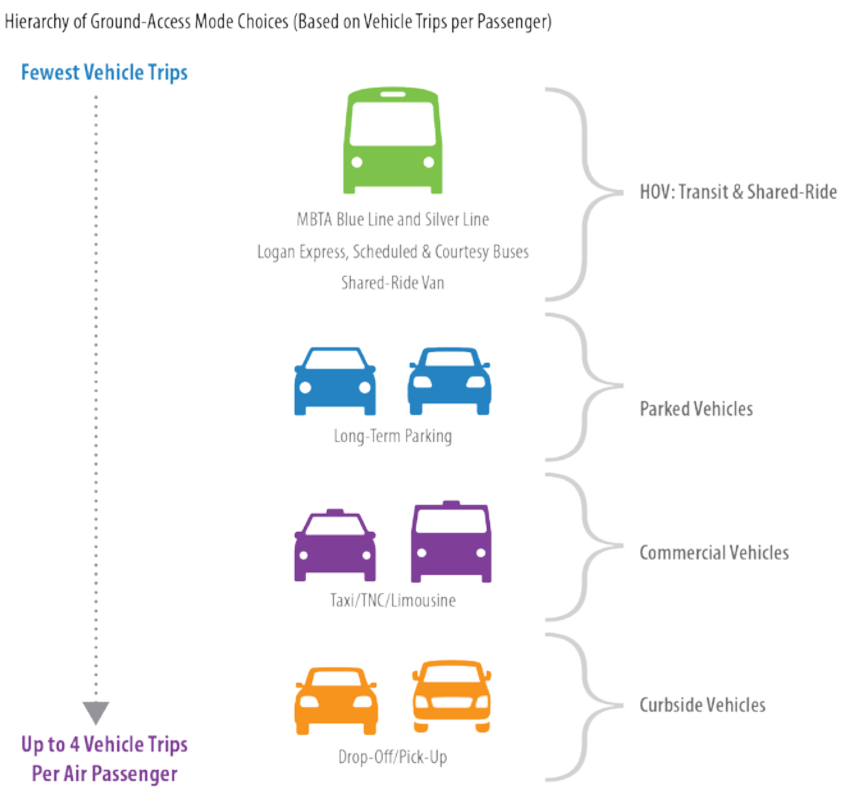
Table 3-6 describes current commercial parking projects at Logan Airport. The locations of parking garages are shown on **Figure 3-8**.

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

4 310 Code of Massachusetts Regulations 7.30.

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

Figure 3-7 Ground-Access Mode Choice Hierarchy



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

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

2016 Environmental Data Report

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

1. West Garage Parking Consolidation Project (completed)
2a. Logan Airport Parking Project - Economy Garage Concept
2b. Logan Airport Parking Project - Terminal E Surface Lot Concept
3. Automated People Mover Concept (not shown)

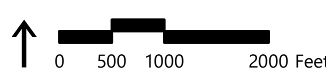


Table 3-6 Description and Status of Airport Parking Projects/Planning Concepts (December 31, 2016)

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

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

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

Massport-wide Projects and Plans

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

Resiliency Planning

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

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

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

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

Logan Airport Sustainability Management Plan (SMP)

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

Logan Airport Annual Sustainability Report

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

4

Regional Transportation

Introduction

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

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

New England Regional Airport System

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

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

1 Massport owns and operates Boston-Logan International Airport, Hanscom Field, and Worcester Regional Airport.

2 A regional airport is an airport serving traffic within a small or lightly populated geographical area.

3 A review of passenger and operations activity levels at Logan Airport is provided in Chapter 2, *Activity Levels*.

4 The New England Regional Airport System Plan (NERASP), which was published by the FAA in 2006, includes Logan International Airport and these 10 regional airports: Bangor International, Bradley International, Burlington International, Hanscom Field, Manchester-Boston Regional, Portland International, Portsmouth International, T.F. Green, Tweed-New Haven, and Worcester Regional airports.

5 Federal Aviation Administration. Final CY 2016 Passenger Boarding Data.

Figure 4-1 New England Regional Transportation System

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

Hanscom Field (BED)

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

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

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

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

Worcester Regional Airport (ORH)

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

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

Other Regional Airports

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

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

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

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

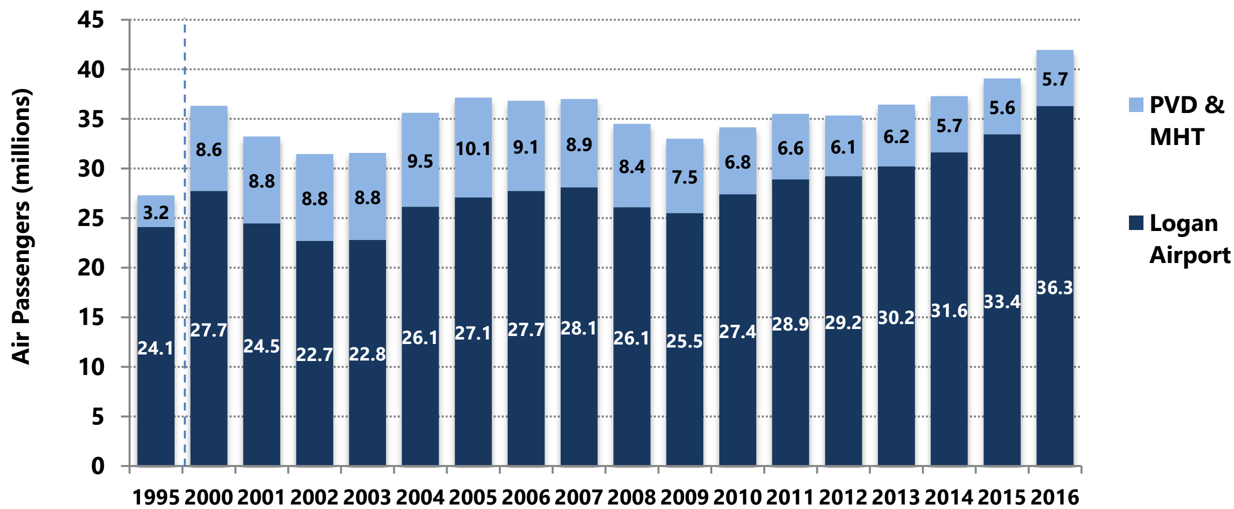
	Market Share (passengers in millions)		Change (passengers in millions)	Percent Change
	1995	**2016**	**1995-2016**	**1995-2016**
Logan Airport	24.1	36.3	12.2	50.6%
Manchester-Boston Regional Airport and T.F. Green Airport	3.2	5.7	2.5	78.1%
Total	**27.3**	**42.0**	**14.7**	**53.8%**
Percent Logan Airport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

Source: Massport and individual airport data reports.

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

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

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



Source: Massport and individual airport data reports.

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

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

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

Air Passenger Trends

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

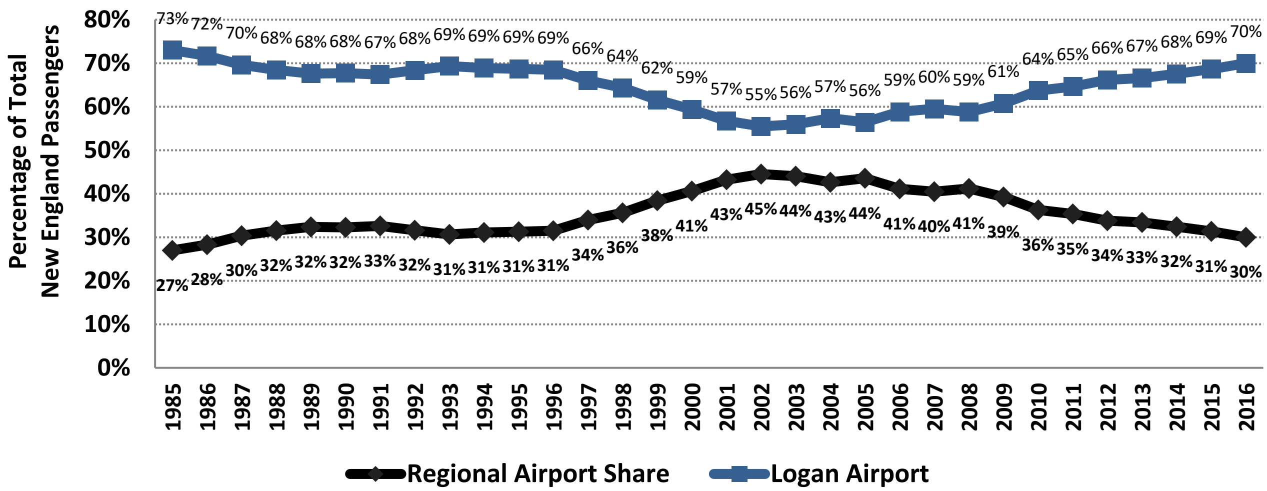
Regional Airport Passengers

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

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

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

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



Source: Massport and individual airport data reports.

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

Aircraft Operation Trends

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

Regional Airports Aircraft Operations

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Sources: Federal Aviation Administration (FAA) tower counts; Massport and individual airport data reports.

Notes: Ranked by commercial operations. FAA tower counts used for all airports except Logan Airport and Portsmouth International.
Numbers in parentheses ( ) indicate negative numbers.
NE - New England, GA – General Aviation

1 May include some Air Taxi operations by fractional jet operators. FAA tower counts combine some fractional jet operations with small regional/commuter airline operations.

2 Includes itinerant and local operations at the regional airports. Military operations at Logan Airport are negligible and not included in Massport counts.

3 Reflects updated CY 2016 aircraft operation statistics based on updated FAA tower counts since the publication of the *2015 EDR*.

Airline Passenger Service in 2016

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

Service Developments at the Regional Airports

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

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

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

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

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

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

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

Worcester Regional Airport

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

Bradley International Airport

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

T.F. Green Airport

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

Manchester-Boston Regional Airport

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

Portland International Jetport

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

Burlington International Airport

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

Bangor International Airport

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

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

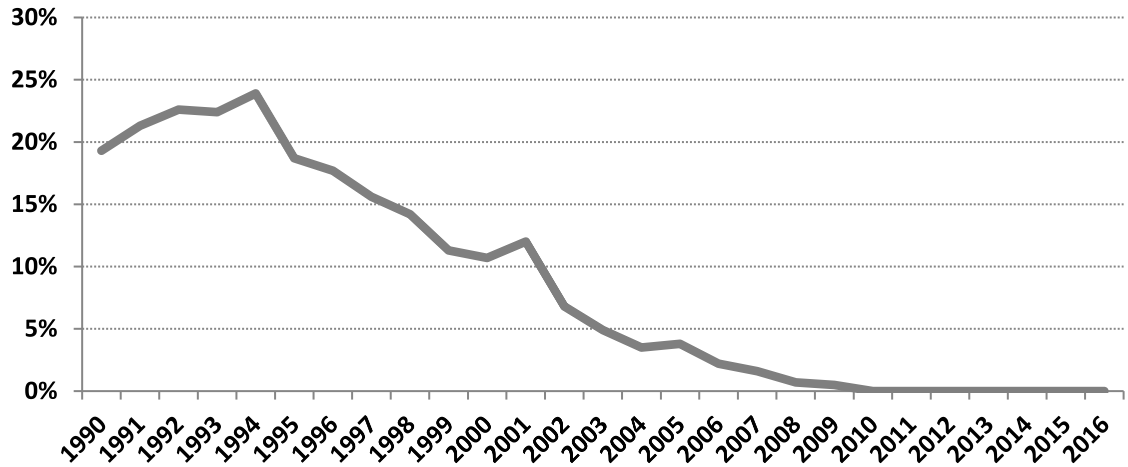
Among the other smaller regional airports, Tweed-New Haven Airport (CT) and Portsmouth International Airport (NH) are both served by a single carrier, while Hanscom Field (MA) has no scheduled commercial service. In 2016, Tweed-New Haven Airport saw reduced departing frequencies of 8.3 percent as American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

Regional Reliance on Logan Airport

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

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

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



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

Regional Aviation Economic Impact Study

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

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

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

- Providing youth outreach activities.

Regional Airport Facility Improvement Plans

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

Hanscom Field (BED)

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

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

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

Upcoming projects include:

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

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

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

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

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

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

Worcester Regional Airport (ORH)

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

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

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

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

T.F. Green Airport (PVD)

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

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

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

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

Manchester-Boston Regional Airport (MHT)

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

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

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

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

Bradley International Airport (BDL)

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

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

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

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

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

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

Local and Regional Long-Range Transportation Planning

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

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

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

Massachusetts Statewide Airport System Plan

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

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

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

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

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

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

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

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

Boston and Statewide Long-Term Transportation Vision

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

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

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

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

weMove Massachusetts

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

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

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

24 Massachusetts Department of Transportation. *weMove Massachusetts.* https://www.massdot.state.ma.us/wemove/Home.aspx.

Focus40

Focus40 is the 25-year investment plan for the MBTA to meet the needs of the Boston Region through the year 2040. The plan considers all rapid transit, commuter rail, bus, ferry, and paratransit services.[25] The plan will develop "a long-term investment strategy that recognizes both today's infrastructure challenges as well as the shifting demographics, changing climate, and evolving technologies that may collectively alter the role the MBTA will play in the Greater Boston of the future."[26] Massport is actively participating in the Focus40 planning process to provide input on the role of Logan Airport and other Massport assets.

Massachusetts State Freight Plan

In 2016, MassDOT began the process of preparing a new, comprehensive Massachusetts State Freight Plan to look at the near-term and long-term vision for the freight system in Massachusetts. MassDOT released a draft plan for comment in 2017 and plans to release the final document in 2018. The new plan will include all freight modes, including air, rail, truck, and maritime. This plan will help document and guide Massport's freight planning work at Logan Airport, the Port of Boston, and Massport's other assets. Part of the plan includes the designation of new miles of Critical Urban and Rural Freight Routes to the National Highway Freight Network, improving connections to Logan Airport and Massport maritime facilities. The State Freight Plan will also assist in identifying cargo trends. For example, the 2010 Massachusetts State Freight Plan[27] found that air freight shipping will grow more quickly than any other shipping mode. Massport is actively engaged in the Statewide Freight Plan public process as a member of the leadership Freight Advisory Committee.

Massachusetts State Rail Plan[28]

In 2010, MassDOT developed the first State Rail Plan to guide planning and investment in freight, commuter, and passenger rail services across Massachusetts. The current plan lays out a 20-year vision and a four-year action plan describing policies, planning, infrastructure, and investment to guide the state's rail system. MassDOT is currently in the process of updating the plan with a proposed release date in 2018. Massport has supported and advised MassDOT on this plan.

Regional Cooperative Planning Efforts

Massport participates in regional transportation planning efforts, which are listed below.

New England Regional Airport System Plan (NERASP) – Commercial Service Airports

In fall of 2006, FAA New England Region, in concert with the New England Airport Directors and New England State Aviation Directors, completed the NERASP.[29] The results of this study describe the foundation of a

25 Transportation for persons with disabilities to supplement public transportation systems.
26 Massachusetts Department of Transportation. Focus40. https://www.mbtafocus40.com/.
27 Massachusetts Department of Transportation. September 2010. State Freight Plan. https://www.massdot.state.ma.us/portals/17/docs/freightplan/MAFreightPlanSeptember2010v2.pdf.
30 Massachusetts Department of Transportation. State Rail Plan. https://www.mass.gov/service-details/rail-plan.
29 The New England Regional Airport System Plan (NERASP), which was published by the FAA in 2006, includes Logan International Airport and these 10 regional airports: Bangor International, Bradley International, Burlington International, Hanscom Field, Manchester-Boston Regional, Portland International, Portsmouth International, T.F. Green, Tweed-New Haven, and Worcester Regional airports.

regional strategy for the air carrier airport system to support the needs of air passengers through 2020. To date, the development of that strategy has been instrumental in facilitating the investment and development of the primary commercial airport system in New England.

New England Regional Airport System Plan – General Aviation (NERASP-GA)

During preparation of the 2006 NERASP study, which analyzed the primary commercial airports in New England, the group recognized that a similar evaluation of GA would also prove useful. It would provide state aviation officials with a greater understanding of airport roles and infrastructure investment. Faced with the current economy, rising airport and aircraft operational costs, declining operational activity, an aging infrastructure, and with limited state and federal funds to address improvements, the importance of developing both a short-range and long-range perspective on the future performance of the New England GA airport system is clear.

The New England state aviation officials, in partnership with the FAA, are currently conducting a study of the GA airport system in New England, including primary commercial service airports that service a GA component. This assessment of the New England GA airport system will provide state aviation officials with a common understanding of their state airport systems in relation to the New England region as a whole. Assisted by this information, the FAA will be better positioned to make decisions regarding priority capital investments. Moreover, the NERASP study proved that the geographic boundary of the New England region, as well as its cultural identity, makes an overall study of New England an effective planning approach. Information on the NERASP-GA study can be found at http://www.nerasp-ga.com.

At a local level, Massport engages with municipalities, particularly the City of Boston, to coordinate on transportation planning and land use issues. Three recent plans, released by the City of Boston and discussed below, provide a relevant policy framework.

Imagine Boston 2030

Imagine Boston 2030, the City of Boston's comprehensive plan, commenced in the fall of 2015 and was published in July 2017. This new citywide plan provides a policy framework for future development in Boston, addressing key themes including: housing, mobility, climate adaptation, open space, equity, arts and culture, design and placemaking, and health. Many themes addressed in this plan will inform Massport's planning efforts and conversely, Massport continues to engage with the City of Boston and other stakeholders to shape the implementation of relevant strategies.

GoBoston 2030

The City of Boston's long-range transportation plan, GoBoston 2030, is intended as both a visioning and action plan to guide transportation planning policy and infrastructure investments until 2030. The plan expresses three guiding principles: equity, economic opportunity, and climate responsiveness establishing primary goals and aspirational targets. These targets include expanding access to transportation options, improving safety, reducing commute times, and promoting mode shift. To meet these aspirational targets, the plan prioritizes capital investments in transportation improvements. Many of these transportation planning initiatives will impact Massport's facilities and include projects where Massport is a key stakeholder and a member of working groups evaluating implementation options.

Climate Ready Boston

Climate Ready Boston is the City of Boston's comprehensive action plan to guide Boston toward a more affordable, equitable, connected, and resilient future. The four components of the Climate Ready Boston plan are updating climate projections (e.g., extreme temperatures, sea level rise, and precipitation), completing vulnerability assessments, identifying impacts to focus areas, and creating more climate resiliency initiatives through policy, planning and financial initiatives. Climate Ready Boston is coordinated with the Imagine Boston 2030 long range transportation plan. In December 2016, the study report was released. It will be followed in 2017 and 2018 with neighborhood implementation strategies.

Conference of New England Governors (CONEG) and the Conference of New England Governors and Eastern Canadian Premiers (NEG/ECP)

The Conference of New England Governors (CONEG) is a formally established body that coordinates regional policy programs in the areas of economic development, transportation, environment, energy, and health, among others. The CONEG also provides secretarial support to the separate Conference of New England Governors and Eastern Canadian Premiers (NEG/ECP). The latter coordinates policies of common interest across borders including infrastructure, energy, the environment, economic development, and trade. The CONEG offers a forum for policy on aviation and intercity passenger rail, particularly in the northeastern coastal mega-region, as part of a larger transportation system that needs modal balance. Efficient use of this multi-state network affects the overall viability of the highway, aviation, freight, and commuter rail transportation networks that serve the region and the nation. Improved planning coordination between airports and intercity passenger rail services and related ground transportation offers the potential to achieve complementary investments in airport and rail capacity and services.

MassDOT has a representative on the NEG/ECP Transportation and Air Quality Committee, which covers regional transportation issues and infrastructure development, use, and efficiency. The NEG/ECP and other policy decision makers throughout the region have been able to utilize strategies and information developed in the NERASP, which provides a framework for integrated regional aviation policy and planning. This organization serves an important function to help achieve a greater balance between air, rail, and auto trips, and ultimately help to increase overall transportation capacity without overburdening Logan Airport and the New England aviation system.

In 2015, the NEG/ECP passed and implemented the *Climate Change Action Plan* which provided direction on reducing greenhouse gas emissions and a target range of at least 35 to 45 percent below 1990 levels by 2030.[30] Since 1973, the six New England states and the five Eastern Canadian provinces have worked cooperatively to address their shared interests across the border. Through the annual conferences of governors and premiers and discussions of joint committees, NEG/ECP encourages cooperation by:

- Developing networks and relationships;
- Taking collective action;

30 Conference of New England Governors and Eastern Canadian Premiers. Resolution 39-1, *Resolution Concerning Climate Change*. August 30, 2015.

- Engaging in regional projects;
- Undertaking research; and
- Increasing public awareness of shared interests.

Among the topics recently addressed by the governors and premiers are:

- Ensuring a clean, efficient and reliable energy future for the region;
- Energy innovation for a competitive economy;
- Changing global energy markets and the region's energy landscape;
- Cross-border partnerships for economic development and trade;
- Transportation and air quality;
- Climate change action plans and greenhouse gas emission reduction strategies;
- Energy efficient vehicle and infrastructure technologies; and
- Cross border mutual aid in emergency planning.[31]

Regional Rail Transportation Initiatives

This section reports on recent developments and current rail service originating in Boston, the status of air-rail linkages in the NEC, and the expanding Pilgrim Partnership, which provides commuter rail between Massachusetts and Rhode Island.

Amtrak Northeast Corridor (NEC)

Amtrak's NEC is an intercity rail line that operates between Boston-South Station and Washington, DC via New York City. Other major destinations served by the route include Providence, RI; New Haven, CT; Philadelphia, PA; and Baltimore, MD. Logan Airport passengers can connect directly to Boston-South Station via Silver Line bus rapid transit (BRT) service or via taxi or other unscheduled mode. Amtrak operates two services between Boston and Washington, DC: the Acela Express (high-speed, limited-stop service) and the Northeast Regional (lower-speed service that makes local stops along the route). Travel times on the Acela Express range from approximately 3.5 hours from Boston to New York to approximately 6.75 hours from Boston to Washington, DC. Travel times on the Northeast Regional range from about 4.25 hours from Boston to New York to approximately 7.75 hours from Boston to Washington, DC. On weekdays, a total of 19 daily departures are offered from Boston-South Station to New York-Penn Station, of which about half are Acela Express. On Saturdays and Sundays, a total of 12 departures and 15 departures are offered from Boston-South Station to New York, respectively. Most trips continue south to Washington, DC, and a smaller number of Northeast Regional trains continue further south to Central and Eastern Virginia.

System-wide Amtrak ridership was 31.3 million one-way trips in FY 2016, an increase of 400,000 over the previous year.[32] In FY 2016, the NEC carried 11.9 million passengers on its Acela Express and Northeast

31 New England Governors/Eastern Canadian Premiers. http://www.coneg.org/negecp.
32 Amtrak. November 2016. Amtrak Media Center. https://media.amtrak.com/2016/11/amtrak-delivers-strong-fy-2016-financial- results/.

Regional services, up 2 percent from the prior year. Acela Express accounted for nearly 3.5 million passengers, while the Northeast Regional accounted for 8.4 million passengers. Overall NEC ridership reached a new record in 2016, surpassing 2015 record levels. Amtrak's share of the Northeast total passenger market has increased substantially since the introduction of Acela Express service in 2000.

Northeast Corridor Infrastructure Master Plan and Next-Generation High Speed Rail Plan

The *Northeast Corridor Infrastructure Master Plan*, a regional rail planning study, was released in May 2010. The Master Plan[33] documents NEC growth needs through 2030, including expanded capacity and improvements in Boston-New York and New York-Washington intercity travel times. A 76-percent increase in rail ridership from 13 million to 23 million,[34] a 36-percent increase in train movements from 154 average weekday to 210 average weekday, and the need for $52 billion in additional capital investment is forecasted over the 20-year study period. The Federal Railroad Administration (FRA) is currently preparing a future plan for the NEC. In December 2016, the FRA released a Tier 1 Final Environmental Impact Statement for NEC FUTURE, which includes a Preferred Alternative for the FRA's recommended plan for growing passenger rail service on the NEC, available online at: http://www.necfuture.com/tier1_eis/feis/.

To follow up on the release of the *Northeast Corridor Infrastructure Master Plan*, Amtrak also unveiled a next-generation high-speed rail proposal in September 2010, titled *A Vision for High-Speed Rail in the Northeast Corridor*. The proposal outlines a brand-new 427-mile two-track corridor running from Boston to Washington, offering high-speed rail service with sustained maximum speeds of 220 mph. Operations simulations estimate 83-minute trip times between Boston and New York by 2040 and 3-hour and 23-minute trip times between Boston and Washington. Under this Next-Generation high-speed rail plan, the New York City – Boston market would see a further shift in demand from auto and air to rail due to the dramatic improvements in rail travel times, and the air market between the two city-pairs is projected to be nearly eliminated by 2050.[35] This plan states that traveler's shift to high-speed rail would reduce delays on competing modes (air and auto) and the shift away from shorter and smaller intraregional flights would free up air transport capacity for higher-value transnational and international flights.[36]

An update to the *Northeast Corridor Infrastructure Master Plan* and *A Vision for High-Speed Rail in the Northeast Corridor* was released in July 2012. Since these two documents were released, the two programs have been integrated into a single coherent service and investment program, called the Northeast Corridor Capital Investment Program. The Northeast Corridor Capital Investment Program would advance the near-term projects outlined in the Master Plan to benefit the NEC, while incrementally phasing improvements to the Acela Express high-speed service to support the proposed next-generation high-speed rail.[37] The near-term NEC improvements are identified to occur between 2012 and 2025 and the long-term Next-Generation High-Speed Rail improvements are identified to occur between 2025 and 2040. The publication of the 2012

33 The NEC Master Plan Working Group. *The Northeast Corridor Infrastructure Master Plan*. https://www.amtrak.com/ccurl/870/270/Northeast-Corridor-Infrastructure-Master-Plan.pdf.

34 Includes ridership on Amtrak and state rail lines, but excludes ridership on commuter rail lines.

35 Amtrak. September 2010. *A Vision for High-Speed Rail in the Northeast Corridor*. Page 21. https://www.amtrak.com/ccurl/214/393/A-Vision-for-High-Speed-Rail-in-the-Northeast-Corridor.pdf.

36 *Ibid.*

37 Amtrak. July 2012. *The Amtrak Vision for the Northeast Corridor: 2012 Update Report*. https://www.amtrak.com/ccurl/453/325/Amtrak-Vision-for-the-Northeast-Corridor.pdf.

update is the first step in "improving the NEC for all users in order to sustainably support the population and economic growth facing the Northeast over the next 30 years," but a considerable amount of additional planning work is required by all stakeholders.[38]

In 2011, the U.S. DOT awarded Amtrak and the New York State DOT $745 million for two high-speed rail projects on the NEC. A major upgrade to tracks and overhead wires will be conducted along a 23-mile stretch in New Jersey, allowing for an improvement in Acela Express train speeds from 135 mph today to 160 mph. Improvements to the Harold railroad interlocking in Queens, NY will also be completed, eliminating delays and reducing commuting time for Amtrak riders.

In 2015, the Rhode Island Department of Transportation (RIDOT) and Amtrak began work on the Kingston Station Capacity Expansion. The project will improve train operations and the passenger experience along the Rhode Island stretch of the Northeast Corridor. The project features the construction of a third track at Kingston Station, which will enable higher speed Acela trains to safely bypass regional trains. The project was completed in 2017.[39]

RIDOT is also planning improvements to Providence Station, including interior and exterior station enhancements. This project will also analyze improvements that may provide new capacity for high-speed services.[40]

Northern New England Intercity Rail Initiative

The Northern New England Intercity Rail Initiative is an interstate, interagency collaboration between the Massachusetts Department of Transportation, the Vermont Agency of Transportation, and the Connecticut Department of Transportation to examine "the opportunities and impacts of more frequent and higher speed intercity passenger rail service on two major rail corridors."[41] The studied corridors are the Inland Route (between South Station and Western Massachusetts via Worcester and Springfield) and the Boston to Montreal Route. The study will evaluate ridership, environmental impacts, and service plans along the 470 miles along these two corridors.

Boston-South Station Expansion

In support of the Northeast Corridor Capital Investment Program, MassDOT is planning to expand Boston's South Station Rail Terminal capacity and related layover capacity to meet current and anticipated future (2035) high-speed, intercity, and commuter rail services needs on the NEC and on the MBTA's South Side commuter rail system. At present, South Station operates above its design capacity for efficient train operations and orderly passenger queuing. Operating with only 13 tracks, South Station constrains the current and future rail

38 *Ibid.*
39 Amtrak. *NEC Projects, Kingston Station Capacity Expansion.* https://nec.amtrak.com/content/kingston-station-capacity-expansion.
40 Amtrak. *NEC Projects, Providence Station Improvements.* https://nec.amtrak.com/content/providence-station-improvements.
41 Massachusetts Department of Transportation. Northern New England Intercity Rail Initiative. http://www.massdot.state.ma.us/northernnewenglandrail/Home.aspx.

mobility within Massachusetts and throughout New England and the NEC.[42] The proposed South Station Expansion Project will result in a number of benefits to rail mobility:[43]

- Enable growth in passenger rail transportation along the NEC and within the Commonwealth of Massachusetts;
- Improve service reliability through updates to rail infrastructure and related layover capacity;
- Improve the passenger capacity and experience of using South Station;
- Promote city-building in a key area of Boston; and
- Allow for Dorchester Avenue to be reopened for public use and enjoyment for the first time in decades.

The MEPA environmental review process for this project concluded with the issuance of a Secretary's Certificate on August 12, 2016 on the Final Environmental Impact Report (FEIR).[44] The National Environmental Policy Act (NEPA) environmental review process for this project concluded with the issuance of a Final EA and Section 4(f) Determination and FONSI on October 27, 2017.[45] FRA and MassDOT collected comments on the Draft EA and Draft Section 4(f) Determination for a 30-day public comment period, which concluded May 27, 2017. The draft document was circulated to agencies, project stakeholders, and individuals on the project distribution list for review and comment. Written responses to comments were provided in the FONSI.

North-South Rail Link

Boston is served by two commuter rail systems, one extending to the north of the city, the other to the south. They are disconnected from each other, and neither connects fully to the subway system. The North-South Rail Link is a proposed pair of rail tunnels that would connect North and South Stations in downtown Boston. MassDOT completed a Draft Environmental Impact Report (DEIR) between 1995 and 2003, but the project was not pursued at that time. MassDOT is currently undertaking a Feasibility Reassessment for the North South Rail Link Project to update the prior work and determine if further technical and financial analysis is needed. MassDOT anticipates completion of this Feasibility Reassessment in 2018.[46]

Commuter Rail Services

The Pilgrim Partnership is an arrangement between the MBTA and RIDOT, under which RIDOT allocates some of its federal funding to the MBTA in return for commuter rail service between Boston and Rhode Island. On weekdays, 20 round trips are provided between Boston and Providence. On Saturdays, nine round trips are provided between Boston and Providence, while seven round trips are provided on Sundays. Expanded weekday commuter rail service to T.F. Green Airport in Warwick, RI was introduced in December 2010. Travel

42 Massachusetts Department of Transportation. *About this Project.* http://www.massdot.state.ma.us/southstationexpansion/Home.aspx.

43 Massachusetts Department of Transportation. October 2017. *South Station Expansion Final Environmental Assessment and Section 4(f) Determination* https://www.massdot.state.ma.us/southstationexpansion/Documents/FinalEnvironmentalAssessment.aspx

44 Massachusetts Department of Transportation. June 2016. *South Station Expansion Final Environmental Impact Report.* http://www.massdot.state.ma.us/southstationexpansion/Documents/FEIR.aspx.

45 Massachusetts Department of Transportation. October 2017. *South Station Expansion Final Environmental Assessment and Section 4(f) Determination and Finding of No Significant Impact.* https://www.massdot.state.ma.us/southstationexpansion/Documents/FinalEnvironmentalAssessment.aspx.

46 Massachusetts Department of Transportation. *About this Project.* http://www.massdot.state.ma.us/planning/Main/CurrentStudies/NorthSouthRailLink.aspx

time between Boston and Warwick is approximately 1.25 to 1.5 hours. On weekdays, seven of the 20 daily outbound trips from Boston to Providence currently continue on to Warwick as well as Wickford, RI. Expanded weekday service to Wickford, RI commenced in 2012, with a potential extension further into South County as service in the state expands and ridership grows. Additionally, RIDOT, in cooperation with the City of Pawtucket, is currently procuring a Design-Build contractor to design and construct a new commuter rail station in Pawtucket, RI. The station is scheduled to open at the end of 2019.

The expansion of commuter rail service into RI enhances ground access options from the Boston metropolitan area to T.F. Green Airport. The passenger catchment areas of T.F. Green Airport and Logan Airport overlap, and this commuter rail service has the potential to attract passengers in the overlapping catchment area, living along the MBTA's Providence Line service to T.F. Green Airport.

Other Regional Cooperative Planning Efforts

Recognizing that Logan Airport is a substantial trip generator and key transportation resource in the metropolitan area, Massport participates in several interagency transportation planning forums pertaining to enhancing a variety of travel modes.

Healthy Transportation Compact

The Healthy Transportation Compact interagency initiative brings together the state departments of Health and Human Services, Energy and Environmental Affairs, the Commissioner of Public Health, the MassDOT Highway Division, and the MassDOT Rail and Transit Division, with the intention of facilitating transportation decisions that balance the needs of all transportation users, expand mobility, improve public health, support a cleaner environment, and create stronger communities. Actions include facilitating better accommodations for those with mobility limitations; increasing opportunities for physical activities; increasing bicycle and pedestrian travel through additional, safer, and better-connected bicycle and pedestrian infrastructure; a statewide complete streets policy; implementing health impact analyses for transportation decisions; and the federal Safe Routes to School program.

Massport activities at Logan Airport will support the Healthy Transportation Compact through its ongoing development of the Southwest Service Area and North Cargo Area. The projects include an improved pedestrian environment for employees, neighborhood residents, and visitors. Streetscape improvements and new pedestrian and bicycle routes strengthen connections between the neighborhoods, terminals, mass transit, the Harborwalk (a multimodal off-road path), Bremen Street Park, and the Greenway Connector, as well as the Logan Office Center and the on-Airport shuttle bus. Pedestrian actuated crossings are planned at signalized intersections along Harborside Drive and sidewalks provided along Harborside Drive, Jeffries Street, and Porter Street. Midblock crossings or crosswalks at unsignalized intersections will consider street and pedestrian level lighting, as well as advanced warning signs and/or systems, as necessary. As described previously, bicycle access and parking is planned in secured locations for public and employee use.

South Boston Waterfront Transportation Plan

Massport, the City of Boston, MassDOT, and the Massachusetts Convention Center Authority all participate in and manage the new sustainable transportation plan for the South Boston Waterfront. The resulting plan, featuring an unprecedented collaboration of the private and public sectors, is a blueprint for improving the growth of the Waterfront, proposing solutions to meet the growing and changing transportation needs of the district, and improving the public realm of the area, all the while preserving the quality of life for the surrounding neighborhoods. The plan benefitted from the input of area stakeholders through five community meetings and more than 50 outreach meetings throughout the process. Massport continues to engage in implementation of recommendations from this plan, in collaboration with other agency partners.

Water Transportation Advisory Council and Ferry Study

Massport participates in planning for water transportation in the Boston region as a member of state Water Transportation Advisory Council, convened by MassDOT. Massport also participates in a comprehensive study of commuter, recreational, and landside access needs to support water transportation in Boston Harbor. Massport is a steering committee member for this study led by Boston Harbor Now with support from MassDOT and other stakeholders.

Boston Metropolitan Planning Organization (Boston MPO)

Massport supports multimodal transportation planning and improving integration with its facilities through its permanent voting membership on the Boston MPO, providing input on policy and programming decisions.

MPOs are established in large metropolitan areas and are responsible for conducting a federally required cooperative, comprehensive, and continuous metropolitan transportation planning process. Based on this planning, MPOs determine which surface transportation system improvements will receive federal capital (and occasionally, operating) transportation funds. The Boston MPO´s mission is to establish a vision and goals for transportation in the region and then develop, evaluate, and implement strategies for achieving them.

Massport plays an active role on the MPO's decision-making board, participating in policy decisions related to the *Long-Range Regional Transportation Plan* and project programming for the Transportation Improvement Program. The MPO also guides the work conducted by Central Transportation Planning Staff (CTPS) via its Unified Planning Work Program. CTPS is also used by Massport to support its ground transportation planning initiatives.

Metropolitan Area Planning Council (MAPC)

Massport is also an ex-officio member of MAPC, a regional planning agency that serves the people who live and work in the cities and towns of Metropolitan Boston. The MAPC mission is to promote smart growth and regional collaboration, which includes protecting the environment, supporting economic development, encouraging sustainable land use, improving transportation, ensuring public safety, advancing equity and opportunity among people of all backgrounds, and fostering collaboration among municipalities. MAPC membership includes 101 municipal government representatives, 21 gubernatorial appointees, 10 state officials (including Massport), and three City of Boston officials. A staff of approximately 40 individuals supports the Council and its Executive Committee of 25 selected members.

5

Ground Access to and from Logan Airport

Introduction

The Massachusetts Port Authority (Massport) has a comprehensive strategy to diversify and enhance ground transportation options for passengers and employees for travel to and from Boston-Logan International Airport (Logan Airport or Airport). The ground transportation strategy is designed to offer passengers with a choice of a broad range of high-occupancy vehicle (HOV), transit, and shared-ride options for travel to and from Logan Airport and to minimize vehicle trips by providing convenient transit, shuttle, bike, and pedestrian connections to the Airport. The strategy also aims to provide on-Airport parking for air passengers choosing automobile access modes and/or who have limited HOV options. Massport aims to limit impacts to the environment and community, while providing air passengers and employees with many alternatives for convenient and reliable travel to and from Logan Airport. In addition to highlighting recent changes to ground transportation services, operations, and pricing, this chapter reports on ground access conditions and activity levels in 2016, which are compared to past conditions. Activity levels include measures of ridership on various ground access modes and traffic volumes. The chapter provides an overview of parking demand and its impacts under Logan Airport's constrained parking supply.

Massport is implementing a multi-pronged trip reduction strategy to limit impacts to the environment and to reduce the number of private vehicles that access Logan Airport and, in particular, the associated environmentally undesirable drop-off/pick-up modes, which generate up to four vehicle trips instead of two.[1] Massport continues to invest in and operate Logan Airport with a goal of maintaining and increasing the HOV mode share – the number of passengers (and Airport employees) arriving by transit or other HOV/shared-ride modes. Logan Airport continues to rank at the top of U.S. airports in terms of HOV/transit mode share, with the current HOV mode share just over 30 percent.[2] Because of the different demographics of Logan Airport air passenger travelers, no single measure alone will accomplish the goal to increase the HOV mode share. Measures implemented by Massport to increase HOV use include initiatives related to pricing (incentives and disincentives), service availability, service quality, marketing, and traveler information.

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

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

Improving the multimodal connectivity of the Airport can provide traffic and environmental benefits by reducing vehicle trips, miles traveled, and greenhouse gas (GHG) emissions associated with travel to and from Logan Airport. The cost, speed, convenience, safety, and reliability of all modes of transportation connecting to the Airport affect how passengers and employees choose among these access modes. Offering a range of ground access options also improves customer service for air passengers, employees, and other Airport users.

Regional transportation efforts, as they relate to the Airport, and planning efforts to diversify transportation options in the New England region (primarily through commuter, passenger, and high-speed rail), are discussed in Chapter 4, *Regional Transportation*.

Ground Transportation Modes of Access to Logan Airport

The Logan Airport Environmental Data Reports (EDR) and Environmental Status and Planning Reports (ESPR) provide over two decades of tracking and reporting on ground access and ground transportation at the Airport. For the purposes of tracking ground access mode share over the years, Massport historically uses the following definitions:

HOV (Shared-Ride) Modes

- Public transit (Massachusetts Bay Transportation Authority (MBTA) Blue Line subway, Silver Line bus rapid transit, other MBTA buses, and water transportation);
- Logan Express scheduled bus service;
- Scheduled buses and vans;
- Courtesy shuttle buses;
- Charter buses; and
- Unscheduled private limousines and vans.

Non-HOV (Automobile) Modes

- Private automobiles;
- Taxis (regardless of the number of passengers in a vehicle);
- Rental cars; and
- Transportation Network Companies (TNCs), such as Uber and Lyft.

Although private automobiles, taxis, TNCs, and rental cars often carry multiple occupants, they are not categorized as HOV modes.[3] The *Ground Access Planning Considerations* section later in this chapter includes further discussion of the Logan Airport HOV mode share.

3 The *2016 Logan Airport Air Passenger Ground-Access Survey* indicates that the average occupancy of these automobile modes (private automobiles, taxis, TNCs, and rental cars) is 1.66 persons per vehicle, indicating that Massport is somewhat conservative in the calculation of the HOV/SOV split. The HOV mode share goal is based on modal categories and not on actual vehicle occupancies.

Massport is rethinking the relationship among the different ground access modes and focusing on the trip generation associated with each of these modes. Air passengers have three major options for getting to Logan Airport: (1) transit and shared-ride HOV services; (2) drive to Logan Airport and park; or (3) drop-off/pick-up mode, which can involve a private vehicle, taxi, limousine, or TNCs. In this categorization, the major “modes” are:

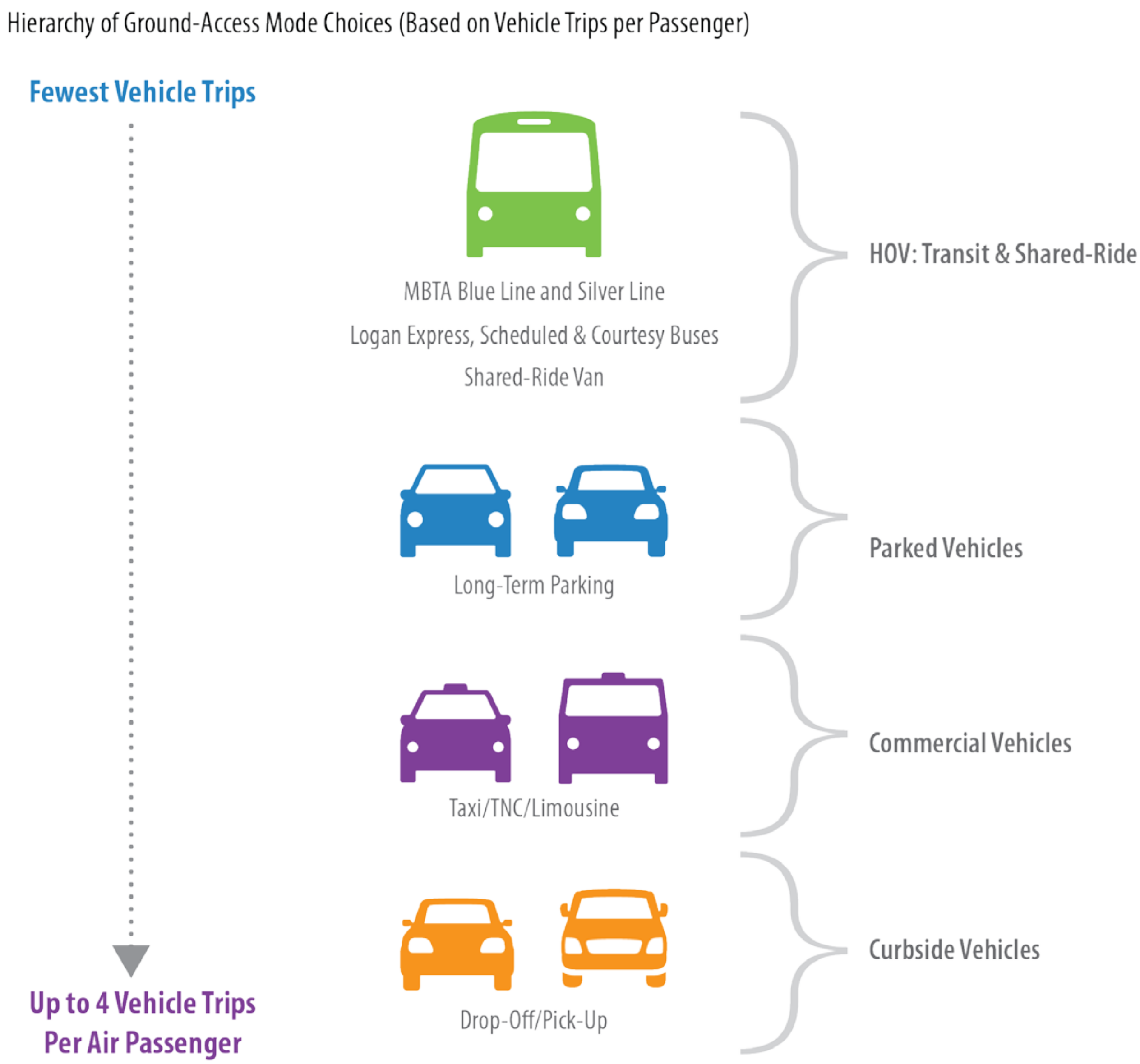
- Transit and shared-ride:
  - MBTA services (Blue Line, Silver Line, bus, and ferry) and water taxis;
  - Massport services (Logan Express); and
  - Private operators (scheduled coach express bus, charter bus, shared-ride vans, and courtesy shuttles).
- Private vehicles that are parked for the duration of the trip.
- Vehicles that drop-off or pick-up air passengers at the terminal curbs, but do not necessarily remain on-Airport:
  - Private vehicles that do not park for the duration of a passenger’s trip;
  - Taxicabs or TNCs; and
  - “Black car” limousines.[4]

Mobile application ride-booking services, such as Uber and Lyft, are increasingly becoming a mode of choice for ground access at airports throughout the country. Data from the *2016 Logan Airport Air Passenger Ground-Access Survey* show a number of departing air passengers choosing TNCs. Pursuant to Massachusetts state law, An Act Regulating Transportation Network Companies (Bill H.4570), and Massport Rules for Safe and Efficient Operation of TNCs at Logan Airport, beginning in February 2017, in cooperation with state regulators, Massport began allowing TNCs to pick-up arriving air passengers via a TNC pool lot. This is a service that is being tracked for reporting in 2017.

As noted in **Figure 5-1**, transit and shared-ride modes are designed for use by multiple travelers. With a higher occupancy, the Airport vehicle trips per passenger for the transit and shared-ride modes is relatively low. Private vehicles that park at the Airport (or an off-Airport lot) generate a single vehicle trip to the Airport for the departing air passenger (and a single vehicle trip from the Airport for the arriving air passenger). Vehicles that do not remain on the Airport for an air passenger’s trip duration, such as those private vehicles that have dropped off an air passenger at the curb, generate a trip to and a trip from the Airport for a departing air passenger. In the case of taxicabs, TNCs, and black-car limousines, many of these depart Logan Airport empty after dropping off an air passenger or arrive at the airport empty to pick-up air passengers. As **Figure 5-1** shows, when measured in terms of vehicle trips generated, the most environmentally desirable mode is HOV (transit and shared-ride), followed by drive-and-park, with the least desirable mode being drop-off/pick-up**.**

4 Private limousines are included in the definition of HOV. For the purposes of discussing three major options for getting to Logan Airport, however, scheduled “black car” limousines are classified as drop-off/pick-up.

Figure 5-1 Ground Access Mode Choice Hierarchy



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

On-Airport Vehicle Traffic: Volumes and Vehicle Miles Traveled (VMT)

This section reports on Logan Airport's traffic-related activity for 2016, specifically:

- Traffic volumes
- VMT calculations

Central to these components is Massport's leadership in and commitment to developing, promoting, and providing alternative means of ground transportation for access to and from Logan Airport. The diverse range of environmentally responsible transportation modes to access the Airport by air travelers, employees, and other Airport users has reduced reliance on automobile travel, thus reducing traffic congestion and contributing to improvements in air quality. **Figure 5-2** shows the roadway infrastructure at Logan Airport in 2016.

Gateway Traffic Volumes

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

Data Collection and Annual Average Daily Calculation Method

All of the Airport's gateway roadways are equipped with permanent traffic count stations, as part of the Airport-wide Automated Traffic Monitoring System (ATMS). These stations provide data to calculate:

- Annual average daily traffic (AADT);
- Annual average weekday daily traffic (AWDT); and
- Annual average weekend daily traffic (AWEDT).

Since the data are collected continuously throughout the year, seasonal adjustment factors are only necessary when significant gaps in the data occur (typically due to equipment failure/malfunction or construction activity). When seasonal adjustment factors are used, these are generally based on a combination of the seasonality (monthly variation) of counts from other ATMS stations or the same station in the previous year.

Annual Average Daily Activity Levels

Table 5-1 summarizes the daily gateway traffic volumes at Logan Airport for the years 2012 through 2016. It includes AADT, AWDT, AWEDT, and annual air passengers, for reference.

The AADT entering and departing Logan Airport via its gateway roadways increased by 5.4 percent between 2015 and 2016. The change in average daily traffic can be attributed primarily to:

- An 8.5-percent increase in air passenger activity in 2016;
- A 5.1-percent increase in taxi dispatches in 2016; and
- The impact of TNCs, for which ridership data were not comprehensively available for 2016.

Although daily traffic volumes on the airport roadway system have been increasing, it is important to place this growth in the context of overall Airport activity and Massport's successful efforts to promote HOV ground access. In 2016 air passenger volumes were 32.3 percent higher than in 2010; while AADT, AWDT, and AWEDT volumes grew at only 27.2, 27.0, and 26.5 percent, respectively, over the same time period. Growth in gateway traffic volumes is also partially attributable to growth in non-air passenger activity such as air cargo, aviation services, and other Airport activities. Thus, gateway traffic volume is growing at a lower rate than air passenger growth, reflecting Massport's decade-long commitment to improving and supporting HOV access to the Airport, which saw HOV mode share rise to 30.5 percent in the *2016 Logan Airport Air Passenger Ground-Access Survey* in contrast to 27.8 percent in the previous survey in 2013.

Table 5-1 Logan Airport Gateways: Annual Average Daily Traffic, 2010 - 2016

	AADT		AWDT		AWEDT		Annual Air Passengers	
Year	**Volume**	**Percent Change**	**Volume**	**Percent Change**	**Volume**	**Percent Change**	**Level of Activity**	**Percent Change**
2010	94,179	4.9%	98,968	5.5%	82,595	4.5%	27,428,962	7.5%
2011	99,449	5.6%	104,863	6.0%	85,879	4.0%	28,907,938	5.4%
2012	99,281	(0.2%)	104,439	(0.4%)	86,494	0.7%	29,235,643	1.1%
2013	102,771	3.5%	107,656	3.1%	90,822	5.0%	30,218,970	3.4%
2014	108,172	5.3%	113,564	5.5%	94,881	4.5%	31,634,445	4.7%
2015[1]	113,623	5.0%	119,288	5.0%	99,415	4.8%	33,449,580	5.7%
2016	**119,750**	**5.4%**	**125,728**	**5.4%**	**104,471**	**5.1%**	**36,288,042**	**8.5%**

Source: Massport.
Notes: Numbers in parentheses ( ) represent negative numbers.
1 After a review of additional available data, Massport has updated 2015 average annual traffic since the 2015 EDR filing.
AADT Annual average daily traffic.
AWDT Annual average weekday daily traffic.
AWEDT Annual average weekend daily traffic.

On-Airport Vehicle Miles Traveled (VMT)

On-Airport VMT is calculated based on the total number of miles traveled by all vehicles on the Logan Airport roadway system. VMT is an important metric because it is used to calculate motor vehicle air quality emissions, and it is also one indication of the levels of traffic on roadways in specific areas and at specific times.

Calculation Method and Model Description

In 2011, Massport upgraded its modeling capabilities and began using an on-Airport VISSIM[5] model to estimate VMT. This model can be adapted to reflect changes in the evolving Logan Airport roadway transportation network and is more robust than the previous model developed in 1994, which was based on the prior terminal roadway system. The study area of the VISSIM model roadway network can be found in Appendix G, *Ground Access*. The VISSIM model not only estimates VMT associated with curbside activity and parking, but also with Logan Airport operations, rental car activity, and hotel activity.

The model is calibrated to existing evening peak hour volume data, which is generally the peak hour of the airport roadway system. Adjustment factors were determined to calculate morning peak hour, highest 8-hour, and average weekday VMT from the VISSIM model. The adjustment factors for the 2016 VMT calculations were determined by using 2011 to 2016 gateway, Airport roadway, and parking volume averages. Tables provided in Appendix G, *Ground Access,* compare existing and simulated traffic volumes at Logan Airport for the 2016 condition.

Estimated VMT Calculations and Modeling Results

Consistent with previous years, the following specific time periods were analyzed for 2016:

- Morning peak hour (AM Peak Hour);
- Evening peak hour (PM Peak Hour);
- Highest consecutive 8-hour (High 8-Hour); and
- Average weekday VMT.

Table 5-2 summarizes the VMT estimates for Logan Airport-related traffic from 2010 through 2016. The change in average weekday VMT between 2015 and 2016 was approximately 4.8 percent, despite higher increases in passenger levels (8.5 percent) and traffic volume (5.4 percent) during the same time period, as noted above. Absent any major shift in traffic volumes entering the gateways, the change in VMT is expected to closely mirror the change in traffic volume, as it did in 2016. Details of the 2016 VMT modeling results are presented in Appendix G, *Ground Access*.

5 PTV America. (2011). Verkehr In Städen Simulationsmodell- VISSIM version 5.40 [computer software]. Portland, OR.

Table 5-2 Airport Study Area Vehicle Miles Traveled (VMT) for Airport-Related Traffic, 2010 - 2016

Analysis Year	AM Peak Hour	PM Peak Hour	High 8-Hour	Average Weekday	Average Weekday Percent Change
2010	8,451	10,887	78,185	162,885	4.8%
2011	8,391	10,978	76,920	167,647	2.9%
2012	8,387	10,974	76,883	167,564	(0.05%)
2013	9,006	11,407	80,088	177,094	5.7%
2014	8,155	10,107	71,361	158,443	(10.5%)[1]
2015	8,580	10,660	76,058	168,791	6.5%
2016	**9,009**	**11,101**	**79,234**	**176,841**	**4.8%**

Source: VHB and Massport.
Notes: Numbers in parentheses ( ) represent a reduction in VMT.
1 The 10.5-percent decrease in 2014 VMT can be attributed to the addition of the Rental Car Center (which consolidated the rental car shuttle bus fleet and some Massport shuttle buses into a unified shuttle route system), the relocation of the taxi and bus/limousine pools closer to the terminals, and terminal curbside reallocations.

Since 2000, the highest average weekday VMT estimated at Logan Airport was in 2007, when weekday VMT was modeled to be 184,613. Current weekday VMT calculations remain about 4.4 percent lower than 2007 VMT, despite the 29.1 percent increase in air passenger traffic during the same time period. This is partially attributed to Massport's dedication to promoting HOV modes and reducing unnecessary on-airport vehicle trips whenever possible. A direct and quantifiable comparison between VMT values prior to 2011 is difficult to make because the current VMT model (adopted in 2011) includes a larger on-Airport study area than the previous model, which was limited to terminal access roads.

Parking Conditions

Massport manages the on-Airport parking supply at Logan Airport to promote long-term rather than short-term parking (thus reducing the number of daily trips to Logan Airport), support efficient use of parking facilities, provide good customer service, and comply with the provisions of the Logan Airport Parking Freeze. Details on current conditions are presented in the following sections.

Massport has a comprehensive parking monitoring and management program including tracking of:

- On-Airport parking conditions, including parking facilities and supply, demand, and parking rates; and
- Parking programs (including preferred parking for hybrid vehicles).

FIGURE 5-2 Logan Airport Roadway Network

2016 Environmental Data Report

Parking Garages

Terminal Buildings

Airport Roadways

0 450 900 1800 Feet

Logan Airport Parking Freeze[6]

The number of commercial and employee parking spaces allowed at Logan Airport is regulated by the Logan Airport Parking Freeze (310 Code of Massachusetts Regulations 7.30), which is an element of the Massachusetts State Implementation Plan (SIP) under the Federal Clean Air Act (42 U.S.C. §7401 et seq. [1970]). As required, Massport submits semi-annual filings to the Massachusetts Department of Environmental Protection (MassDEP) demonstrating Massport's compliance with the Logan Airport Parking Freeze. The reports for March and September of 2016 are provided in Appendix G, *Ground Access*.

The Logan Airport Parking Freeze sets an upper limit to the supply of commercial and employee parking spaces at Logan Airport. As permitted (and encouraged) by the Parking Freeze provisions, Massport has converted employee spaces to commercial spaces, within the overall limit imposed by the Logan Airport Parking Freeze. As explained in **Table 5-3**, Massport has also transferred Airport-related park-and-fly spaces managed under the East Boston Parking Freeze[7] to be managed under the Logan Airport Parking Freeze. **Table 5-3** presents the total number of parking spaces permitted on-Airport and the allocation of those spaces between commercial and employee spaces through 2016.

Under the Logan Airport Parking Freeze regulation, Massport must monitor the number of commercial and employee vehicles parked on-Airport and ensure that the total number of parked commercial and employee vehicles do not exceed the Parking Freeze limits. If the number of commercially parked vehicles exceeds the allocated commercial parking limit under the Parking Freeze on any day, those additional vehicles are considered to be using "Restricted Use Parking Spaces." Use of Restricted Use Parking Spaces is allowed under the regulation when Logan Airport experiences "extreme peaks of air travel and corresponding demand for parking spaces" and may be made available for use only at such times, up to ten days in any calendar year. These spaces must be provided free of charge when demand exceeds the limit.

6 310 Code of Massachusetts Regulations 7.30 and 40 CFR 52.1120.

7 310 Code of Massachusetts Regulations 7.31.

Table 5-3 Logan Airport Parking Freeze: Allocation of Parking Spaces

	Type of Spaces		
Year[1]	**On-Airport Commercial Spaces**	**On-Airport Employee Spaces**	**Total Logan Airport Spaces Permitted**
2007- 2010	17,319	3,373	20,692
2010 - 2011	17,619	3,073	20,692
2011 – 2012	18,019	2,673	20,692
2012 – 2013	18,265	2,673	20,938[2]
2013 – 2014	18,415	2,673	21,088[3]
2014 – 2015	18,415	2,673	21,088
2015 – 2016	**18,640**	**2,448**	**21,088**

Source: Massport.

Notes:

1 The range of years represents the number of years that various parking space allocations were in effect. For example, from 2007, 2008, 2009, and 2010 there were 17,319 on-Airport commercial spaces and 3,373 on-Airport employee spaces.

2 In July 2012, Massport acquired property at 135B Bremen Street in East Boston, which supported 246 park-and-fly spaces that were in the East Boston Parking Freeze inventory. Massport's relocation of those park-and-fly spaces from the East Boston Parking Freeze Area to the Logan Airport Parking Freeze Area led to a revised Parking Freeze inventory for Logan Airport and East Boston, respectively.

3 In June 2013, Massport acquired property at 413-419 Bremen Street in East Boston which had 150 park-and-fly spaces that were located within the East Boston Parking Freeze Area. Massport's relocation of those park-and-fly spaces from the East Boston Parking Freeze Area to the Logan Airport Parking Freeze Area led to a revised Parking Freeze inventory for Logan Airport and East Boston, respectively.

The intent of the Logan Airport Parking Freeze is to reduce air emissions by shifting air passengers to travel modes requiring fewer vehicle trips. However, survey data since the 1970s has consistently shown that constrained parking has the unintended consequence of shifting air passengers to travel modes with higher numbers of vehicle trips, despite Massport's extensive efforts to provide and encourage the use of HOV travel modes. According to the *2016 Logan Airport Air Passenger Ground-Access Survey,* if parking was not an option for passengers who parked on-Airport, 77 percent of survey respondents indicated that they would use drop-off/pick-up modes (i.e., dropped off or picked up by private vehicles, taxi, TNC, or black car/limousine service). Prior surveys of Logan Airport air passengers have consistently shown similar results.

As the number of air travelers has increased, the constrained parking supply at Logan Airport may have contributed to an increase in environmentally harmful drop-off/pick-up vehicle activity (which generates up to four vehicle trips per air passenger, compared to two trips for those who drive and park). The potential impact has been mitigated by the successful growth of transit and shared-ride mode ground access, especially Logan Express park-and-ride and private buses. Nonetheless, implementing parking policies and investments to reduce diversion to growing drop-off/pick-up modes remains an Airport priority.

As one element of its comprehensive transportation strategy, Massport proposed to increase the Logan Airport Parking Freeze cap by 5,000 on-Airport commercial parking spaces at Logan Airport. The goal was to provide Massport with the ability to reduce the number of air passengers choosing more environmentally harmful drop-off/pick-up modes by allowing passengers to park on-Airport.

The increase in the Logan Airport Parking Freeze Cap was predicated on the approval of a regulatory change by MassDEP, whereby MassDEP would amend the existing Logan Airport Parking Freeze regulation to allow for an additional 5,000 commercial parking spaces at Logan Airport. [8] As part of the process to amend the Logan Airport Parking Freeze regulation, MassDEP conducted a stakeholder process, which was followed by a public process to amend the Parking Freeze regulation. MassDEP issued the amended regulation on June 30, 2017 approving the requested parking cap increase. Massport initiated a parallel process with the Executive Office of Energy and Environmental Affairs (EEA) by filing an Environmental Notification Form (ENF) for new parking facilities on March 31, 2017. On May 5, 2017, EEA issued its Certificate on the ENF establishing the Scope for the required Draft Environmental Impact Report (EIR). On December 5, 2017, the U.S. Environmental Protection Agency (EPA) proposed a rule approving the revision of the Massachusetts SIP incorporating the amended Logan Airport Parking Freeze Cap. The final rule was issued on March 6, 2018, and became effective on April 5, 2018.

Initiation of concept design for the parking facilities and preparation of a Draft EIR is expected to commence in the Spring of 2018. The Draft EIR will provide additional details on the number of spaces per location and planned construction phasing. Massport has identified two potential sites for the new parking, atop the Economy Garage and the Terminal E Surface Lot (see Chapter 3, *Airport Planning.*)

Parking Space Availability

Table 5-4 provides a summary of the Logan Airport commercial parking space inventory and reported to the MassDEP on a quarterly basis.

Daily Parking Occupancy

On-Airport commercial parking occupancy typically peaks mid-week (Tuesday through Thursday) with lower occupancies occurring Friday through Monday. The number of vehicles parked at Logan Airport in commercial spaces over the course of any 24-hour period was obtained from parked vehicle count data for Tuesdays, Wednesdays, and Thursdays, which are collected throughout the year. The peak daily parking occupancy data are presented in **Figure 5-3**.

Peak day demand for on-Airport parking has been increasing, resulting in daily demand frequently nearing the Logan Airport Parking Freeze cap (see **Figures 5-3** to **5-5**). While Massport continued to be in full compliance with the Logan Airport Parking Freeze[9] in 2016, it was forced to divert vehicles to overflow lots or valet-park passenger vehicles on 116 out of 260 working days. Vehicle diversions primarily occurred on Tuesdays and Wednesdays, during hours of peak parking demand.

8 310 Code of Massachusetts Regulations 7.30.

9 310 Code of Massachusetts Regulations 7.30 and 40 CFR 52.1120.

Table 5-4 Logan Airport Parking Freeze: Allocation of Commercial Parking Spaces, 2010-2016

Location and Facility	March 2010	March 2011	March 2012	March 2013	March 2014	March 2015	March 2016	Sept. 2016	Status
Terminal Area									
Central Garage and West Garage[1]	10,375	10,375	10,344	10,396	10,267	10,267	11,954	11,954	West Garage expansion in 2016
Terminal B Garage	2,235	2,380	2,632	2,553	2,254	2,254	2,212	2,212	Lower level Terminal B garage now used for limousines/taxis/TNCs pick-up
Terminal E Lot 1	269	269	269	269	275	243	237	237	
Terminal E Lot 2	257	257	257	251	248	248	249	249	
Terminal E Lot 3	150	229	222	222	219	219	217	217	
Blue Lot							367	367	
North Cargo Area (NCA)									
Economy Parking Garage	932[2]	2,880	2,789	2,809	2,809	2,809	2,864	2,864	
Overflow/Temp Lots	416	666	-[3]	-[3]	-[3]	832	-	-	Eliminated for West Garage expansion in 2016
North Service Area									
Sky Chef Valet Lot[4]	260	-	-	-	-	-	-	-	
Total in-service revenue commercial spaces	14,894	17,056	16,513	16,505	16,072	16,872	18,100	18,100	Excludes hotel and general aviation (GA) spaces (noted below)
Signature Flight Support (General Aviation)	35	35	35	35	35	35	35	35	
Hotel (Hilton, Hyatt)	-	505	505	505	505	305	505	505	Hilton now primarily accommodated in the West Garage
Total in-service commercial spaces	14,929	17,596	17,053	17,040	16,612	17,212	18,640	18,640	Includes hotel and GA spaces
Total commercial spaces (Freeze limit)[5, 6]	17,319	17,619	18,019	18,265	18,415	18,415	18,640	18,640	Includes in-service and designated spaces

Source: Massport, Parking Freeze Inventory, March 2010, March 2011, March 2012, March 2013, March 2014, March 2015, March and September 2016.

Notes:

1 In 2016, Massport opened the West Garage Expansion, reallocating commerical overflow spaces to in-service commercial spaces and permanently reallocating 225 employee spaces to commercial.

2 Before the Economy Parking Garage was constructed, it was known as Economy Lot 2 in 2010.

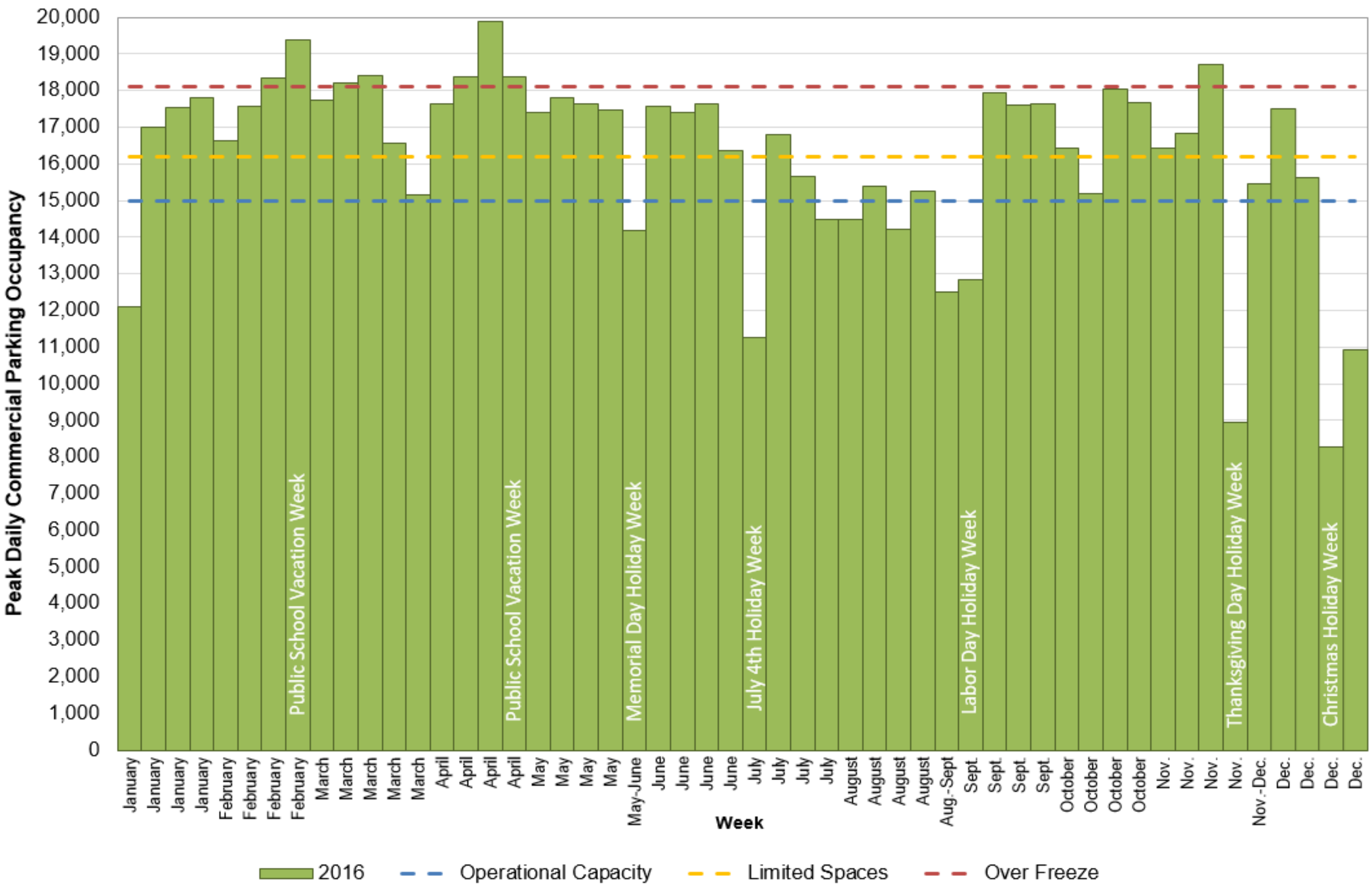
3 In mid-2011 the temporary Southwest Service Area (SWSA) lots were eliminated for Rental Car Center (RCC) construction.

4 Eliminated for construction purposes, November 3, 2010.

5 In July 2012, 246 spaces were transferred from the East Boston freeze allocation to the Logan Airport Commercial Parking Spaces inventory through the acquistion of Paul's Parking at 135B Bremen Street.

6 In June 2013, 150 spaces were transferred from the East Boston Freeze Area to the Logan Airport Parking Freeze Area through the acquistion of Paul's Parking at 413-419 Bremen Street.

Figure 5-3 Commercial Parking: Weekly Peak Daily Occupancy, 2016



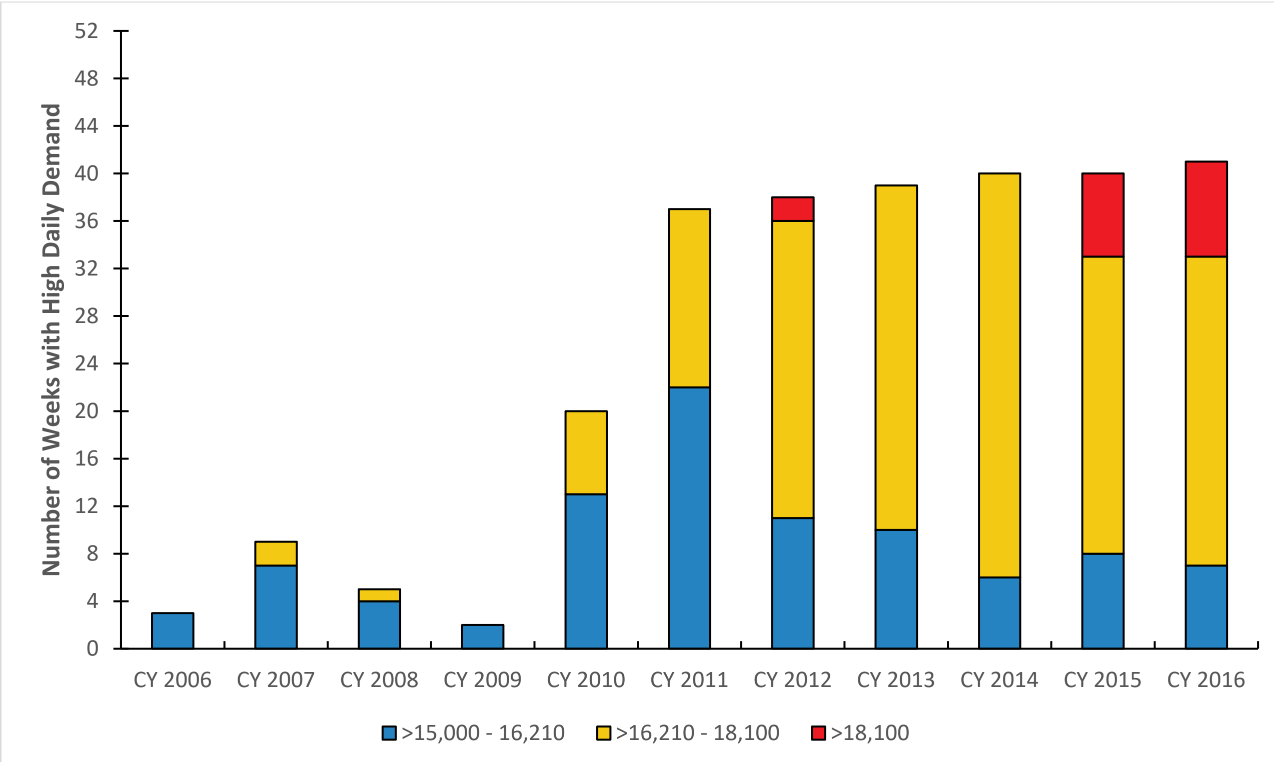
Source: Massport.

Notes: The chart shows the highest daily count for each week in 2016.
In 2016, the operational capacity of in-service commercial spaces was 15,000.
At no time in 2016 did the Parking Freeze limit on Restricted Use Spaces exceed the allowed 10 days. Massport was at all times in full compliance with the Parking Freeze regulations in 2016.

Operational Adjustments to Meet Parking Demand

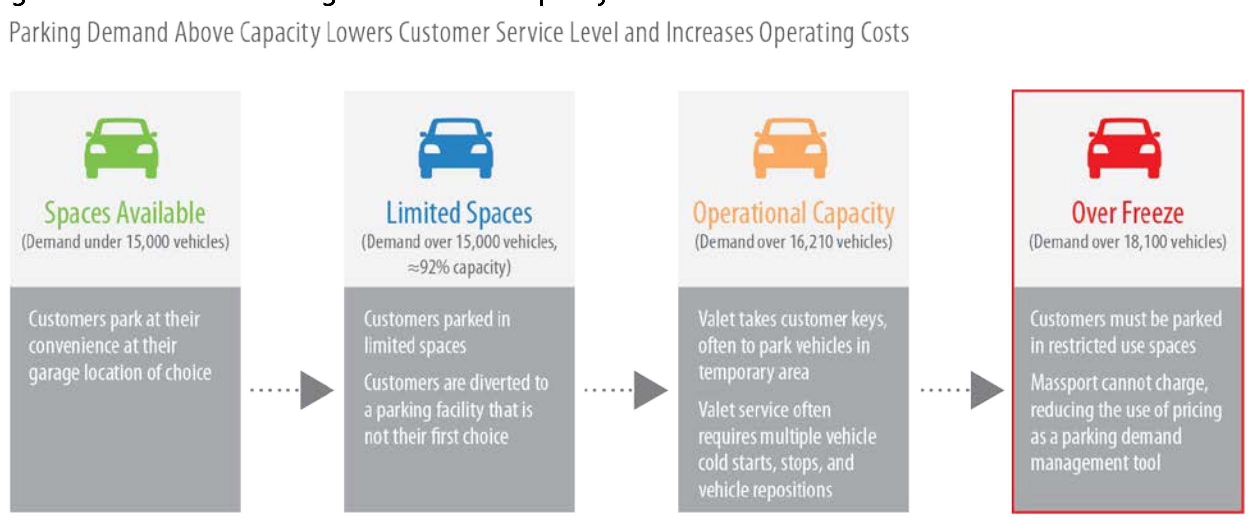
The inadequate supply of parking causes air passengers to circulate on Airport roadways to find parking, and in overflow conditions, cars are diverted or moved to non-garage parking areas, including overflow lots, some of which are located off-Airport. Not only does parking demand activity above capacity lower customer service levels, it also increases on-Airport roadway vehicle emissions related to circulating traffic. Diversions and valeting have become a regular occurrence at Logan Airport. These diversions decrease operational efficiency and compromise customer service.

Figure 5-4 Demand for Parking: Number of Weeks per Calendar Year with High Daily Parking Demand



Source: Massport.

Figure 5-5 2016 Parking Demand and Capacity



Source: Massport.

Notes: 18,100 represents the total number of on-Airport parking spaces allocated within the Parking Freeze in 2016. Hotel and general aviation uses, which are included in the 18,640 Parking Freeze Limit, are excluded from this figure.

These vehicle diversions, in general, increase on-Airport VMT. The peak of valet operations coincides with peak parking demand, requiring Airport operations to use all available spaces to meet parking demand.

Parking Exits by Duration

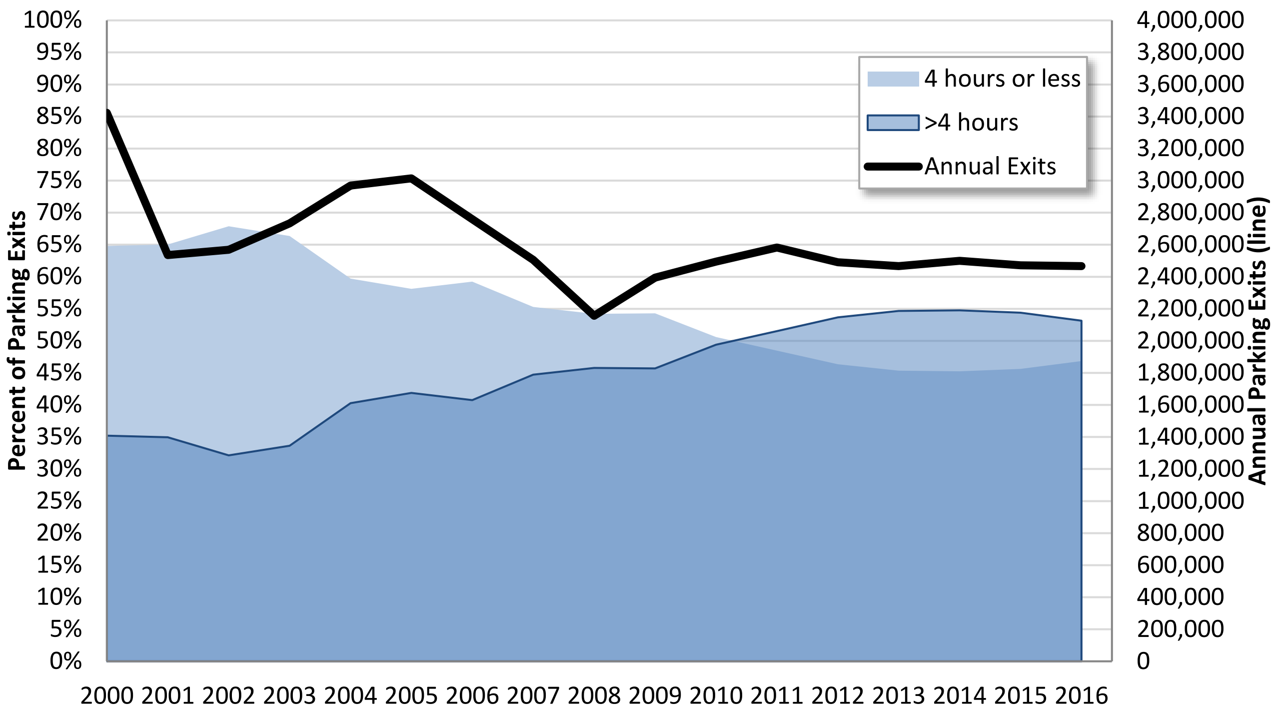
As presented in **Table 5-5**, the total annual parking activity (as defined by revenue parking exits) remained relatively constant in 2016, even as short-term parking durations (less than 4 hours) grew (see **Figure 5-6**). Stagnant growth in overall parking coupled with an increase in the number of vehicles entering the Airport may be a symptom of a shift to drop-off/pick-up modes as a result of constrained parking conditions. The Parking Freeze Amendment will allow Massport the flexibility to build additional parking supply in conjunction with expanding HOV alternatives in order to divert drop-off/pick-up modes.

Table 5-5 Parking Exits by Length of Stay (Parking Duration)

		0-4 hrs.	>4-24 hrs.	>1-4 days	>4 days	Total
2010	Tickets	1,261,813	230,260	741,706	260,240	2,494,019
	Percent	51%	9%	30%	10%	
2011	Tickets	1,251,956	235,039	800,188	295,270	2,582,453
	Percent	48%	9%	31%	11%	
2012	Tickets	1,153,781	215,028	815,266	305,925	2,490,000
	Percent	46%	9%	33%	12%	
2013	Tickets	1,118,218	209,437	823,187	315,295	2,466,137
	Percent	45%	8%	33%	13%	
2014	Tickets	1,130,560	213,567	830,545	324,332	2,499,004
	Percent	45%	9%	33%	13%	
2015	Tickets	1,127,353	219,014	796,228	329,044	2,471,639
	Percent	46%	9%	32%	13%	
2016	**Tickets**	**1,155,606**	**208,537**	**791,319**	**310,740**	**2,466,202**
	Percent	**47%**	**8%**	**32%**	**13%**	
Percent change – 2015 to 2016		**2.5%**	**(4.8%)**	**(<1%)**	**(5.6%)**	**(<1%)**

Source: Massport.
Notes: Numbers in parentheses ( ) represent a reduction. Tickets are representative of revenue parking exits.

Figure 5-6 Percent of Parking Exits by Duration: Short vs. Long-Term Parking



Source: Massport.

2016 Commercial Parking Rates

Massport periodically assesses its parking rate structure to support its ground-access strategy. As detailed in **Table 5-6**, parking rates in the on-Airport garages were increased in July 2016, while the substantially lower parking rates for Logan Express remote parking have been maintained at $7 per day. These policies contributed to growth in Logan Express park-and-ride by 9.4 percent since 2015.[10]

With a pay-on-foot system, Massport requires parking fees to be pre-paid at kiosks inside the terminals and at garage access points at the pedestrian walkways, thus improving parking exit flow and reducing vehicle idling and associated emissions at exit plazas. Pay stations are located in the terminals, at the Massport shuttle drop-off/pick-up location in the Economy Garage and at the pedestrian entrances to the Central Garage, Terminal B garage, and Terminal E parking lot. Approximately 80 percent of parking patrons use the pay-on-foot system to pre-pay their parking fees before exiting.

Several off-Airport parking facilities, such as PreFlight Airport Parking in Chelsea, are privately owned and operated, and they are outside of the Logan Airport Parking Freeze area. Massport has no control over rates at off-Airport parking lots. For 2016, the parking rates for the three major off-Airport parking providers (PreFlight, Park Shuttle & Fly, and Thrifty) vary from $17.95 to $22.50 for daily parking and from $108 to $150 for weekly parking.

10 Overall Logan Express growth was less than 1 percent, but owing primarily to declines in ridership on the Back Bay pilot service for which Massport parking is not available.

Table 5-6 On-Airport Commercial Parking Rates, 2010 - 2016

Terminal Area Facility	2010	2011	2012	2013	2014	2015	2016
Central/West Parking Garage, Terminal B Garage, Terminal E Lots							
0 to 30 minutes	$3	$3	$3	$3	$3	$3	$3
31 minutes to 1 hour	$6	$6	$6	$6	$6	$6	$6
1 to 1.5 hours	$9	$9	$9	$9	$11	$10	$12
1.5 to 2 hours	$12	$12	$12	$12	$14	$14	$17
2 to 3 hours	$15	$15	$17	$17	$19	$19	$22
3 to 4 hours	$18	$18	$21	$21	$23	$23	$26
4 to 7 hours	$22	$22	$25	$25	$27	$27	$30
7 to 24 hours (Daily)	$24	$24	$27	$27	$29	$29	$32
Additional days 0 to 6 hours	$12	$12	$14	$14	$15	$15	$16
Additional day(s) 6 to 24 hours	$24	$24	$27	$27	$29	$29	$32

Economy Parking	2010	2011	2012	2013	2014	2015	2016
Economy Parking Garage							
Daily Rate	$18	$18	$18	$18	$20	$20	$23
Additional days 0 to 6 hours	$9	$9	$9	$9	$10	$10	$12
Additional days 6 to 24 hours	$18	$18	$18	$18	$20	$20	$23
Weekly Rate (6-7 days)	$108	$108	$108	$108	$120	$120	$138

Source: Massport; most recent rates effective 2016.

Long-Term Parking Management Plan

In addition to supporting HOV, Massport actively manages parking supply as another strategy to reduce drop-off/pick-up modes. Massport manages the on-Airport parking supply at Logan Airport to: (1) promote long-term rather than short-term parking (thus reducing the number of daily trips to Logan Airport); (2) support efficient utilization of parking facilities; (3) provide good customer service; and (4) comply with the provisions of the Logan Airport Parking Freeze. Massport has substantially reduced the number of on-Airport employee spaces to further reduce VMT, and promotes sustainable transportation options through a Massport-wide newsletter (see **Figure 5-7**).

As part of its ongoing review of ground access and strategic-planning initiatives, Massport has been reviewing recent parking demand trends. That analysis shows that in 2016, Massport diverted or valet-parked private passenger vehicles to various on-Airport locations approximately 116 out of 260 work days. While Logan Airport has experienced diversions in the past, the number of days per year diversions occur has increased over the past several years. As presented in previous EDR/ESPR filings, diverting or valeting cars is inefficient and reduces customer service. The Long-Term Parking Management Plan, which was first included in the *2012/2013 EDR,* lays out a multi-part strategy for efficiently managing parking supply, pricing, and operations – both at Logan Airport and at Massport-controlled off-Airport locations – to maximize transit/shared-ride ground access while minimizing both drive-and-park and drop-off/pick-up modes. The Long-Term Parking Management Plan represents Massport's current strategy to manage parking pricing, supply, and demand within the current Logan Airport Parking Freeze.

Table 5-7 describes each parking plan element and progress to date. Massport is actively working to manage Airport parking and encourage the use of multi-occupant vehicle access to Logan Airport. Additional measures are currently under discussion as part of Massport's strategic planning efforts.

The focus of the Long-Term Parking Management Plan sets out the efforts that Massport has undertaken, and will continue to take in the future, to manage the supply, pricing, and operation of parking.

Table 5-7 Long-Term Parking Management Plan Elements and Progress

Parking Plan Element	Progress to Date
Parking Supply:	
▪ Add revenue-controlled parking spaces in the terminal area to bring supply up to the maximum number of spaces allowed under the Logan Airport Parking Freeze	▪ Massport completed construction of approximately 1,700 commercial parking spaces at the Central Garage in late 2015. This project is consistent with the Logan Airport Parking Freeze and builds out the maximum number of striped spaces under the existing Logan Airport Parking Freeze.
▪ Work to increase the supply of Massport-controlled off-Airport parking at Logan Express sites	▪ A new 1,100 car parking garage opened in Framingham on April 15, 2015, increasing on-site capacity at that location by approximately 550 spaces.

Table 5-7 Long-Term Parking Management Plan Elements and Progress (Continued)

Parking Plan Element	Progress to Date
Parking Pricing:	
▪ Discourage air passengers from driving and parking at Logan Airport by ensuring that the least expensive Massport-controlled parking will be provided at remote Logan Express sites	▪ Massport has reduced parking rates at Logan Express facilities from $11.00 per day to $7.00 per day. The least expensive parking at Logan Airport is $23.00 per day.
▪ Encourage more efficient use of available on-Airport parking by maintaining a meaningful price differential between rates at the Economy Parking Garage and terminal-area parking garages	▪ Economy Parking is $23.00 per day in 2016; Terminal Area garage and lot rates in 2016 are $32.00 per day.
▪ Evaluate increased parking prices for terminal-area parking to encourage Airport passengers and visitors to consider transit and shared-ride alternatives	▪ Ongoing.
Parking Demand:	
▪ Increase alternative HOV mode options to decrease use of private vehicles	▪ Massport implemented Back Bay Logan Express scheduled bus service in May 2014 as a pilot program. ▪ Massport offers discounted parking and bus fares at all Logan Express locations during peak air travel periods. ▪ Massport placed signage in all terminals to help promote the use of the regional express bus carriers. ▪ Massport continues to sponsor free outbound (from Logan Airport) Silver Line bus service. ▪ Massport increased available parking from approximately 550 spaces to 1,100 spaces at its Framingham location to encourage the use of Logan Express. ▪ Massport works with private carriers to increase HOV options to and from Logan Airport. ▪ Massport supports the Sunrise Shuttle, which provided early morning bus service from East Boston and parts of Winthrop and Revere prior to the start of MBTA service.
Employee Parking:	
▪ Continue to work to reduce the number of Airport employees commuting by private automobile and parking at the Airport by providing off-Airport parking both near Logan Airport and at Logan Express sites, and implementing measures to enhance employee commuting options	▪ Massport provides employee parking in Chelsea with free shuttle bus transportation to the Airport. ▪ Massport offers employee rates to encourage the use of Logan Express facilities. ▪ Additional early morning and late-night bus service has been added to Logan Express sites to encourage use and better serve Logan Airport employee schedules. ▪ In April 2016, Massport further decreased the number of on-Airport employee parking spaces from 2,673 to 2,448 employee spaces.

Figure 5-7 Massport Sustainable Transportation Options Newsletter, February 2018

How to Put the Brakes on Driving Alone to Work

TRANSIT AND VANPOOL DISCOUNTS

- All full, part-time, and job share employees are eligible for 50% reduction off the cost of their public transportation commuting costs, up to $100.00 per month.
- Employees can take advantage of this program either through reimbursement or on a pretax basis from your paycheck.
- Eligible mass transportation options include MBTA transit, Inner Harbor Ferry, Logan Express buses, Commuter Boat, Vanpool and privately operated scheduled buses.

For more information, please contact Emily Navarro at x393, except for Vanpools. Matt Carral of Rideshare by Enterprise can be contacted at Matthew.d.carral@ehi.com or 508-259-8959 for information regarding establishing a Vanpool.

MASSPORT SHUTTLES

- Shuttles circulate the airport, making it easy to connect to the Blue Line (Airport Station), the Silver Line, Logan Express, privately operated scheduled buses, and water transportation.
- Shuttles run during the work week between the LOC, Terminal C and the Blue Line every 15 minutes from 7:30 - 9:30 AM and 2:00 - 6:00 PM.

LOGAN EXPRESS

- Employee discounts on fares and parking are available at all Logan Express locations, including Framingham, Braintree, Woburn, and Peabody. Discounts are also available on the Back Bay Logan Express..
- For tickets, please contact Emily Navarro at x3937.
- Click here for schedules: https://www.massport.com/logan-airport/to-and-from-logan/logan-express/

WATER TRANSPORTATION

- Massport employees can ride the water taxi free of charge Monday – Friday from 7:15 – 9:15am and 3:30 – 5:30pm with a Massport badge all-year round.
- Pre-paid vouchers are also available for work-related travel during other hours. For more information, contact Jamila Richardson at x1756.
- Valid for transportation between the following docks: Logan, Long Wharf, Central Wharf, Rowes Wharf, Moakley Court House, and World Trade Center.
- For a map of water taxi pickup/drop-off locations click here: https://www.massport.com/logan-airport/to-and-from-logan/water-transport/

BIKE TO WORK

- Massport offers bike racks around Logan airport and at other facilities for convenient bike parking.
- Shower facilities are available at the LOC (for badged employees) and may be available at other facilities (check with your supervisor for access and availability).

massport

Pedestrian Facilities and Bicycle Parking

Massport has made substantial progress in providing Airport-wide pedestrian access. Sidewalks along Harborside Drive and Hotel Drive connect to the terminals, where a series of overhead, enclosed walkways connect to the Central and West Parking garages as well as the Hilton Hotel. The sidewalks along Harborside Drive, Transportation Way, North Service Road, and the Harborwalk facilitate pedestrian access to the Airport water shuttle boat dock, MBTA Blue Line Airport Station, and the pedestrian and bicycle pathways at Memorial Stadium Park, Bremen Street Park, and the East Boston Greenway.

Bicycle parking at Massport facilities.

Bicycle parking racks are provided at many landside facilities. Generally, these racks are expected to primarily serve employees, but are open for use by air passengers as well. Terminal A, Terminal E, the Logan Office Center, Signature General Aviation Terminal, the Economy Parking Garage, the Green Bus Depot, and Airport MBTA Station all have bicycle racks. The Rental Car Center (RCC) has sheltered bicycle parking racks for use by both employees and passengers. Shower and change facilities were also added to the Logan Office Center for employees.

Pedestrian and bicycle safety is further enhanced through the design of streetscape, intersections, lighting, and defined vehicle zones with new curbing, crosswalks, sidewalks, plantings, and fencing. Bicycle connections are available around Airport Station, Memorial Stadium Park, Bremen Street Park, and the East Boston Greenway. As part of the RCC construction, connections in the SWSA now allow employees and customers of the Airport to arrive via bicycle and park in a secure covered area at the new RCC. Commuters can use the unified bus system or pedestrian connections to the terminals. In the North Service Area, connections to and from Bremen Street Park and the Greenway Connector were completed in early 2015. These improvements connect the existing shared-use path to a new northern connector of the East Boston Greenway (the Narrow-Gauge Connector). The Logan Airport portion of this connection was completed in July 2014. In 2016, a 1/3-mile extension of the East Boston Greenway network was completed by the City of Boston. There are pedestrian and bike counters along the Greenway Connector. In 2016, there were 43,787 East Boston Greenway users that were recorded by the counter. Massport assumed ownership of an additional section of the park, known as the Narrow-Gauge Connector and located beyond the Greenway, in the spring of 2016.

Ground Transportation Ridership and Activity Levels in 2016

This section of the chapter:

- Provides an overview of transportation services available to Logan Airport users from the Boston metropolitan area;
- Reports on 2016 ridership levels and recent historical trends;
- Reports on Massport's progress in meeting ground access goals; and
- Describes Massport's cooperative planning ventures with other transportation agencies in Massachusetts.

Logan Express, MBTA Transit, and Water Transportation Modes

Annual ridership levels for HOV/transit/shared-ride transportation modes serving Logan Airport are summarized in **Table 5-8**.

Table 5-8 Annual Ridership and Activity Levels on Logan Express, MBTA, and Water Transportation Services, 2010 – 2016

	MBTA Transit		Logan Express Bus			Water Transportation[3]	
Year	**Blue Line[1]**	**Silver Line[2]**	**Air Passengers**	**Employees**	**Total**	**MBTA Ferry[3]**	**Private Water Taxis**
2010	2,270,241	831,323	644,412	467,020	1,111,432	34,794	54,382
2011	2,277,311	900,359	649,609	536,513	1,186,122	33,403	58,879
2012	2,442,085	906,177	681,040	624,149	1,305,189	30,337	60,840
2013	2,597,306	N/A	733,005	634,693	1,367,698	21,952	70,378
2014[4]	2,378,965	N/A	941,043	632,011	1,573,054	19,340	67,479
2015	2,122,597	N/A	1,150,999	622,005	1,773,004	7,748	70,798
2016	**2,240,744**	**N/A**	**1,163,201**	**652,468**	**1,815,669**	**7,757**	**74,788**
Percent Change (2015-2016)	**6%**	**N/A**	**1%**	**5%**	**2%**	**<1%**	**6%**

Source: Massport

Notes:

N/A Not available.

1 Airport Station fare gate entrances only. Automatic Fare Collection introduced in January 2007. The Bremen Street Park entrance to MBTA Airport Station opened June 2007; station activity is not limited to only Airport-related passengers.

2 Boardings at Logan Airport. Silver Line: 2012 values are estimates. No information available for 2013 to present.

3 MBTA Ferry is the Harbor Express F2/F2H service, Hingham/Hull-Logan and Long Wharf. Service from Quincy Fore River was suspended in 2013. Private water taxis include: City Water Taxi and Rowes Wharf Water Transport.

4 Back Bay Logan Express introduced.

Figure 5-8 Logan Airport – Logan Express Bus Service Locations and Routes

Massachusetts Port Authority
Strategic and Business Planning
November 2016

Logan Express Bus Service

0 1.25 2.5 5 Miles

Projection: Lambert Conformal Conic **Coordinate System:** NAD 1983 State Plane Massachusetts Mainland FIPS 2001 (Meter)

Logan Express Bus Service

Massport provides frequent, scheduled, express coach bus service to Logan Airport for air passengers and Logan Airport employees from park-and-ride lots in Braintree, Framingham, Woburn, and Peabody. Full service bus terminals and secure parking are provided at all four locations. In addition, a pilot service from Back Bay, described in this section, was introduced in April 2014 (May 2014 was its first full month of operation). A new parking facility was opened in Framingham in April 2015 for Logan Express customers. More information related to this facility is described in this section. **Figure 5-8** depicts Logan Express bus locations with respect to the regional transportation network.

The Logan Express park-and-ride location round-trip adult fare is $22; reduced fares are offered to seniors, and children under the age of 17 ride free. To encourage greater ridership, a parking rate restructuring went into effect in 2012, which featured lower parking rates at $7 per day (from $11 per day) at Logan Express parking lots. On weekdays and Sunday afternoons/evenings, scheduled half-hour headways are provided between the Braintree, Woburn, and Framingham locations and Logan Airport; one-hour headways are provided at these locations on Saturdays and Sunday mornings. Scheduled bus service to/from Peabody is provided hourly. Services conforming to these schedules for all four locations are roughly 4:00 AM to 11:00 PM, with some earlier and later buses provided that vary by location and day of the week.

In 2015, Massport acquired the property on which the Braintree Logan Express site is located, furthering its commitment to providing HOV access from key regional nodes. The Braintree Logan Express service had a ridership of 655,158 passenger trips in 2016, representing 36 percent of the entire Logan Express system ridership. Approximately half of the Braintree Logan Express riders are Logan Airport employees. The Braintree site is approximately 20 acres (14 acres of usable land area) and has approximately 1,800 lined spaces.

As illustrated in **Table 5-8**, air passenger ridership on Logan Express increased by approximately 1 percent from 2015 to 2016; however, park-and-ride increased by 9.4 percent. Declining Back Bay pilot program ridership, described later in this chapter, offset much of the park-and-ride gains. Employee ridership increased by approximately 5 percent between 2015 and 2016. A detailed breakdown of the Logan Express ridership is presented in Appendix G, *Ground Access*.

Framingham Logan Express Upgrades

In April 2015, Massport opened a new parking facility in Framingham to serve Logan Express customers. The new four-level, 1,100-car parking garage increased the capacity at the Logan Express facility by approximately 550 spaces (compared to the previous surface lot). The new garage has improved the customer experience by providing secure parking at one central location rather than relying on a series of remote overflow lots. The new garage was built to high environmental standards, with energy-efficient LED lighting, water saving fixtures, bike racks, and priority parking for alternative fuel vehicles. The new facility continues to be successful: 2016 ridership of the Framingham Logan Express increased by 16.4 percent compared to the 2015 ridership, with 498,895 riders in 2016 versus 428,623 riders in 2015.

Back Bay Logan Express (Pilot Project)

On April 28, 2014, Massport initiated the Back Bay Logan Express service with pick-up locations at the Copley MBTA Green Line Station and the Hynes Convention Center. The Back Bay Logan Express operates daily between the hours of 5:00 AM and 10:00 PM. One-way fares are $7.50 per passenger. Riders with a current, valid MBTA pass receive a reduced fare of $3. The Back Bay Logan Express bus service is a pilot program to observe whether a frequent, direct, express bus service from the downtown business area provides a viable alternative mode of transportation to the Airport.

The Back Bay Logan Express Pilot has been valuable in providing an alternative to air passengers and employees who had been impacted by the temporary, two-year MBTA Government Center Station closure (a key connection to the MBTA Blue Line and Logan Airport), and it provides a new transit alternative to the Airport. Ridership in 2016 for the Back Bay Logan Express totaled 216,329 passengers, an average of about 600 riders per day. In 2015, the service average 805 riders per day, with a total of 290,796 passengers. This 26 percent reduction in ridership can be attributed to the re-opening of the Government Center Station in March 2016 and the ending in June 2016 of a temporary initial price promotion that offered free fares for riders with an MBTA pass and reduced fares for all others. The decline in Back Bay Logan Express ridership is possibly reflected in the uptick in Blue Line service turnstile counts at the MBTA Airport Station between 2015 and 2016. The monthly totals for the Back Bay Logan Express service are summarized in **Table 5-9**.

Table 5-9 Monthly Ridership on Back Bay Logan Express Service for 2015 and 2016

Month	2015	2016
January	16,742	18,440
February	14,671	17,120
March	24,930	24,527
April	23,175	22,078
May	27,638	30,369
June	25,655	16,720
July	28,118	17,087
August	28,746	15,208
September	27,311	14,784
October	25,848	14,368
November	25,126	14,945
December	22,838	10,683
Annual Total	**290,798**	**216,329**

Rapid Transit

The MBTA provides direct connections to Logan Airport via the Blue Line subway at Airport Station and via the Silver Line bus to each of the terminals. According to the *2016 Logan Airport Air Passenger Ground-Access*

Survey, these services are used by over 6 percent of Logan Airport's air passengers, a slight reduction from the previous 2013 survey. Almost 15 percent of passengers with trip origins in Boston, Cambridge, Brookline, and Somerville used MBTA public transit to travel to the Airport. Both services are important for reducing automobile travel to the Airport; according to the survey, over three quarters of users of the Blue Line and Silver Line indicated that their alternative mode of travel to Logan Airport would have been a taxi or TNC, or they would have been dropped off at the Airport by private vehicle. **Figure 5-9** illustrates the public transportation options to access Logan Airport.

Blue Line Ridership/Airport Station Activity

Fare gate data indicate that approximately 2.2 million riders entered the MBTA Airport Station in 2016 (see **Figure 5-10**). This is about a 6-percent increase compared to 2015. As noted in previous reports, fare gate data do not distinguish between Airport related riders and East Boston users, nor between Logan Airport air passengers and employees. Therefore, Airport passenger ridership levels on the Blue Line cannot be directly identified.[11] However, it is assumed that the increase in riders this year can be at least partially attributed to the reopening of Government Center Station and improved Blue Line connectivity between downtown Boston and Logan Airport.

Silver Line (SL1) Ridership

The Silver Line bus service to Logan Airport provides a direct connection between South Station and the Airport terminals via the South Boston Transitway and the Interstate-90 Ted Williams Tunnel. The introduction of free boardings of the Silver Line Airport buses (SL1) at Logan Airport has eliminated the need for fareboxes; thus, 2016 figures of passenger boardings are not available (see **Figure 5-10**). Eliminating fare collection allows all three doors to be used for boarding, thus improving curb operations and schedule adherence. Massport is consulting with the MBTA on the potential for Automated Passenger Counting (APC) systems as a means to continue to collect ridership data.

Eight SL1 buses are owned by Massport and are operated by the MBTA with Massport paying operating costs for the SL1. In 2016, Massport funded an approximate $6 million mid-life rebuild of these eight buses. The mid-life rebuild will extend the useful life of each vehicle by approximately eight years. This will allow the MBTA to improve reliability and quality of operations along the Silver Line today while starting the procurement process to acquire new vehicles in the future.

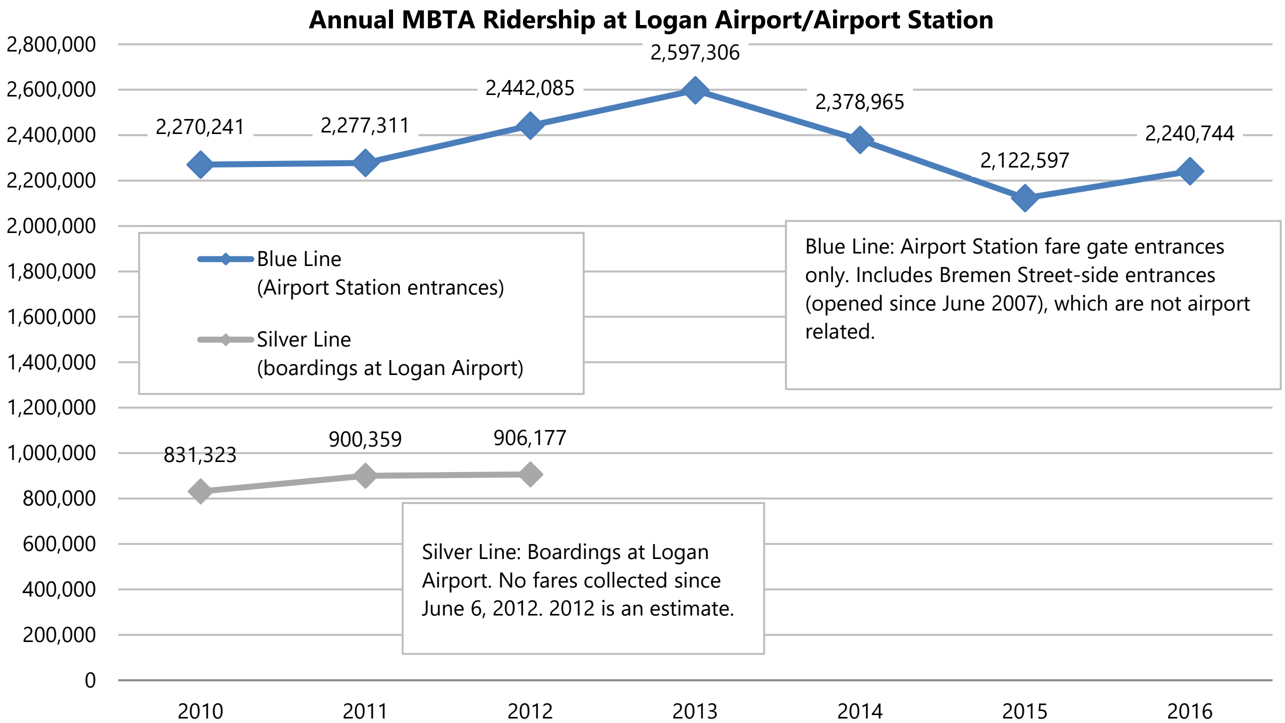
The Silver Line is the only MBTA rapid transit service that provides a direct, one-seat connection to each Airport terminal (the Blue Line requires a second-seat ride on a free Massport shuttle to connect riders to terminals, while express MBTA transit buses connect only at Terminal C, and local bus service to the Airport is limited). Transfers between the Silver Line and the Red Line at South Station are free. At South Station, passengers may also connect to the MBTA commuter rail, Amtrak, and regional intercity buses.

11 Based on automated fare gate entrance counts, approximately 50 percent of entrances occur via the Bremen Street Park fare gates at Airport Station. Based on Massport curbside observations, approximately 45 percent of Airport Station entrances are by airport users.

Figure 5-9 Logan Airport - Public Transportation Options

Projection: Lambert Conformal Conic Coordinate System: NAD 1983 State Plane Massachusetts Mainland FIPS 2001 (Meter)

Figure 5-10 Passenger Activity - Blue Line (Airport Station) and Silver Line (SL1), 2010-2016



Source: Massport,

Water Transportation: Water Taxis and MBTA Ferries

Three companies provide water transportation within the Boston area: Boston Harbor Cruises Water Taxi, Rowes Wharf Water Taxi, and MBTA Harbor Express. Collectively, these companies serve numerous destinations throughout Boston Inner Harbor. The water taxi landing locations include: Long, Rowes, and Central wharfs; the World Trade Center and the Moakley Courthouse in South Boston; and stops in the North End, Charlestown, Chelsea, and East Boston. A new stop is planned at Lovejoy Wharf near North Station. The MBTA Harbor Express provides services to Long Wharf and destinations outside of the Inner Harbor, including Hingham and Hull.[12] The water transportation services stop at the Logan Airport dock on Harborside Drive. Massport provides a courtesy shuttle bus service between the Logan Airport dock, the MBTA Airport Station, and all Airport terminals. Massport also provides an employee subsidy for water transportation modes.

Water transportation accounts for less than 1 percent of the mode share to Logan Airport, according to the *2016 Logan Airport Air Passenger Ground-Access Survey*. Annual ridership on privately-provided water

12 The MBTA ferry schedule from Hingham/Hull to the Logan Airport Ferry Dock is not as frequent as Blue Line and Silver Line services, and does not run on frequent and consistent headways throughout the day. Headways between ferries range from one hour to several hours. There are 14 MBTA ferries to Logan Airport on weekdays; however, there are no MBTA ferries direct to Logan Airport from the South Shore during morning commuting times. In 2016, the one-way fare to cross the Boston Harbor from Long Wharf to Logan Airport costs $12, and $18.50 from Hingham/Hull (twice the regular fare to Boston). The MBTA suspended ferry service from Quincy's Fore River stop in fall 2013, and has since added service to the Hingham service, which has incorporated the Hull stop.

transportation experienced an increase of 6 percent in 2016 compared to 2015, while ridership on the MBTA Harbor Express remained constant (**Table 5-8**).

Other HOV Modes: Scheduled Buses, Shared-Ride Vans, Courtesy Vehicles, and Limousines

Massport provides priority, designated curb areas at all Airport terminals to support the use of HOV/transit modes, including privately-operated scheduled buses and shared-ride vans and limousine services. The majority of scheduled shared-ride carriers use a combination of 15- to 40-passenger vehicles and 40+ passenger coach buses. Scheduled express bus service is offered by several privately-operated carriers from outlying areas of the Boston metropolitan area and neighboring states. Shared-ride van services include services between Logan Airport and many hotels in the Greater Boston area. Shared-ride vans also provide service from western Massachusetts and other regional points throughout New England.

As shown in **Table 5-10**, the estimated total number of seats provided by these HOV modes increased by about 24 percent in 2016 compared to 2015.

Massport offers a 50-percent discount on the ground access fees for alternative fuel vehicles (AFVs) that use compressed natural gas (CNG) or are powered by electricity.

Table 5-10 Estimated Total Seats for Other Scheduled and Unscheduled HOV Modes: Scheduled Buses, Shared-Ride Vans, Courtesy Vehicles, and Limousines, 2010 - 2016

	Scheduled and Unscheduled HOV Modes			
Year	**Scheduled Buses**	**Scheduled Vans & Limousines**	**Courtesy Vehicles**	**Limousines (unscheduled)**
2010	2,345,145	893,992	2,021,415	1,882,172
2011	2,251,480	996,208	1,885,575	1,991,672
2012	2,360,050	656,288	2,071,545	2,180,020
2013	2,342,450	437,344	2,043,870	2,125,044
2014	2,332,110	311,680	2,092,965	2,739,464
2015	2,324,080	499,344	2,118,810	3,277,000
2016	2,754,290	640,586	2,583,345	4,203,915
Percent Change (2015 - 2016)	**18.5%**	**28.3%**	**21.9%**	**28.3%**

Source: Massport

Non-HOV (Automobile) Modes

Logan Airport passengers can access the Airport by a number of automobile modes, including private automobiles, taxis, TNCs, and rental cars. These modes account for about 69.5 percent of the access modes used by air passengers, based on the *2016 Logan Airport Air Passenger Ground-Access Survey*, a reduction of 2.7 percent since 2013. Although these modes are categorized as non-HOV, they frequently carry more than one passenger per vehicle. Based on the 2016 survey results, the average vehicle occupancies for these automobile modes range from 1.4 to 1.9 passengers per vehicle.

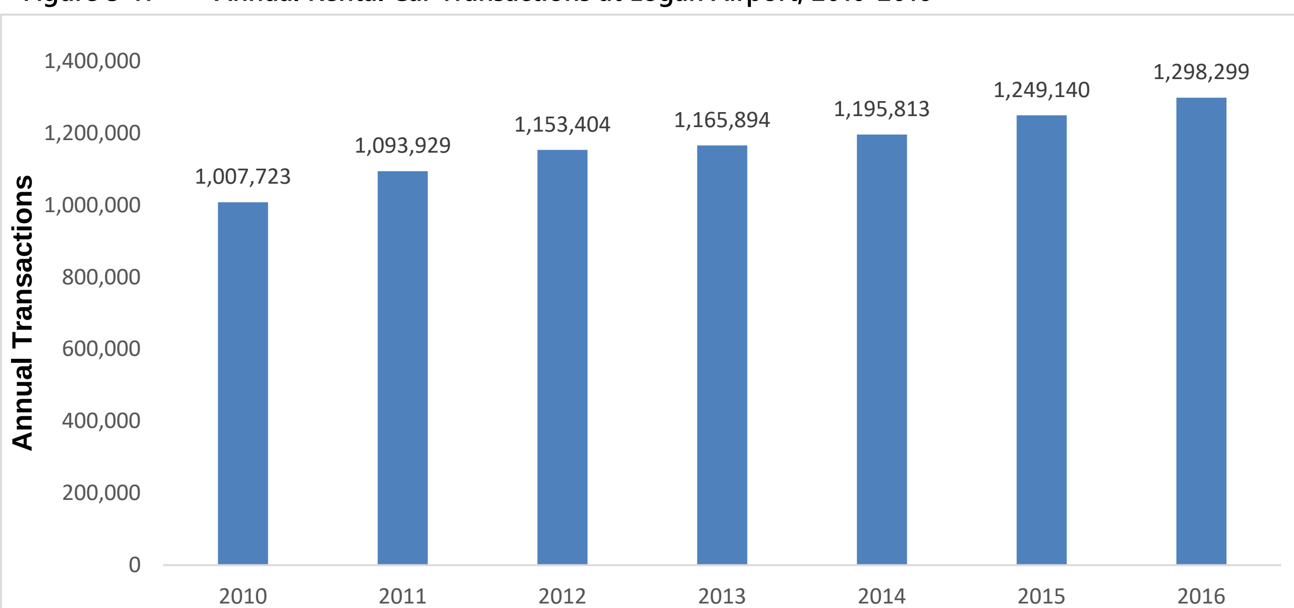
Automobile Access

Private automobile access to the Airport is classified as either curbside drop-off or parked-on-Airport (terminal area or remote/Economy). Traffic associated with these trips are described in this chapter's section on traffic conditions.

Rental Car

At the opening of the RCC in 2013, nine rental car brands were serving Logan Airport: Advantage, Alamo, Avis, Budget, Dollar, Enterprise, Hertz, National, and Thrifty. Payless and Firefly initiated operations in 2014 and Zipcar began operations at Logan Airport at the end of 2013. Rental car transactions (see **Figure 5-11**) have been increasing in recent years, following the trend of air passenger activity.

Figure 5-11 Annual Rental Car Transactions at Logan Airport, 2010-2016



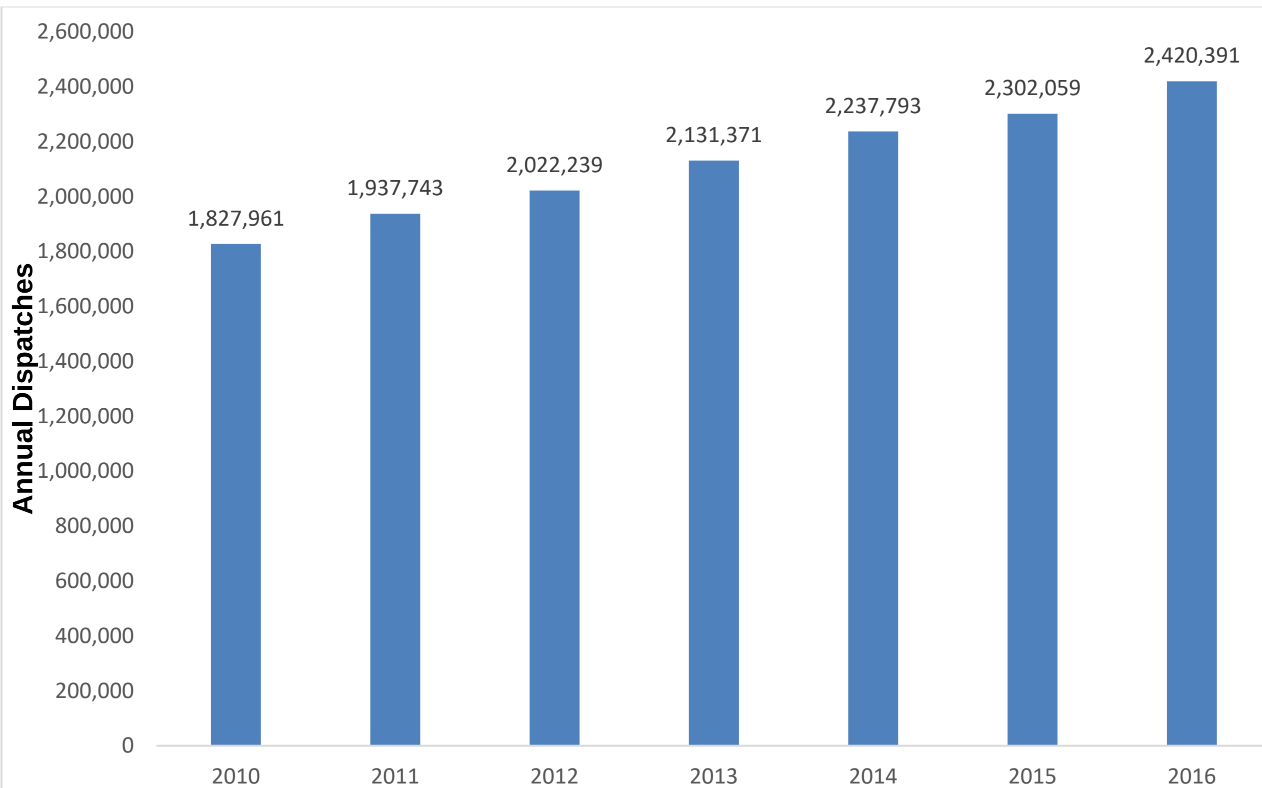
Source: Massport.

Taxis

Taxi ridership trends are reflected in the total number of taxis dispatched from Logan Airport (serving outbound passengers). The number of taxis dispatched rose in 2016 by 5.1 percent over the 2015 level (see **Figure 5-12**).

Taxi dispatches reflect the increase in air passenger levels. Taxi use in 2016 reached the highest recorded level at Logan Airport (2.4 million dispatches in 2016, when Logan Airport served 36.3 million annual air passengers).

Figure 5-12 Annual Taxi Dispatches at Logan Airport, 2010-2016



Source: Massport

Green Cab Program

Since 2007, Massport has sponsored a "Head-of-Line" hybrid vehicle taxi incentive program, in partnership with the City of Boston. Under this program, Boston taxis that qualify as clean-fuel vehicles may obtain permission to move up in the line at Logan Airport's taxi pool; this allows these "green cabs" to be dispatched to the terminals in a shorter amount of time.

TNC Program

Massport initiated TNC pick-up and drop-off operations in February 2017. Data and figures specific to the TNC program will be reported in the *2017 ESPR*.

Ground Access Planning Considerations

Surface transportation modes have environmental impacts, and are considered a standard component of airport GHG emissions inventories (see Chapter 7, *Air Quality/ Emissions Reduction*). Enhancing multimodal transportation options is one way an airport can reduce GHG emissions and improve its environmental footprint.

Potential emissions reductions are one reason why Massport is committed to a long-term goal to promote and support public and private HOV/shared-ride services aimed at serving air passengers, Airport users, and employees. Other benefits include:

- Reducing congestion on the terminal roadways and curbside drop-off/pick-up areas;
- Alleviating constraints on limited parking facilities; and
- Customer service (providing a range of transportation options for different traveler demographics).

Passenger HOV Mode Share Goal

Massport's current ground access goal is to attain a 35.2-percent passenger HOV mode share when annual air passenger levels reach 37.5 million. The 35.2-percent HOV mode share figure was developed by a planning process involving Massport staff and was first presented in the Logan Growth and Impact Control (LOGIC) planning studies that were completed in the early 1990s.[13] In subsequent environmental documents, the 35.2-percent HOV mode share became a declared goal related to ground access to Logan Airport.[14]

Beginning in 2017, Massport will introduce a new definition for HOV that takes into account vehicle occupancies of taxi, livery (black car limousine), and TNC modes. Under the current system, Massport counts all taxis as non-HOV and all black car limousines as HOV, regardless of the number of passengers transported. Massport is also classifying TNCs, which did not exist during LOGIC planning studies, as non-HOV, regardless of the number of passengers transported. Beginning in 2017, Massport will use a new HOV definition where vehicle occupancies of taxis, livery services, and TNCs that exceed one air passenger per vehicle, will be defined as HOV. With this new definition, Massport has committed to a goal of 35.5 percent HOV by 2022 and 40 percent by 2027.

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

13 Logan Growth & Impact Control Study (LOGIC) Phase I Report (1990) and Logan Growth & Impact Control Study (LOGIC), Phase II Final Report (June 1993).

14 West Garage Final EIR (January 31, 1995) and 1994 & 1995 Annual Update of the Final Generic Environmental Impact Report (GEIR), vol. 1 (July 1996), which presents for the first time "Massport's Ground Access Management Plan" and states that its goals are "to achieve a 35 percent high-occupancy vehicle (HOV) mode share by air passengers…" [p. I-7-4]

to roadway access to the Airport and despite significant increases in air passenger levels. Also, the result confirms Logan Airport's rank at the top of U.S. airports with respect to HOV/shared-ride mode share.[15]

Although generally useful, the calculation of overall HOV mode share is limited in that some modes can operate as both high-occupancy and low-occupancy vehicles (**Table 5-11**). Many automobile modes carry multiple passengers; for example, as seen in **Table 5-11.** The *2016 Logan Airport Air Passenger Ground-Access Survey* indicates an average occupancy of 1.66 air passengers per automobile used for airport ground access. The new Massport definition for HOV, beginning in 2017, aims to more closely align tracking metrics with Authority objectives for reducing on-Airport motor vehicle use, including accounting for emerging HOV alternatives for otherwise existing commercial drop-off/pick-up modes.

Table 5-11 Average Vehicle Occupancy by Vehicular Ground Access Mode (2016)

Mode	Est. Vehicle Occupancy	% SOV Trips
Private Vehicle	1.75	33.4%
Taxicab	1.54	41.8%
Rental Vehicle	1.91	27.1%
TNC	1.41	51.8%
Subtotal for Automobile Modes	**1.66**	**37.4%**
Car Service ("black car" limousine by reservation)	1.56	42.2%
Shared-Ride Van or Limousine (scheduled or reservation)	8.12	7.7%

Source: Massport, *2016 Logan Airport Air Passenger Ground-Access Survey*.
Notes: Based on air passengers departing on both weekdays and weekend days.
Average occupancy in this table was calculated as the average occupancy of arriving vehicles across survey respondents.
An SOV (single occupancy vehicle) passenger is defined as an air passenger that arrives at the Airport with no other air passengers in the vehicle. Air passengers can arrive as the only traveling air passenger in any of the above modes; thus, drivers and/or occupants who are not air passengers are excluded from the vehicle occupancy calculation.

Through a strategic planning process, Massport has concluded that its overarching ground access goal must be to minimize the number of motor vehicles used by both passengers and employees traveling to and from Logan Airport. Achieving this goal will require balancing the need to accomplish three objectives:

- Increasing the availability and use of transit, HOV, and shared-ride options for Logan Airport passengers and employees;
- Minimizing the number of drop-off/pick-up trips, particularly "dead head" trips in which a vehicle brings a passenger to Logan Airport and leaves with only the driver, effectively doubling the number of vehicle trips needed for that passenger to get to and from the Airport; and

15 It is useful to note that there is no standard aviation industry definition with respect to categorizing ground access modes as HOV versus single occupancy vehicle (SOV). While some modes (e.g., Logan Express and the Silver Line) clearly fall into the HOV mode category, the appropriate category for a limousine or taxi is less clear.

- Managing parking supply, pricing, and operations to promote use of transit/HOV/shared-ride options and reduce the amount of diversions/valeting, all without increasing the number of drop-off/pick-up trips due in part to a constrained parking supply.

The new HOV definition beginning in 2017 will describe the mode use and travel patterns of air passengers using Logan Airport to better reflect these considerations and track progress toward meeting all its ground access goals, including, but not limited to, maintaining its high HOV mode share.

Conditions Under Constrained Parking

According to research conducted for Massport, Logan Airport is the only airport in the country with a parking freeze.[16] As described earlier in this chapter, during many weeks in 2016, vehicles were diverted from Central Parking to Economy Parking or Terminal E lots, or valeted to other areas until lined spaces became available. Peak-day demand exhibited few signs of dampening, and overflow conditions persist. These conditions exist despite the supply of over 2,700 parking spaces off-Airport at nearby private lots, and despite the increases in Logan Express use since the lowering of parking rates at those locations.

With the Logan Airport Parking Freeze (and current capacity levels) in place, weekday demand is outpacing supply on a regular basis. Under such conditions, travelers arriving at the Airport to park on Tuesdays and Wednesdays would find themselves unable to park their cars on-Airport.

In 2015, Massport completed the West Garage Parking Consolidation Project. This project consolidated 2,050 temporary parking spaces as an addition to the West Garage and at the existing surface lot between the Logan Office Center and the Harborside Hyatt. Construction of these spaces constituted all the remaining spaces permitted under the Logan Airport Parking Freeze. As air traveler numbers have increased, the constrained parking supply at Logan Airport has periodically had the unintended consequence of causing an increase in environmentally harmful drop-off/pick-up vehicle trips (which generate up to four vehicle trips per air passenger, compared to two trips for those who drive and park, see **Figure 5-1**).

Another element of Massport's comprehensive transportation strategy was increasing the Logan Airport Parking Freeze Cap. Massport proposed to increase the Logan Airport Parking Freeze Cap by 5,000 on-Airport commercial parking spaces at Logan Airport. The goal of this change was to provide Massport with the ability to reduce the number of air passengers choosing more environmentally harmful drop-off/pick-up modes by allowing passengers to park on-Airport. MassDEP issued the amended regulation on June 30, 2017 approving the requested parking cap increase, and Massport initiated a parallel process with EEA by filing an ENF for new parking facilities on March 31, 2017. On May 5, 2017, EEA issued its Certificate on the ENF establishing the Scope for the required Draft EIR. On December 5, 2017, the EPA proposed a rule approving the revision of the Massachusetts SIP incorporating the amended Logan Airport Parking Freeze Cap. EPA finalized the rule on March 6, 2018, and became effective on April 5, 2018. Initiation of concept design for the parking facilities and preparation of a Draft EIR is expected to commence in the Spring of 2018.

16 LeighFisher, August 2011.

Planning for Passenger Ground Access

In the past, the ground access strategy has operated within the constraints of the Logan Airport Parking Freeze. Future efforts will need to address the growing use of drop-off/pick-up modes that include private vehicles, taxis, limousines, and TNCs. Drop-off/pick-up vehicle activity is growing at a time when commercial parking supply is at or beyond capacity.

Passenger surveys have shown that under constrained parking conditions, over 75 percent of "would be" parkers opt for drop-off/pick-up modes rather than HOV/shared-ride modes. Accordingly, an unintended effect of constrained parking supply has been an increase in the total number of vehicle trips generated by Logan Airport passengers.

Therefore, Massport's challenge is how to influence a mode shift so that the passengers generating the excess parking demand are encouraged to use sustainable transportation modes (including public transit, Logan Express, and other shared-ride services) rather than increase commercial and private vehicle drop-off and pick-up activity that would generate increased levels of traffic and curbside congestion (and associated emissions) at Logan Airport. As passenger levels have increased, the lack of commercial parking spaces has had the counterproductive effect of inducing more drop-off/pick-up travel, which entails more trips, VMTs, and air emissions than trips by people who park at the Airport. This is a key planning issue that Massport will address in future Airport-wide efforts. Massport's longer-range ground access strategy will balance the need to increase the HOV/transit/shared-ride mode share, manage on-Airport parking, and reduce drop-off/pick-up vehicle trips.

As part of the Terminal E Modernization Project, a connection between Terminal E and the MBTA Blue Line Airport Station will be constructed to improve the passenger convenience. This connection is currently being studied and various approaches are under consideration. Consideration is being given to constructing an Automated People Mover (APM) which ultimately would connect the MBTA Blue Line Airport Station to all the terminals. The APM concept is in the very early stages of feasibility assessment and will be more definitive as the Terminal E Modernization Project moves into Phase 2. Future EDRs and ESPRs will provide updates as final design and construction proceed (see Chapter 3, *Airport Planning,* for additional information on this project.)

Ground Access Initiatives

Massport promotes ridership on HOV/transit/shared-ride modes and maintains efficient transportation access and parking options in and around Logan Airport to reduce the reliance on automobile modes as a means to achieving the HOV mode share goal. Measures implemented by Massport include a blend of strategies related to pricing (incentives and disincentives), service availability, service quality, marketing, and traveler information. Because of the different demographics of Logan Airport air passenger travelers, no single measure alone will accomplish the goal.

HOV/Transit/Shared-Ride Initiatives

In April 2014, Massport initiated the Back Bay Logan Express pilot service. Using Massport's 42-foot CNG buses, this service provides travelers with three scheduled trips per hour between the Hynes Convention Center, Copley Square (at the MBTA Green Line Copley Station), and Logan Airport. In addition to serving an area that generates a significant number of trips to the Airport, the Back Bay Logan Express service served transit riders inconvenienced by the two-year closure of the MBTA Government Center Station, where the Green Line meets the Blue Line. Since the re-opening of Government Center in March 2016, Massport has chosen to continue this pilot program.

Massport has expanded its Logan Express bus service, including spending $30 million to build a 1,100-space parking garage in Framingham to meet growing air passenger and employee demand. The Framingham Logan Express carries the highest number of non-employee passengers of all the Logan Express services. The completion of this new parking facility increased capacity by 550 spaces as compared to the previous surface lot.

Parking Programs and Initiatives

Cell Phone Waiting Lot

The cell phone waiting lot in the vicinity of Terminal E provides 61 parking spaces where drivers waiting for passengers on arriving flights may park. Before the creation of the Cell Phone Waiting Lot, drivers who were waiting for arriving passengers either used short-term parking, circulated around the Airport, or dwelled at the curb until asked to move by State Police officers. This facility reduces vehicle emissions by minimizing idling and on-Airport VMT by such motorists. The maximum wait time permitted at this parking lot is 30 minutes and parking is free of charge.

Parking PASSport Gold and Parking PASSport

Parking PASSport Gold and Parking PASSport allow users to enter and exit Logan Airport's parking garages and lots with an access card that is linked to an established account for faster payment transactions. Parking fees are automatically charged to a registered credit card and the receipt is emailed to the account holder. Customers in the Parking PASSport programs account for approximately 3 to 4 percent of parking exits at Logan Airport.

Massport offers guaranteed parking through its Parking PASSport Gold program. Parking PASSport Gold eliminates the need for a motorist to circle the garage looking for available spaces. First implemented in 2006, the Parking PASSport Gold program had 10,723 customers as of December 31, 2016, compared to 10,761 at the end of 2015. About 8 percent of spaces in the Central/West Parking garage and 12 percent of spaces in the Terminal B garage are set aside for these customers.

Hybrid and Alternative Fuel Vehicle (AFV) Preferred Parking

In the State's first preferred parking program for hybrid and AFVs, Massport began offering preferred parking for customers driving hybrid and AFVs in the spring of 2007. Massport provides designated parking spaces at Logan Airport's Central Garage, Terminal B Garage, Terminal E surface lot, and Economy Parking. Massport also offers a 50-percent discount on the ground access fees for AFVs that use CNG or are powered by electricity.

Employee Ground Transportation Initiatives

Airport employee transportation has different ground access considerations than passenger transportation. Airport employees often have non-traditional (and often unpredictable) working hours that are difficult to match to typical transit service hours (MBTA service does not start until after 5:00 AM and ends by 1:00 AM). Due to the time-sensitive nature of airline operations, on-time reliability is important for employee transportation, as is flexibility during severe weather or other delays that may extend a typical employee workday or work shift.

Massport strives to reduce the number of Airport employees commuting by private automobile, to enhance commuter options, and to reduce traffic and parking demands at Logan Airport. To help accomplish these objectives Massport continues to:

- Provide off-Airport employee parking in Chelsea, which is served by frequent shuttle bus service to the terminals (Route 77) 24 hours a day, 7 days a week;
- Run free employee shuttle buses between Airport Station and employment areas in the SWSA and the South Cargo Area (SCA) locations (Routes 44, 66, and Logan Office Center);
- Operate early morning and late-night Logan Express bus trips for commuters;
- Support the Logan Transportation Management Association (TMA);
- Support the Sunrise Shuttle for early morning bus service from East Boston, Winthrop, and Revere prior to the start of MBTA service;
- Create and maintain a comprehensive sidewalk/walkway system on Logan Airport to facilitate pedestrian access;
- Provide bicycle racks; [17] and
- Comply with the state rideshare regulation.

Two of these initiatives that are exclusively targeted to employees are described below.

Logan Transportation Management Association (TMA)

The Logan TMA advises Airport employers on transit benefits and provides information on available commuting transportation alternatives, ride-matching services, and reduced-rate HOV/transit fare options. Massport continues to contribute $65,000 annually to the Logan TMA. Benefits and services provided by the Logan TMA in 2016 included:

- East Boston, Winthrop, and Revere early morning shuttle service (Sunrise Shuttle; further details are provided below);
- Computerized ride-matching services for participating in carpools and vanpools;

17 Bicycle racks are provided at Terminal A, Terminal E, Logan Office Center, MBTA's Airport Station, Economy Parking Garage (covered), Signature general aviation terminal, the Green Bus Depot (Bus Maintenance Facility), and the Rental Car Center (covered).

- Advocacy for improved service and reduced fares for its members from Massport, the MBTA, or other providers of mass transit and other alternative forms of transportation; and
- Outreach to Airport employees about commuting transportation alternatives.

Sunrise Shuttle

Originally launched in August 2007, this shuttle service provides low-cost transportation to Airport employees who live in nearby East Boston, Revere, and Winthrop. A second shuttle route was added in October 2011 that serves East Boston's Orient Heights neighborhood and Winthrop.

The Sunrise Shuttle services operate outside of MBTA service hours between 2:40 AM and 6:00 AM, with shuttles every half-hour transporting employees to the Airport terminals. Ridership levels have steadily increased since the shuttle's launch. The two-route service has reached over 1,500 riders per month.

Logan Airport Air Passenger Ground-Access Survey

Massport periodically[18] administers an extensive survey of air passengers to better understand the ground access characteristics of air passengers traveling to and from Logan Airport and to track historical trends of these attributes. Since the late 1970s, the *Logan Airport Air Passenger Ground-Access Survey* has been Massport's primary tool for understanding the changes in air passenger travel behavior, including ground access mode choices, travel patterns, and market characteristics. The survey is a tool that assists Massport in evaluating the effectiveness of its transportation policies and services, and the impacts on the regional transportation system. The survey also shapes the direction of Massport's planning efforts to encourage Logan Airport travelers to use HOV transit/shared-ride modes instead of SOV modes.

The survey is the principal means of measuring air passenger ground access HOV mode share. **Table 5-12** presents the air passenger ground access mode shares from the 2016 survey findings. Additional findings from the *2016 Logan Airport Air Passenger Ground-Access Survey* that relate to mode choice are presented in this section, as are comparisons of the results to past surveys.

Traveling in a private vehicle and being dropped off at the Terminal Area is still the predominant way that air passengers get to Logan Airport; this mode is used by 21.3 percent of departing air passengers. The use of TNCs[19] (such as Uber/Lyft/Fasten) to access the Airport is the second most common mode, at a 14.3-percent share. The combined mode shares for transit modes (including MBTA services, water taxis, Logan Express, and similar scheduled bus services) is approximately 16.3 percent of air passengers traveling to the Airport. Driving and parking at the Airport is the mode used by 11.4 percent of air passengers and taxis are now used by 9.8 percent. The *2016 Logan Airport Air Passenger Ground-Access Survey* is available online at www.massport.com/media/2593/2016-logan-air-passenger-ground-access-survey.pdf.

18 Since 2004, a survey has been administered every three years.
19 TNCs were not legally allowed to operate for arriving passengers in 2016.

Table 5-12 Air Passenger Ground-Access Mode Share, 2016

	Spring 2016 Air Passenger Survey		
Ground Access Mode	**Weekday**	**Weekend**	**All Trips**
Automobile Modes:			
Private Vehicle			
Dropped off	19.2%	26.5%	**21.3%**
Parked at Terminal	9.8%	5.7%	**8.6%**
Parked in Economy Lot or Overflow	3.1%	1.9%	**2.8%**
Parked Off-Airport	1.8%	1.7%	**1.8%**
Rental Vehicle	10.6%	11.6%	**10.9%**
Taxicab	10.0%	9.5%	**9.8%**
Uber/Lyft/Fasten	14.4%	14.2%	**14.3%**
Subtotal	**68.8%**	**71.1%**	**69.5%**
HOV/Shared Ride Modes:			
Public Transit			
Logan Express Bus	5.8%	3.8%	**5.2%**
Other Express Bus	4.6%	4.2%	**4.5%**
MBTA Blue Line Subway	2.2%	5.6%	**3.1%**
MBTA Silver Line Bus	3.8%	2.3%	**3.3%**
Water Shuttle/Water Taxi	0.2%	0.1%	**0.2%**
Other Shared-Ride Vehicles			
Car Service (black car, private limousine, etc.)	5.9%	4.4%	**5.5%**
Shared ride van or limousine	2.6%	2.9%	**2.7%**
Free Hotel/Courtesy Shuttle	3.4%	3.2%	**3.3%**
Charter Bus	1.7%	1.2%	**1.5%**
Other	1.0%	1.3%	**1.1%**
Subtotal	**31.2%**	**28.9%**	**30.5%**
Total	**100%**	**100%**	**100%**

Source: Massport, *2016 Logan Airport Air Passenger Ground-Access Survey*

Table 5-13 presents these aggregated air passenger ground access mode shares for survey years 2004 through 2016. As the data indicate, the overall HOV mode share for air passengers has fluctuated between 28 and 31 percent in each of the survey years during this time period. Thus, even with air passenger growth, the mode share split between HOV and automobile modes has remained relatively stable.

Table 5-13 Ground-Access Mode Share (All Passengers) by Survey Year

Ground Access Mode	2004	2007	2010	2013	2016
Non-HOV/Automobile					
Private Automobile	36.0%	40.2%	40.4%	43.2%	**34.5%**
Taxi	22.8%	19.7%	18.8%	18.6%	**9.8%**
Rental car	10.9%	12.4%	10.9%	10.4%	**10.9%**
TNCs	NA	NA	NA	NA	**14.3%**
Total Non-HOV Share	**69.7%**	**72.3%**	**70.1%**	**72.2%**	**69.5%**
HOV/Shared-Ride					
Unscheduled HOV	8.1%	7.3%	7.6%	8.3%	**8.1%**
Scheduled HOV	10.6%	6.9%	8.2%	6.9%	**9.7%**
Transit	6.5%	6.7%	7.6%	7.6%	**6.6%**
Courtesy Shuttle	3.1%	3.5%	4.6%	3.3%	**3.3%**
Other	2.0%	3.4%	1.8%	1.7%	**2.6%**
Total HOV Share	**30.3%**	**27.8%**	**29.9%**	**27.8%**	**30.5%**

Source: Massport, *2004, 2007, 2010, 2013, 2016 Air Passenger Ground-Access Surveys*

Notes: For this table, air passenger ground access modes are grouped into the following categories:

- Private Automobile: Includes all passengers that are dropped off by a privately-owned automobile, and all passengers who drive and park their vehicles at the Airport or at an off-airport parking facility.
- Taxi: A passenger driven to Logan Airport in a licensed, commercial taxi.
- Rental Car: A passenger who rents a car from an on-Airport or nearby off-Airport rental car agency.
- TNCs include services such as Uber, Lyft, and Fasten and are captured in the 2016 survey data for the first time.
- Scheduled HOV Service: A passenger who arrives at Logan Airport via scheduled bus, limousine, or van service, including privately-operated services and Massport's Logan Express.
- Unscheduled HOV Service: Includes passengers who travel to Logan Airport via unscheduled limousine or van providers.
- Transit: A passenger who takes an MBTA public transit service (including the Blue Line subway, Silver Line bus rapid transit) or one of the water transportation services (operated in conjunction with a dedicated Massport shuttle bus to/from Logan Airport terminals).
- Courtesy Shuttle: A passenger who arrives at the Airport in a courtesy shuttle, such as those offered by nearby hotels.
- Other: Includes passengers that access the Airport by walking, riding a bicycle, taking a charter bus, or riding an MBTA bus (excluding the Silver Line).

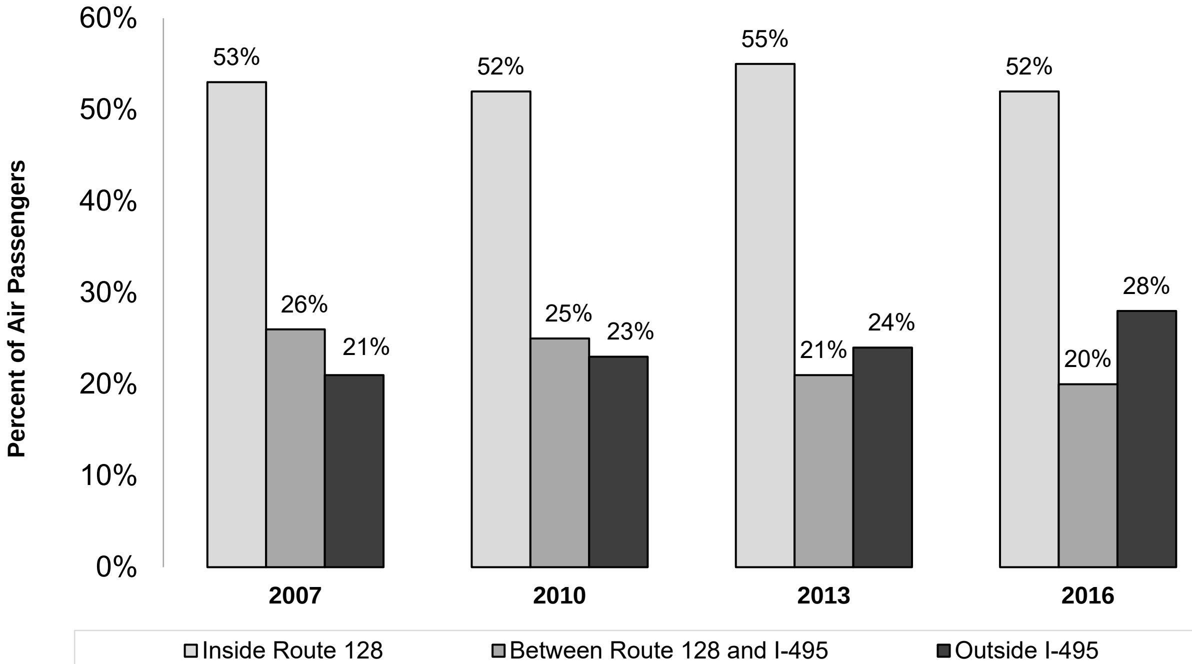
Average Vehicle Occupancy (Air Passengers) by Ground-Access Vehicle Modes

Table 5-11 presented estimates of average vehicle occupancy and the share of ground access trips made by air passengers in single-occupant vehicles by various ground access modes (transit modes and charter and express buses and vans are excluded). These estimates are based on the responses provided in the *2016 Logan Airport Air Passenger Ground-Access Survey*. In 2016, the average occupancy for non-HOV automobile vehicle modes was 1.66 passengers per vehicle, down from 1.85 in 2013. Some of this change can be explained by the introduction of TNCs, which on average have lower vehicle occupancies. Most trips made by air passengers in private automobiles carry more than one passenger per vehicle; only 33 percent of air passengers arriving by private vehicle were traveling alone.

Ground-Access Origins of Air Passengers

Figure 5-13 indicates how the distribution of air passenger trips by geographic area has changed since 2004. The majority of trips still originate in Boston and other communities within Route 128. Nevertheless, Logan Airport now draws over a quarter of its passengers from areas outside of I-495.

Figure 5-13 Logan Airport Air Passenger Ground Access Trip Origins



Source: Massport, *2004, 2007, 2010, 2013, 2016 Logan Airport Air Passenger Ground-Access Surveys*.
Note: Based on air passengers departing on both weekdays and weekend days.

The origin of an air passenger ground access trip has an important influence on mode choice. Simply stated, transportation systems and services vary by geographic area, and thus affect the travel behavior of a passenger traveling to Logan Airport. This is apparent from the results shown in **Table 5-14,** in which the distribution of ground access modes among passengers within four geographic areas is provided.

As expected, transit use is highest in the Urban Core (defined as Boston, Brookline, Cambridge, and Somerville) as this area is served by the MBTA's rapid transit system. TNC and taxi use is also highest in this area (approximately half of all trips), due in part to the proximity to the Airport. The area outside of the Urban Core but within the Route 128 highway belt is the area with fewest HOV/transit options, and its mode share reflects this, including the highest share of private vehicle drop-off. Outside of Route 128, scheduled express bus services provide the bulk of the HOV/shared-ride services; correspondingly, these modes carry the highest HOV mode share in these areas. In fact, ridership growth in Logan Express and private buses have helped increase transit shares outside of Route 128 (but within the Commonwealth of Massachusetts) to near parity with the Urban Core. Otherwise, private vehicles are the dominant mode of access for passengers originating in areas outside of the Boston metropolitan area urban core.

Table 5-14 Ground-Access Mode Share by Air Passenger Ground Trip Origin, 2016

	Ground Trip Origin				
Ground Access Mode	**Urban Core**	**Between Urban Core and Route 128**	**Between Route 128 and I-495**	**Outside I-495**	**Outside of MA**
Automobile Modes					
Private Vehicle					
Dropped off	14%	32%	26%	27%	18%
Parked On-Airport	4%	13%	20%	16%	18%
Parked Off-Airport	0%	1%	2%	3%	5%
Subtotal Private Vehicle	**18%**	**47%**	**48%**	**46%**	**41%**
Rental Vehicle	5%	12%	13%	15%	14%
Taxicab	19%	10%	3%	2%	1%
TNC	30%	12%	4%	2%	2%
Subtotal – Automobile Modes	**71%**	**80%**	**69%**	**65%**	**57%**
HOV/Shared Ride Modes					
Public Transit					
Logan Express Bus	3%	2%	13%	7%	4%
Other Express Bus	<1%	0%	1%	8%	21%
MBTA Silver Line Bus	7%	2%	1%	2%	1%
MBTA Blue Line Subway	8%	1%	1%	0%	<1%
Water Shuttle/Water Taxi	<1%	0%	<1%	0%	<1%
Subtotal Public Transit	18%	5%	17%	17%	27%
Other Shared-Ride Vehicles					
Car service (black car, private limousine, etc.)	3%	7%	9%	6%	7%

Table 5-14 Ground-Access Mode Share by Air Passenger Ground Trip Origin, 2016 (Continued)

	Ground Trip Origin				
Ground Access Mode	**Urban Core**	**Between Urban Core and Route 128**	**Between Route 128 and I-495**	**Outside I-495**	**Outside of MA**
Shared ride van or limousine	2%	2%	2%	5%	4%
Free Hotel/Courtesy Shuttle	4%	6%	1%	1%	2%
Charter Bus	1%	0%	0%	5%	2%
Subtotal Other Shared-Ride Vehicles	**10%**	**14%**	**12%**	**18%**	**16%**
Other	1%	1%	2%	1%	1%
Subtotal – HOV/Shared Ride/Other Modes	**29%**	**20%**	**31%**	**35%**	**43%**

Source: Massport, *2004, 2007, 2010, 2013, 2016 Logan Airport Air Passenger Ground-Access Surveys*

Market Segment: Trip Purpose and Residency

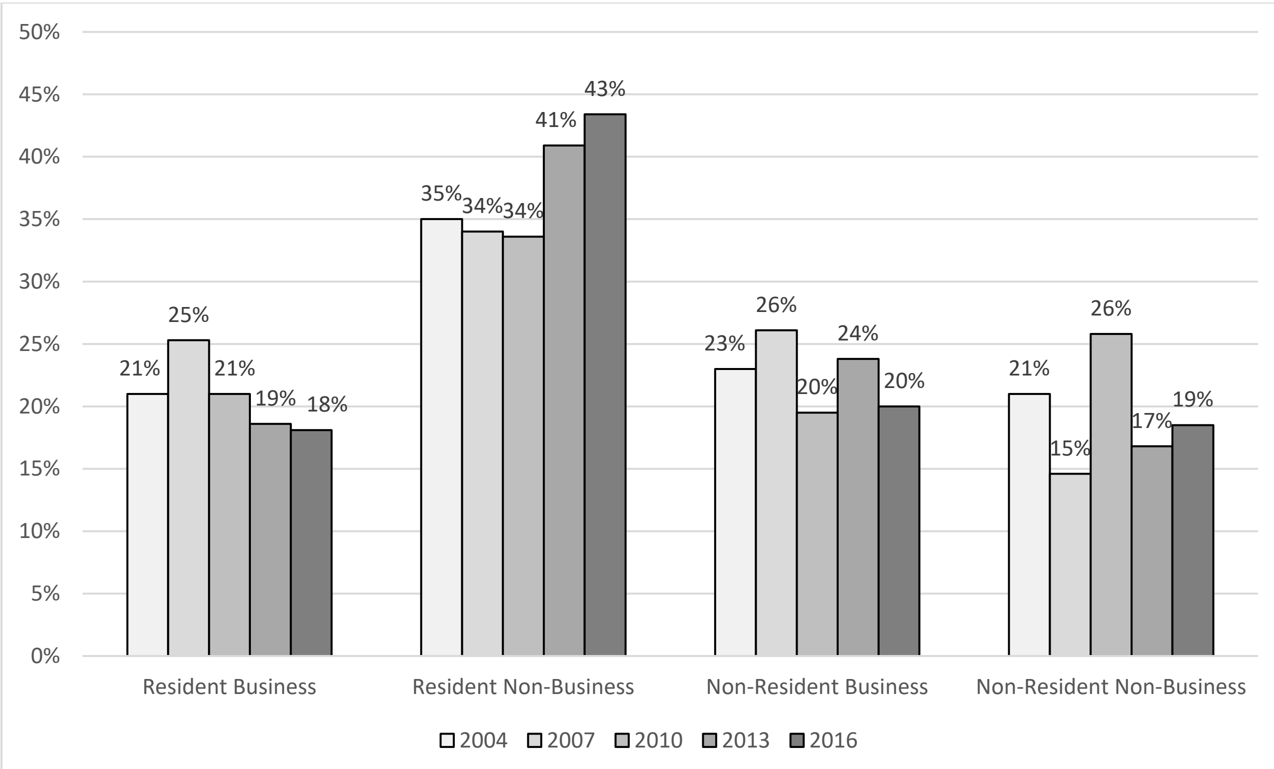
Massport characterizes air passengers into four distinct market segments:

- **Resident Business:** passengers living within the region served by Logan Airport and traveling for business reasons;
- **Resident Non-Business:** passengers living within the region served by Logan Airport and conducting personal travel (e.g., leisure trip);
- **Non-Resident Business:** passengers living outside the region served by Logan Airport and traveling to conduct business; and
- **Non-Resident Non-Business:** passengers living outside the region served by Logan Airport and traveling for personal reasons (e.g., leisure or vacation travelers).

Residents are defined as passengers who use Logan Airport as their "home" airport, regardless of their proximity to other airports. It is important to study the passenger market in this manner because sensitivity to key factors that influence travel behavior such as convenience, time reliability, and pricing varies substantially among these passenger market segments. This information assists Massport in developing appropriate ground access services for passengers.

Figure 5-14 compares the share of weekday trips by market segment across the five most recent surveys. The resident non-business market is the largest market segment, contributing over one-third of all air passengers at Logan Airport. In general, the market share of leisure segments increased in 2016 compared to 2013.

Figure 5-14 Weekday Market Segments (Combined Trip Purpose and Residency)[1]



Source: Massport, *2004, 2007, 2010, 2013, 2016 Logan Airport Air Passenger Ground-Access Surveys*.
Note:
1 Based on air passengers departing on weekdays only. Figures rounded.

There are numerous implications for ground access due to the changing mix of Logan Airport air passengers. **Tables 5-15** and **5-16** present ground access mode shares by market segment. HOV mode share is overall typically lower in the business market segments; business travelers typically have a high sensitivity to time, require flexibility and schedule reliability, and often make decisions related more to convenience than to cost (which is often covered by their employer not by the air passenger). Public transit and scheduled HOV services (including Logan Express) have a higher share among the non-business market segments, particularly for residents that have greater familiarities with the systems. Non-business market segments are more sensitive to ground transportation costs, travel less frequently but for longer time periods, and tend to travel at off-peak fly times/days. These factors help account for the increase in HOV and the relatively flat year-over-year changes observed in parking exits.

Table 5-15 Ground-Access Mode Share by Market Segment, 2016

	Resident Business	Resident Non-business	Non-resident Business	Non-resident Non-business
Private Automobile	48%	44%	6%	29%
Taxi	9%	5%	21%	10%
Rental Car	2%	2%	29%	21%
TNCs	14%	14%	15%	15%
Subtotal Non-HOV	**74%**	**65%**	**72%**	**75%**
Unscheduled HOV/limousine	12%	7%	10%	5%
Public and Water Transit	3%	9%	4%	7%
Scheduled Bus	8%	14%	3%	7%
Courtesy shuttle	<1%	2%	7%	5%
Other	2%	2%	4%	1%
Subtotal HOV	**26%**	**35%**	**28%**	**25%**

Source: Massport, *2016 Logan Airport Air Passenger Ground-Access Survey*
Notes: Based on air passengers departing on both weekdays and weekend days. Rounded figures.

Table 5-16 Ground-Access Mode Share by Market Segment (Recent Surveys)

	Resident Business					Non-Resident Business				
Ground- Access Mode	**2004**	**2007**	**2010**	**2013**	**2016**	**2004**	**2007**	**2010**	**2013**	**2016**
Automobile Modes										
Private Automobile	54%	54%	59%	62%	48%	18%	12%	12%	14%	6%
Taxi	19%	18%	16%	17%	9%	30%	35%	36%	30%	21%
Rental Car	1%	2%	<1%	<1%	2%	24%	29%	27%	25%	29%
TNCs	-	-	-	-	14%	-	-	-	-	15%
Subtotal Automobile Modes	**74%**	**74%**	**76%**	**80%**	**74%**	**72%**	**76%**	**75%**	**69%**	**72%**
HOV Modes										
Unscheduled HOV	11%	13%	10%	9%	12%	7%	8%	10%	12%	10%
Scheduled HOV	8%	6%	6%	6%	8%	7%	3%	3%	2%	3%
Transit	5%	6%	4%	5%	3%	6%	6%	5%	9%	4%
Courtesy shuttle	1%	<1%	2%	<1%	<1%	7%	5%	5%	6%	7%

Source: Massport, *2016 Logan Airport Air Passenger Ground-Access Survey*
Notes: Based on air passengers departing on both weekdays and weekend days. Rounded figures.
1 Previously reported as Schedule HOV
2 Previously reported as Transit

Table 5-16 Ground-Access Mode Share by Market Segment (Recent Surveys) (Continued)

	Resident Business					Non-Resident Business				
Other	1%	1%	1%	<1%	2%	1%	2%	2%	2%	4%
Subtotal HOV Modes	**26%**	**26%**	**24%**	**20%**	**26%**	**28%**	**24%**	**25%**	**31%**	**28%**
	Resident Non-Business					**Non-Resident Non-Business**				
Ground Access Mode	**2004**	**2007**	**2010**	**2013**	**2016**	**2004**	**2007**	**2010**	**2013**	**2016**
Automobile Modes										
Private Automobile	49%	51%	49%	55%	44%	38%	36%	36%	33%	29%
Taxi	16%	14%	13%	13%	5%	15%	19%	17%	18%	10%
Rental Car	3%	2%	2%	1%	2%	17%	19%	18%	20%	21%
TNCs	-	-	-	-	14%	-	-	-	-	15%
Subtotal Automobile Modes	**68%**	**67%**	**63%**	**69%**	**65%**	**70%**	**73%**	**71%**	**71%**	**75%**
HOV Modes										
Unscheduled HOV	9%	7%	8%	9%	7%	5%	3%	4%	4%	5%
Scheduled HOV	13%	12%	12%	11%	14%	11%	6%	8%	6%	7%
Transit	8%	11%	11%	7%	9%	8%	9%	9%	11%	7%
Courtesy shuttle	1%	3%	4%	2%	2%	5%	5%	6%	6%	5%
Other	1%	1%	2%	1%	2%	1%	4%	2%	2%	1%
Subtotal HOV Modes	**32%**	**33%**	**37%**	**30%**	**35%**	**30%**	**27%**	**29%**	**29%**	**25%**

Source: Massport, *2004, 2007, 2010, 2013, 2016 Logan Airport Air Passenger Ground-Access Surveys*

Ground Access Goals

Table 5-17 lists each ground access goal and updates Massport's initiatives associated with each goal. Initiatives are planned, designed, implemented, and continuously refined to account for the changing national, regional, and local conditions that affect Logan Airport and its users.

Table 5-17 Ground Access Planning Goals and Progress (2016)

Goal	2016 Update
Increase air passenger ground-access (high-occupancy vehicle) HOV mode share to 35.2 percent by the time Logan Airport accommodates 37.5 million annual air passengers.[20]	The *2016 Logan Airport Air Passenger Ground-Access Survey* revealed that 30.5 percent of air passengers use high-occupancy vehicles (HOV)/shared-ride modes to access the Airport. Massport continues to provide and actively promote numerous HOV/shared-ride options to air passengers, including Logan Express bus service, the Silver Line, water shuttle services, and frequent, free shuttle bus service to and from the Massachusetts Bay Transportation Authority (MBTA) Blue Line Airport Station. Massport is investigating ways to increase HOV mode share by implementing new HOV initiatives and pricing strategies. Logan Airport continues to rank at the top of U.S. airports in terms of HOV/transit mode share. Massport continues its partnership with the MBTA to offer free boardings of the Silver Line bus at the Airport. The promising results of reduced dwell times and faster travel times through the terminal area led Massport to extend the free-fare program indefinitely. Next-bus arrival digital dynamic signs have been added to the Terminal curb bus stops to now include Airport Shuttle, Blue Line/Rental Car, and Logan Express (in addition to Silver Line signs previously installed). Massport continues to improve wayfinding for ground transportation (with an emphasis on public transportation) within the terminals, resulting in enhanced directional signs in the terminals for arriving air passengers. In April 2014, the Boston Back Bay Logan Express service was implemented. In April 2015, 1,100-space garage was opened at the Framingham Logan Express to encourage passenger use of HOV modes.
Reduce employee reliance on commuting alone by private automobile	Massport continues to support the Logan Transportation Management Association (TMA) with $65,000 annually (no dues are collected from Airport employers). Massport uses funds from the Logan TMA to operate the two early morning Sunrise Shuttle services that serve East Boston, Winthrop, and Revere. Massport continues to provide outreach to employees about commute options. For employees who reside in neighborhoods and communities closer to the Airport, bicycle parking options have increased with bicycle racks offered at Terminal A, Terminal E, the Economy Garage, the Green Bus Depot, the Rental Car Center, the Logan Office Center, and the Signature general aviation terminal. Massport is also investigating ways to improve bicycle access to/around Logan Airport facilities. For example, the East Boston Greenway Connector construction was completed in July 2014.
Increase the overall efficiency of the metropolitan transportation system through interagency coordination	Massport participates in the Boston Metropolitan Planning Organization (MPO) to promote planning and funding of transportation system options that enhance access to the Airport. Massport and the MBTA have worked together on several initiatives including the renovated Blue Line Airport Station and the Silver Line SL1 service to Logan Airport. Massport has also partnered with the MBTA, the Massachusetts Department of Transportation (MassDOT), the City of Boston, and the Convention Center Authority in implementing transportation improvement plans recommended in the South Boston Waterfront, including sustainable transportation plans, as a means to improve the MBTA Silver Line access between South Station, the South Boston Waterfront, and the Airport.

20 Beginning in 2017, Massport will use a new HOV definition where vehicle occupancies of taxis, limo services and TNCs exceed one air passenger per vehicle, while the same modes with one air passenger will count as non-HOV. With this new definition, Massport has committed to a goal of 35.5 percent HOV by 2022 and 40 percent by 2027.

Table 5-17 Ground Access Planning Goals and Progress (2016) (Continued)

Goal	2016 Update
Improve management of on-Airport ground access and infrastructure through technology	Massport disseminates ground access and parking information through the Internet (www.massport.com), social media (Twitter and Facebook), a toll-free telephone number (1-800-23-LOGAN), Smartraveler, and in-Airport kiosks. Massport's redesigned website has an interactive tool that helps users access Logan Airport, while providing multimodal options. In 2016, Logan Airport continued to experience peak levels of parking demand for the terminal area parking garages. In an effort to reduce the operational impacts of peak parking, Massport completed the West Garage Parking Consolidation Project in 2015. As one element of its comprehensive ground transportation strategy, Massport proposes to build 5,000 new on-Airport commercial parking spaces at Logan Airport in two locations. The goal of the Logan Airport Parking Project is to reduce the number of air passengers choosing more environmentally harmful drop-off/pick-up modes, which generate up to four vehicle trips instead of two (see below for a detailed description). The construction of additional commercial parking spaces at Logan Airport was predicated on a regulatory change, by the Massachusetts Department of Environmental Protection (MassDEP), whereby MassDEP would need to amend the existing Logan Airport Parking Freeze to allow for some additional commercial parking spaces at Logan Airport. In response to Massport's 2016 request to consider an amendment to the Logan Airport Parking Freeze (to increase the commercial parking freeze limit by 5,000 spaces), MassDEP conducted a stakeholder process, which was followed by a public process to amend the Parking Freeze regulation. MassDEP issued the amended regulation on June 30, 2017 approving the requested parking increase. Massport initiated a parallel process with the Executive Office of Energy and Environmental Affairs (EEA) by filing an Environmental Notification Form (ENF) for new parking facilities on March 31, 2017. On May 5, 2017, EEA issued its Certificate on the ENF establishing the Scope for the required Draft Environmental Impact Report (EIR). Initiation of concept design for the parking facilities and preparation of a Draft EIR is expected to commence in the Spring of 2018. MassDEP issued the amended regulation on June 30, 2017, approving the requested parking increase. On December 5, 2017, the U.S. Environmental Protection Agency (EPA) proposed a rule approving the revision of the Massachusetts State Implementation Plan (SIP) incorporating the amended Logan Airport Parking Freeze Cap. EPA approved the proposed rule on March 6, 2018, and the rule went into effect April 5, 2018.The Draft EIR will provide additional details on the number of spaces per location and planned construction phasing.

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Noise Abatement

Introduction

The Massachusetts Port Authority (Massport) strives to minimize the noise effects of Boston-Logan International Airport (Logan Airport or the Airport) operations on its neighbors through a variety of noise abatement programs, procedures, and other tools. At Logan Airport, Massport implements one of the oldest and most extensive noise abatement program of any airport in the nation. Massport's comprehensive noise abatement program includes a dedicated Noise Abatement Office; a state-of-the-art Noise and Operations Monitoring System (NOMS); extensive residential and school sound insulation programs; time and runway restrictions for noisier aircraft; ground run-up procedures; and flight tracks designed to optimize over-water operations (especially during nighttime hours). The public can register noise complaints by phone or online through Massport's website.[1]

The foundation of Massport's noise program is the *Logan Airport Noise Abatement Rules and Regulations*[2] (the Noise Rules), which have been in effect since 1986. Massport's Noise Abatement Office is responsible for implementing noise abatement measures and generally monitoring community complaints and other aspects of the noise effects from Logan Airport operations. This chapter describes runway use, fleet mix, level of operations, noise levels, and modeled noise conditions at Logan Airport related to aircraft operations during 2016 and compares the findings to those for 2015. Historical comparisons to the years 1990, 2000, and 2010 are also provided.

Noise conditions for 2016 were assessed primarily through computer modeling, supplemented by the analysis of measured noise levels from Logan Airport's noise monitoring system. This *2016 Environmental Data Report (EDR)* marks the transition from the Federal Aviation Administration's (FAA) legacy analysis software, the Integrated Noise Model (INM), to its next-generation software, the Aviation Environmental Design Tool (AEDT). Massport developed a suite of customized adjustments for use with INM necessary for accurate modeling of the unique Logan Airport environment, and has been working with FAA since 2015 to implement equivalent methods in AEDT. FAA has responded to Massport's request and did not approve two adjustments: over-water noise propagation and hill effects. However, FAA did concur[3] with the use of 2016 weather data and Logan Airport-specific aircraft stage length adjustments. The adjustments resulted in smaller differences

1 Massport. Noise Complaints. http://www.massport.com/logan-airport/about-logan/noise-abatement/complaints/.

2 The Logan International Airport Noise Abatement Rules and Regulations, effective July 1, 1986, are codified as 740 Code of Massachusetts Regulations (CMR) 24.00 et seq (also known as the Noise Rules).

3 FAA approves non-standard modeling requests only for projects requiring FAA review; such as an EA or Part 150 Study.

between the INM and AEDT contours under the defined flight paths but larger differences along the sides of the runways especially close to the Logan Airport.

Consistent with previous practice, Massport presents AEDT modeling results as the primary model in this *2016 EDR*. INM results are provided for comparison only for 2016 and future filings will present only AEDT results. Research efforts that address potential improvements in AEDT modeling are underway for terrain adjustments and recently concluded for acoustically reflective surfaces. The results of these studies, if and when they are implemented in AEDT, will add capabilities previously addressed by Logan Airport's over-water and hill effect adjustments. Further details regarding the implementation of AEDT are provided in the section *Noise Modeling Process* later in this chapter.

This chapter presents summaries of the 2016 operational data used in the noise modeling, as well as the resultant annual Day-Night Average Sound Level (DNL) noise contours, a comparison of the modeled results with measured levels from the noise monitoring system, and estimates of the population residing within various increments of noise exposure in 2016. Both FAA and the U.S. Department of Housing and Urban Development consider DNL exposure levels above 65 decibels (dB) to be incompatible with residential land use.[4,5] To better understand the noise environment, analyses also include several supplemental noise metrics including Logan Airport's Cumulative Noise Index (CNI), Time Above (TA) various threshold sound levels, and periods of dwell and persistence of noise levels. Massport's progress on implementing noise abatement measures, the aRea NAVigation (RNAV)[6] Pilot study being jointly undertaken by FAA and Massport, and a summary of the recently-concluded Boston Logan Airport Noise Study (BLANS) are also provided.

Appendix H, *Noise Abatement*, provides historical details on aircraft operations, runway use, noise exposed population, and the status of the sound insulation program since 1990. Total runway use from all operations, usage by runway end, and DNL levels at U.S. Census Block group locations are included. Appendix H also contains the *Flight Track Monitoring Report* for 2016 and a *Fundamentals of Acoustics and Environmental Noise* section, which gives an overview of key noise issues, noise metric definition, and terminology for the general reader.

Noise Metrics

The common metrics used in this chapter to describe and evaluate aircraft noise are:

- **Decibel (dB)** – The decibel is the unit of sound pressure level (SPL), the standard measure for sound. It is a logarithmic quantity reflecting the ratio of the pressure of the sound source of interest and a reference pressure. The range of SPL extends from about 0 dB for the quietest sounds that one can detect to about 120 dB for the loudest sounds we can hear without pain. Many sounds in our daily environment have SPL on the order of 30 to 100 dB.

4 14 CFR Part 150, Appendix A to Part 150 Noise Exposure Maps, Sec. A150.101(d)

5 24 CFR Part 51, Subpart B Noise Abatement and Control, Sec. 51.103(c)

6 RNAV – aRea NAVigation, RNAV enables aircraft to fly on any desired flight path within the coverage of ground- or space- based navigation aids, within the limits of the capability of aircraft self-contained systems, or a combination of both capabilities.

- **"A"-weighted decibel (dBA)** – This metric applies frequency weighting (A-weighting) to the SPL to approximate the sensitivity of the human auditory system. Human hearing is less sensitive to both low and high frequency components of sound, while being most sensitive to mid-frequency sounds.
- **Day-Night Average Sound Level (DNL)** – The Day-Night Average Sound Level is a measure of the cumulative noise exposure over a 24-hour day. It is the 24-hour, logarithmic (or energy) average. DNL treats nighttime noise differently than daytime noise; for the A-weighted sound pressure levels occurring at night (between 10:00 PM and 7:00 AM) a 10-dB penalty is applied to the nighttime event. DNL is the FAA-defined metric for evaluating noise and land use compatibility.[7]
- **Time Above (TA)** – The Time Above metric describes the total number of minutes that instantaneous sound levels (usually from aircraft) are above a given threshold. For example, if 65 dB is the specified threshold, the metric would be referred to as "TA65." The TA metric is typically associated with a 24-hour annual average day but can be used to represent any time period. Any threshold may be chosen for the TA calculation. For this study, TA65, TA75, and TA85 were computed at each of the monitoring sites.
- **Effective Perceived Noise Level (EPNL)** – A time series of "tone corrected" perceived noise levels are used to compute EPNL, which is expressed in units of EPNdB. The tone corrected perceived noise level is determined by measuring the perceived noise level and adding to that value a "pure-tone" correction of up to 6 dB. The EPNdB is an international standard for the noise certification of aircraft and is used in this report in the calculation of the CNI.

For a more in-depth description of noise metrics, refer to Appendix H, *Noise Abatement*.

Regulatory Framework

The noise regulatory framework that this *2016 EDR* follows is described in Appendix H, *Noise Abatement*. Regulations discussed include:

- Logan Airport Noise Abatement Rules and Regulations;
- Federal Aviation Regulation (FAR) Part 36;
- FAR Part 150; and
- FAR Parts 91 and 161.

Noise Modeling Process

The sections below provide an overview of the noise modeling included in this *2016 EDR*. For this *2016 EDR*, Massport used the required AEDT model for the noise assessment.

Aviation Environmental Design Tool

For this *2016 EDR*, Massport has transitioned from using FAA's legacy modeling software, INM, to FAA's next-generation software, AEDT. AEDT is the required model for noise studies seeking FAA approval. While the

7 14 CFR Part 150, Appendix A to Part 150 Noise Exposure Maps, Sec. A150.101(b).

Massachusetts Environmental Policy Act (MEPA) EDR/ESPR process does not require FAA approval, Massport wishes to perform analysis to FAA standards.

For past studies using INM, Massport has developed customized adjustments to address specific terrain conditions at Logan Airport:

- **Over-water adjustment** – Logan Airport is surrounded by water, which is an acoustically reflective surface. Consequently, noise levels near the Airport are higher than they would be for an airport surrounded by soft ground, which is acoustically absorptive. A correction is applied in INM for aircraft at low altitudes to account for this.
- **Hill effects** – Elevated locations near the Airport experience line-of-sight exposure to ground operations at the Airport. A corresponding adjustment has been applied in these areas in INM.

Massport has sought FAA approval for implementation of these adjustments in AEDT, but after Massport's request and FAA review, FAA has not approved these adjustments. Further information on these issues is provided in the section *AEDT Analysis* in Appendix H, *Noise Abatement*.

Noise Modeling Overview

The DNL, CNI, and TA noise metrics reported annually by Massport provide varied means of understanding and comparing Logan Airport's complex noise environment from one year to the next. The noise context is influenced by numbers of operations, types of aircraft operating during the day and at night, use of various runway configurations, and the location and frequency of use of flight paths to and from the runways. Changes in any one of these operational parameters from one year to the next can cause changes in the values of the noise metrics and alter the shapes of the noise exposure contours that represent the accumulation of noise events during an average day.

Massport continues to make use of state-of-the-art improvements in the noise modeling process, which has been updated each year. These developments in noise modeling technologies and techniques, which were first employed in the preparation of the *2005 EDR*, and have continued through this *2016 EDR,* are discussed below.

- As with prior reports, the *2016 EDR* continues to use data from Massport's Noise and Operations Management System (NOMS), including all radar data and noise measurement data.[8]
- The flight operations data from the NOMS includes detailed information with each flight record, such as aircraft registration numbers, wherever possible, which provides better AEDT aircraft type selection. This allows for the assignment of the modeled AEDT aircraft type based on the specific aircraft and engine combination used on each flight at Logan Airport during 2016.
- The modeling process includes continued use of U.S. Geological Survey digital terrain data. AEDT uses the detailed terrain data to evaluate each receptor location at its proper elevation, which enhances the accuracy of the results.

8 The noise measurement data are only used for reporting and are not used to calibrate the model.

- Massport uses the proprietary software RC for AEDT™, an AEDT pre-processor that prepares high-fidelity data for processing by AEDT.
  - RC for AEDT™ automates the production of noise contours directly from each individual radar trace. In 2016, approximately 396,615 traces were collected and 388,857 retained enough information to be modeled in the RC for AEDT™ system. Each radar trace was converted to a model track, ensuring that the lateral dispersion of radar tracks was retained in the modeling. The operations on these radar traces were then scaled to account for all the 391,222 operations in 2016. This method also helps to develop more accurate noise contours by retaining the actual runway used and time of each operation.
  - RC for AEDT™ provides greater detail than standard AEDT analyses through the use of individual flight tracks taken directly from radar systems rather than relying on consolidated, representative flight tracks data.

RC for AEDT™ improves the precision of modeling by:

- Directly converting the radar flight track for every identified aircraft operation to an AEDT track, rather than assigning all operations to a limited number of prototypical or representative tracks;
- Modeling each operation for the actual time of day and on the specific runway that it actually used, rather than applying a generalized distribution to broad ranges of aircraft types;
- Selecting the specific airframe and engine combination to model, on an operation by operation basis, based on the aircraft registration or a published composition of the fleets of the specific airlines operating at Logan Airport;
- Using each flight's city-pair information to select the proper stage length; and
- Using each aircraft's actual altitude profile to select from the available flight profiles in the AEDT database.

These enhancements are examples of Massport's continued commitment to improving the monitoring, reporting, and understanding of the noise environment at Logan Airport. The following section of this chapter summarizes the basic operational data used to compute the DNL, CNI, and TA noise metrics reported for 2016.

Noise Model Inputs

For this *2016 EDR*, noise was modeled using the most recently available version of FAA's AEDT version 2c, Service Pack 2 (AEDT 2c SP2). The model requires detailed operational data as inputs for noise calculations, including numbers of operations per day by aircraft type and by time of day, which runway for each arrival and for each departure, and flight track geometry for each track. These data are summarized in tables that follow or are included in Appendix H, *Noise Abatement.* The following section summarizes the average-day operations for each year as used in the noise modeling and compares 2016 inputs to the previous year's data (2015).

Radar Data

Operations data for noise modeling is obtained from the Massport NOMS system, which incorporates the Harris NextGen data feed. This data feed integrates information from ground-based radar and other sensors with transponder data from aircraft. Further detail about this system is provided in the section *2016 Radar Data* in Appendix H, *Noise Abatement*.

Fleet Mix

Since 2004, Massport has relied primarily on radar data as the main source of input for noise calculations, because radar data typically are more accurate than the information reported by airlines. The radar data result in a list of approximately 500 different aircraft types that use Logan Airport during a year, including the wide variety of small corporate jets and propeller aircraft flown by general aviation (GA) users, as well as the large passenger and cargo jets operated by air carriers.

For 2016, the aircraft types identified by the radar data were matched to the AEDT database, which contains individual noise and performance profiles for 279 different fixed-wing aircraft types, 164 of which represent civilian aircraft, the balance being military aircraft.[9] For those aircraft recorded in radar data that are not in the AEDT database, the radar type is paired with the best available alternative using an aircraft substitution list included in the AEDT model. The final list of modeled aircraft, used as an input to AEDT, is presented in detail in Appendix H, *Noise Abatement*.

Operations by aircraft type are summarized into several key categories: commercial (passenger and cargo) or GA operations; Stages 2 to 4 jet aircraft; and turboprop and propeller (non-jet) aircraft. Stage 3 and 4 categories include any aircraft that are certificated in the Stage 3 or Stage 4 FAA noise categories. Note that many aircraft originally certificated as Stage 3 would in fact satisfy the newer Stage 4 and 5 criteria if recertificated. FAA does not require aircraft to be recertificated and FAA has no plans at this time to restrict Stage 3 operations.[10] To better understand noise conditions, aircraft operations are split into daytime and nighttime periods, where nighttime hours are defined as 10:00 PM to 7:00 AM. Operations occurring during nighttime hours incur a 10 dB penalty when included in the DNL modeling calculation.

Table 6-1 summarizes the numbers of operations by categories of aircraft operating at Logan Airport in 2016 and provides comparison data for the previous two years (2014 and 2015) as well as reference years 1990, 2000, 2010, and 1998, the year of peak operations at Logan Airport. Available data for each year prior to 2014 are included in Appendix H, *Noise Abatement*.

The number of operations by regional jet (RJ) aircraft decreased between 2015 and 2016 by an average of five operations per day. Night operations by commercial operators increased in 2016 compared to 2015 by approximately eight operations per night. Most of the increase in operations is due to an increase in passenger and cargo flights at night as airlines expand destinations and the number of flights per day. Commercial non-

9 Some of these are military types as well as older Stage 1 and 2 airplanes that no longer operate in the U.S. or do not operate at Logan Airport. There are ordinarily no military aircraft operations at Logan Airport.

10 Massport does not have the regulatory authority to restrict aircraft using Logan Airport.

jet operations (such as Cape Air and Porter Airlines) were nearly unchanged from 2015 and 2016, increasing by one daily operation to 129 operations per day.

Table 6-1 Modeled Average Daily Operations by Commercial and General Aviation (GA) Aircraft[1]

		1990[2,3]	1998	2000[4]	2010[5]	2014[5]	2015[5]	2016[5]
		Commercial Aircraft (Passenger and Cargo)						
Stage 2 Jets[6]	Day	312.40	84.93	5.13	0.01	0.00	0.00	0.00
	Night[7]	19.99	5.92	0.26	0.01	0.00	0.00	0.00
	Total	**332.39**	**90.85**	**5.39**	**0.02**	**0.00**	**0.00**	**0.00**
Stage 3 and 4 Jets (All)	Day	288.89	541.43	727.09	674.25	670.00	685.92	713.65
	Night[7]	57.25	95.54	103.66	107.92	123.60	130.96	142.16
	Total	**346.14**	**636.97**	**830.75**	**782.17**	**793.61**	**816.88**	**855.81**
Air Carrier Jets	Day	N/A[2]	N/A	648.95	521.64	556.59	585.55	620.45
	Night[7]	N/A[2]	N/A	99.79	93.98	115.84	126.36	134.93
	Total	**N/A[2]**	**N/A**	**748.74**	**615.62**	**672.43**	**711.92**	**755.38**
Regional Jets	Day	N/A[2]	N/A	78.14	152.61	113.41	100.36	93.20
	Night[7]	N/A[2]	N/A	3.87	13.94	7.77	4.60	7.23
	Total	**N/A[2]**	**N/A**	**82.01**	**166.55**	**121.18**	**104.96**	**100.43**
Non-Jet Aircraft	Day	444.41	552.56	409.62	138.53	128.45	125.27	125.88
	Night[7]	11.72	21.86	21.58	5.21	2.28	2.41	3.01
	Total	**456.13**	**574.42**	**431.20**	**143.74**	**130.73**	**127.68**	**128.89**
Total Commercial Operations	Day	1,045.70	1,178.92	1,141.84	812.78	798.45	811.19	839.53
	Night[7]	88.96	123.32	125.51	113.13	125.88	133.37	145.17
	Total	**1,134.60**	**1,302.24**	**1,267.35**	**925.91**	**924.33**	**944.56**	**984.70**
		GA Aircraft						
Stage 2 Jets[6]	Day	N/A[7]	5.25	7.29	0.27	0.00	0.28	0.00
	Night[7]	N/A[7]	0.40	0.64	0.04	0.00	0.02	0.00
	Total	**N/A[7]**	**5.65**	**7.93**	**0.30**	**0.00**	**0.30**	**0.00**
Stage 3 and 4 Jets	Day	N/A[3]	30.54	40.08	27.80	52.64	51.82	53.98
	Night[7]	N/A[3]	4.21	3.21	3.21	4.65	4.28	4.85
	Total	**N/A[3]**	**34.75**	**43.29**	**31.01**	**57.29**	**56.10**	**58.83**

Table 6-1 Modeled Average Daily Operations by Commercial and General Aviation (GA) Aircraft[1] (Continued)

		1990[2,3]	1998	2000[4]	2010[5]	2014[5]	2015[5]	2016[5]
Stage 3&4 Jets	Day	N/A[3]	30.54	40.08	27.80	52.64	51.82	53.98
	Night[7]	N/A[3]	4.21	3.21	3.21	4.65	4.28	4.85
	Total	**N/A[3]**	**34.75**	**43.29**	**31.01**	**57.29**	**56.10**	**58.83**
Non-Jets	Day	N/A[3]	37.29	34.57	8.19	13.95	19.31	23.77
	Night[7]	N/A[3]	16.28	1.83	0.72	1.13	1.46	1.62
	Total	**N/A[3]**	**53.57**	**36.40**	**8.92**	**15.08**	**20.77**	**25.38**
Total GA Operations	Day	N/A[3]	73.08	81.94	36.26	66.59	71.40	77.75
	Night[7]	N/A[3]	20.89	5.68	3.97	5.78	5.77	6.47
	Total	**N/A[3]**	**93.97**	**87.62**	**40.22**	**72.37**	**77.17**	**84.21**
Total (Commercial and GA)	Day	1,045.70	1,252.00	1,223.78	849.03	865.05	882.59	917.28
	Night[7]	88.96	144.21	131.19	117.10	131.66	139.14	151.64
	Total[3]	**1,134.60**	**1,396.21**	**1,354.97**	**966.13**	**996.70**	**1,021.73**	**1,068.91**

Source: Massport's Noise Monitoring System, Revenue Office and HMMH, 2017.

1 Operations include scheduled and unscheduled operations. Data for all years prior to 2014 are available in Appendix H, *Noise Abatement*.

2 RJs were not tracked separately prior to 1999.

3 Totals prior to 1998 do not include GA operations.

4 Prior to 2010, the split between air carrier jets and RJs is 100 seats with RJs having less than 100 seats.

5 After 2009, the split between air carrier jets and regional jets (RJs) is 90 seats with RJs having less than 90 seats.

6 Stage 2 aircraft above 75,000 pounds were banned on December 31, 1999 and all Stage 2 aircraft were banned on December 31, 2015.

7 Nighttime operations occur between 10:00 PM and 7:00 AM.

Commercial Operations

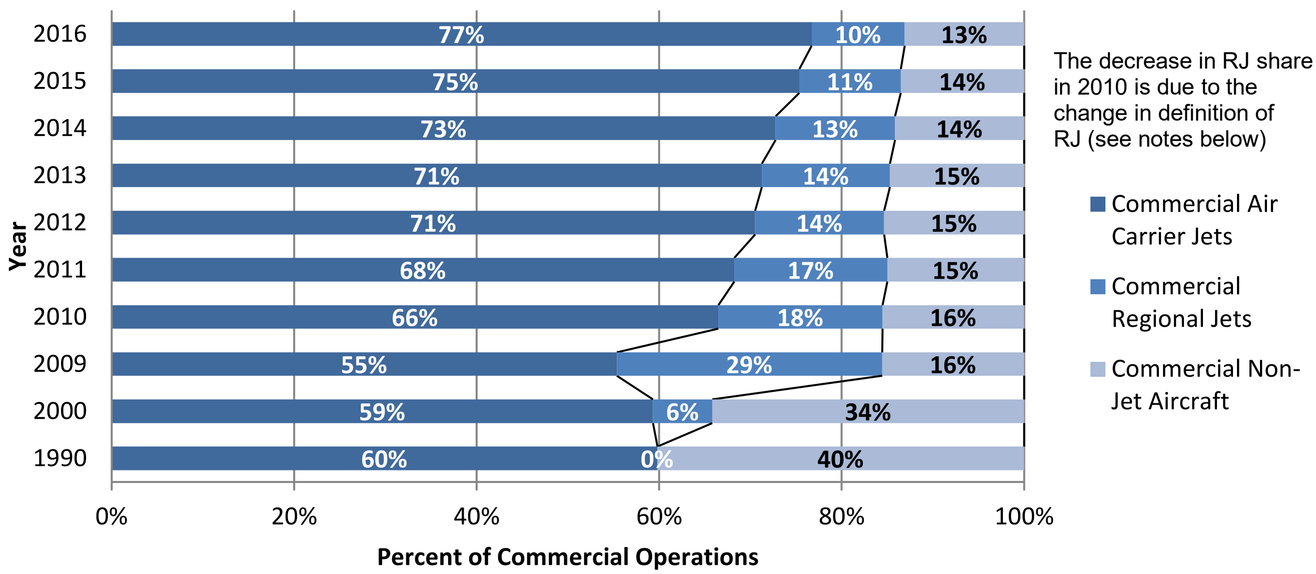
Regional jets (RJ) are defined as those aircraft with 90 or fewer seats, consistent with the categorization in Chapter 2, *Activity Levels*.[11] For years prior to 2010, the RJs in EDRs and ESPRs were classified as aircraft with fewer than 100 seats. When RJs first started gaining popularity, the aircraft types available were typically 50 seats or fewer with the traditional air carrier jet being 100 seats and higher. As newer aircraft types have become available, the smaller 35- to 50-seat types have been replaced by 70- to 99-seat types, with the 90 and above seat types flying many of the traditional air carrier routes. Most of the newer aircraft types fall into two categories: the 70- to 75-seat category, which remain categorized as RJs, and the 91- to 99-seat category, which are categorized as air carrier jets.

The percent of RJs in the overall commercial fleet fell 4 percent between 2015 and 2016 from 38,310 to 36,758 operations, while non-jets' share of the commercial fleet fell from 14 percent to 13 percent (**Figure 6-1**). In contrast, commercial air carrier operations increased their share by 2 percent, accounting for 77 percent of commercial operations in 2016 compared to 75 percent in 2015 (from 259,843 operations in 2015 to 276,469 in 2016).

Figure 6-1 presents the commercial operations groups in terms of percent of the total for each year from 2009 through 2016 and including 1990 and 2000 for historical context. **Figure 6-1** also shows the decrease in commercial non-jet operations after 2000 (34 percent of the fleet) and the rise of RJs, which were just 6 percent of the fleet in 2000 and increased to almost 30 percent of the fleet by 2009. The RJ share decreased in 2010 mainly due to a change in the definition of RJ (from 90 seats to 100 seats), but it has gradually decreased since then as there has been a trend among carriers of operating larger aircraft.

11 United States Code, 2006 Edition, Supplement 3, Title 49 – Transportation Subtitle VII – Aviation Programs Part A – Air Commerce and Safety, Subpart II, Economic Regulation, Chapter 417 - Operations or Carriers, Subchapter III - Regional Air Service Incentive Program, Sec. 41762 – Definitions – defines regional jet air carrier service to be aircraft with a maximum of 75 seats. Therefore, this report categorizes aircraft with 70 to 75 seats and below as regional jets and aircraft with 90 seats and higher aircraft as air carriers (note that there are no aircraft types with 75 to 90 seats).

Figure 6-1 Fleet Mix of Commercial Operations (Passenger and Cargo) at Logan Airport



Source: HMMH, 2017.
Notes: Includes both passenger and cargo operations.
After 2009, the split between air carrier jets and RJs is 90 seats with RJs having fewer than 90 seats.
Prior to 2010, the split between air carrier jets and RJs is 100 seats with RJs having fewer than 100 seats.

General Aviation Operations

Modeled GA activity in 2016 rose slightly compared to 2015, from 77 operations per day in 2015 to 84 operations per day in 2016 (**Table 6-1**). There were no Stage 2 GA jet operations for 2016.

Stage 3, Stage 4, and Stage 5 Jet Aircraft

Jet aircraft currently operating at Logan Airport are categorized by FAA as Stage 3 or Stage 4. Stage 5 aircraft certification will begin in 2018; however, 18 percent of the current jet fleet already meets this standard. As described previously, the designation refers to a noise classification specified in FAR Part 36 that sets noise emission standards based on an aircraft's maximum certificated weight. Generally, the heavier the aircraft, the more noise it is permitted to make within the limits established by FAR Part 36.

FAA has banned Stage 2 aircraft operations in the contiguous United States as of December 31, 2015, and just recently adopted a higher standard of noise classification called Stage 5. Stage 5 aircraft are certificated as a cumulative 17 dB below Stage 3 standards and will be effective for new aircraft type certification after December 31, 2017 and December 31, 2020, depending on the weight of the aircraft.[12]

12 The Stage 5 Final Rule was published on October 5, 2017. https://www.federalregister.gov/documents/2017/10/04/2017-21092/stage-5-airplane-noise-standards.

Because of the noise differences among aircraft certificated as Stage 2, recertificated Stage 3, Stage 3, and Stage 4, Massport tracks operations by these categories to follow their trends. **Table 6-2** provides the percentage of commercial jet operations by stage since 2010 with 2000 and 1990 reported for historical context. As noted in **Table 6-2**, 97 percent of the commercial jet fleet at Logan Airport met Stage 4 requirements in both 2015 and in 2016. FAA's newest noise category, Stage 5, is satisfied by 18 percent of Logan Airport's commercial jet fleet for 2016.

Table 6-2 Percentage of Commercial Jet Operations by Part 36 Stage Category[1]

Year	Stage 5 Requirements[5]	Stage 4 Requirements[2]	Certificated Stage 3	Recertificated Stage 3[3]	Stage 2 Greater than 75,000 lbs.	Total
1990	N/A	N/A	51.1%	0.0%	48.9%	100%
2000	N/A	N/A	70.0%	21.0%	9.0%	100%
2010	N/A	93.2%	4.7%	1.1%[4]	0.0%	100%
2011	N/A	95.5%	4.0%	0.5%[4]	0.0%	100%
2012	N/A	95.8%	4.1%	0.1%[4]	0.0%	100%
2013	N/A	97.4%	2.6%	0.0%	0.0%	100%
2014	N/A	97.4%	2.6%	0.0%	0.0%	100%
2015	N/A	96.7%	3.3%	0.0%	0.0%	100%
2016	17.8%[6]	79.2%	3.0%	0.0%	0.0%	100%

Source: Massport's Noise Monitoring System, Revenue Office and HMMH, 2017.

Notes:

1 Data for all years beginning in 1999 are available in Appendix H, *Noise Abatement*.

2 Aircraft that meet Stage 4 requirements are aircraft that are certificated Stage 4 or would qualify if recertificated. Certificated Stage 4 aircraft were not available until 2006 and the level of aircraft that meet Stage 4 requirements has not been determined prior to 2008.

3 Recertificated Stage 3 aircraft are aircraft originally manufactured as a certificated Stage 1 or 2 aircraft under FAR Part 36 that either have been retrofitted with hushkits or have been re-engined to meet Stage 3 requirements.

4 Prior to 2013, only one commercial carrier, with more than 100 annual operations, continued to use recertificated Stage 3 aircraft at Logan Airport (Federal Express). A few charter operators also use these aircraft.

5 Aircraft that meet Stage 5 requirements are aircraft that are certificated Stage 5 or would qualify if recertificated. Certificated Stage 5 aircraft will not be available until 2018 and the level of aircraft that meet Stage 5 requirements has not been determined prior to 2016. All aircraft listed as meeting Stage 5 requirements are also listed as Stage 3 or 4 aircraft.

Nighttime Operations

Massport monitors flights that operate during the DNL nighttime period of 10:00 PM to 7:00 AM, when each modeled flight is penalized 10 dB in calculations of noise exposure. **Table 6-3** shows this nighttime activity by different groups of aircraft. Commercial jet nighttime operations increased from 131.0 in 2015 to 142.2 in 2016 and commercial non-jet nighttime operations increased from 2.4 in 2015 to 3.0 in 2016. GA nighttime operations increased from 5.8 in 2015 to 6.5 in 2016. These changes resulted in 12.9 additional flights per night. Nighttime operations represent 14 percent of total operations for 2016 at Logan Airport. The majority (85 percent) of nighttime operations occurred either before midnight or after 5:00 AM.

Table 6-3 Modeled Nighttime Operations (10:00 PM to 7:00 AM) at Logan Airport Per Night[1]

	Commercial Jets	Commercial Non-Jets	General Aviation	Total
1990	77.2	11.7	N/A[2]	89.0
1998	101.4	21.9	20.9[3]	144.2
2000	103.9	21.6	5.7	131.2
2010	107.9	5.2	4.0	117.1
2011	109.4	4.7	6.7	120.8
2012	106.6	3.1	8.5	118.1
2013	115.9	3.2	6.3	125.4
2014	123.6	2.3	5.8	131.7
2015	131.0	2.4	5.8	139.1
2016	142.6	3.0	6.5	152.1
Change (2015 to 2016)	**11.6**	**0.6**	**0.7**	**12.9**
Percent Change	**8.9%**	**25.1%**	**12.4%**	**9.3%**

Source: Massport and Harris radar data; and HMMH, 2017.
Notes:
1 Data for all years beginning in 1990 are available in Appendix H, *Noise Abatement*.
2 Totals prior to 1998 do not include GA operations.
3 Previously reported as N/A. 1998 was the first year GA operations were reported and included in the total nighttime operations.

Nighttime cargo operations increased slightly, accounting for 5.8 percent of all commercial nighttime operations in both 2015 and 2016.

Similar to conditions reported in 2015, flights by cargo operators using recertificated Stage 3 aircraft made up almost no commercial nighttime activity in 2016. For comparison, in 2000, flights by cargo operators using recertificated Stage 3 aircraft accounted for 8 percent of the commercial nighttime activity. Though the International Civil Aviation Organization (ICAO) and FAA are not expected to require the phase-out of the remaining recertificated operations prevalent among cargo operators, the use of these aircraft will continue to decrease as these aircraft age and are taken out of service.

Increases to nighttime commercial activity were due to passenger aircraft operations primarily resulting from the overall growth in domestic air carrier flights. In addition to this, nighttime operations on new routes to international destinations were introduced in 2016 (similar to 2015) and contributed to the overall increase in 2016 nighttime activity.

Runway Use

Logan Airport's runways are shown in **Figure 6-2**. Runway use refers to the frequency with which aircraft use each of these runways during the year, as dictated or permitted by availability, wind, weather, aircraft performance, demand, and air traffic control conditions. Runway 15R-33L and Runway 4R-22L are Logan Airport's longest runways; each runway is just over 10,000 feet in length.

In 2016, Runway 15R-33L was the preferred runway to use at night to reduce nearby community noise, with arrivals to Runway 33L and departures from Runway 15R (known as head-to-head procedures), thus keeping flights over Boston Harbor (although these flights do eventually fly over South Shore communities).

During other periods of the day, Runway 9 and 22R are used primarily for departures, and Runway 4R is used primarily for arrivals. Runways 15R, 27, 22L, and 33L are used for both arrivals and departures.

Operations on Runway 27 and Runway 22R are known as Converging Runway Operations (CRO) since the extended centerlines of these runways cross within a short distance. During periods of high demand, and when Runway 22R is in use for departing aircraft, arrivals that would typically be directed to Runway 27 are sent by FAA Air Traffic Control to arrive on Runway 22L.

Runway 14-32 is unidirectional; there are no arrivals to Runway 14 and no departures from Runway 32. Additionally, Runway 14-32 can be used only during northwest or southeast wind conditions when winds are 10 knots or greater. Under certain northwest wind conditions, Runway 32 provides FAA with a second arrival runway, thereby reducing delays at the Airport. Runway 14 is available for departures but is rarely used in that manner. Runway 15L-33R is Logan Airport's shortest runway at under 3,000 feet long. This runway is primarily used for small non-jet aircraft arrivals.

Jet runway use conditions in 2016 are summarized in **Table 6-4** and were as follows:

- Runway 4L-22R was closed for a period of one month in 2016 for a resurfacing project. This resulted in a decrease in the share of departures from Runway 22R from 32 percent in 2015 to 27 percent in 2016.
- These departures were accommodated by other runways. Runway 33L experienced an increased departure share from 15 percent in 2015 to 18 percent in 2016. Departure shares of Runways 9, 15R, and 27 each increased by 1 percent from 2015.
- Runway 4L is not a preferred runway for arrivals, but the closure did cause its share of arrivals to decrease from 5 percent in 2015 to 4 percent in 2016.

- There were negligible numbers of departures from Runway 4L or arrivals to Runway 22R, so these were not affected by the closure.
- Arrival shares experienced little change from 2015 to 2016. Runway 4R increased from 29 percent in 2015 to 31 percent in 2016. All other runways experienced changes of 1 percent or less.

Runway use for all aircraft types (Jet and Non-Jet) for 2015 and 2016 is provided in Appendix H, *Noise Abatement*.

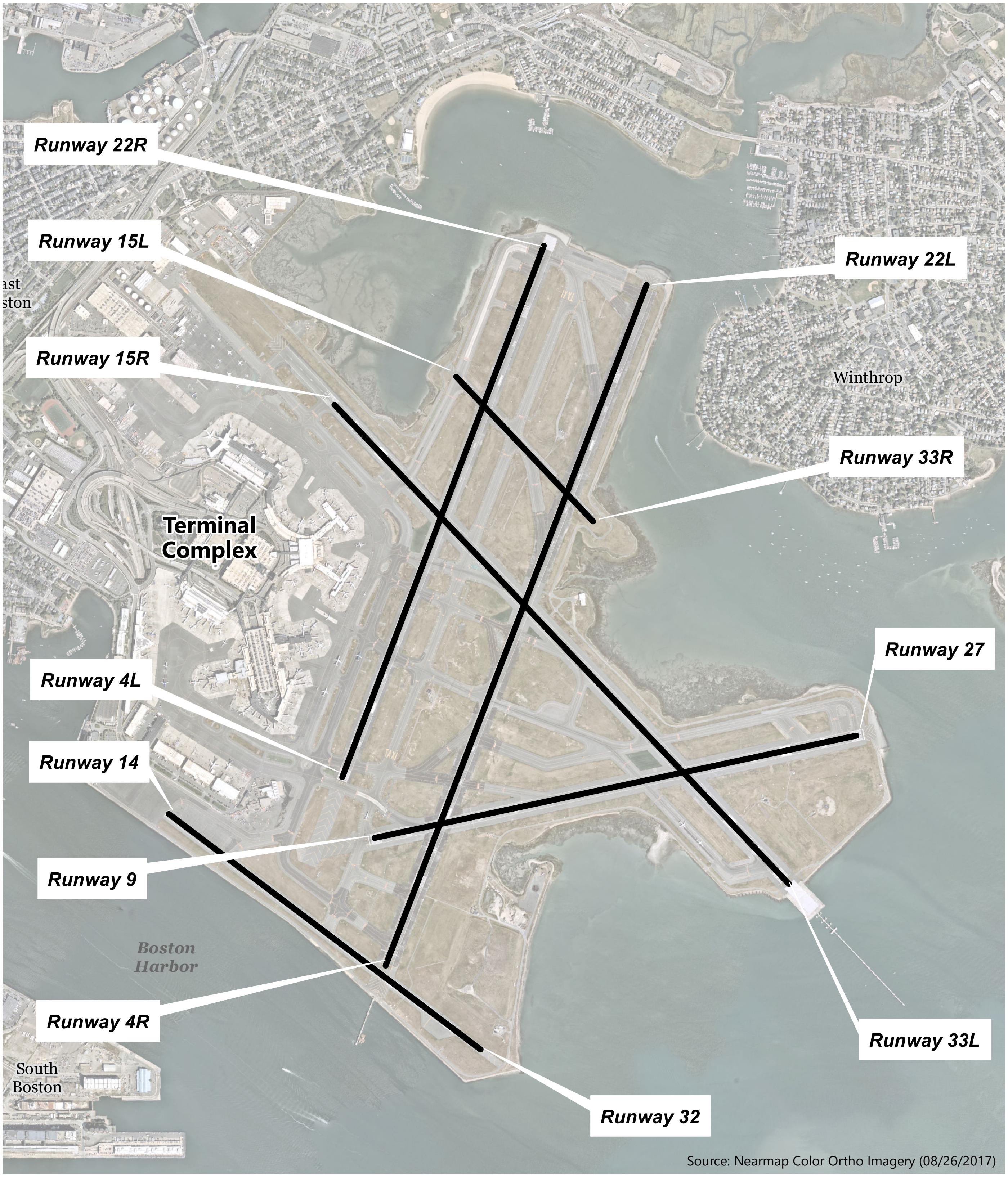


FIGURE 6-2 Logan Airport Runways | **2016 Environmental Data Report**

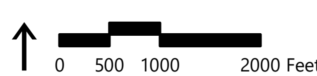


Table 6-4 Summary of Annual Jet Aircraft Runway Use[1]

	Runway									
	4L	**4R**	**9**	**14[2]**	**15R**	**22L**	**22R**	**27**	**32[2]**	**33L**
1990										
Departures	0%	3%	21%	N/A	10%	2%	36%	20%	N/A	7%
Arrivals	1%	25%	0%	N/A	2%	14%	0%	28%	N/A	29%
2000										
Departures	0%	8%	35%	N/A	4%	3%	30%	15%	N/A	6%
Arrivals	4%	40%	0%	N/A	1%	7%	0%	28%	N/A	20%
2010										
Departures	0%	4%	28%	<1%	8%	2%	31%	10%	-	17%
Arrivals	5%	28%	0%	-	1%	15%	0%	32%	1%	16%
2014										
Departures	0%	5%	31%	<1%	5%	2%	28%	13%	-	17%
Arrivals	5%	30%	0%	-	2%	25%	<1%	21%	1%	16%
2015										
Departures	0%	4%	29%	<1%	5%	2%	32%	12%	-	15%
Arrivals	5%	29%	0%	-	2%	25%	<1%	23%	1%	16%
2016										
Departures	0%	4%	30%	-	6%	2%	27%	13%	-	18%
Arrivals	4%	31%	-	-	1%	24%	<1%	23%	1%	16%

Source: Massport Noise Office and HMMH, 2017.
Notes: These data reflect actual percentages of jet aircraft operations on each runway end. They should not be confused with effective runway use.
Jet aircraft are not able to use Runway 15L or 33R due to its length of only 2,557 feet.
Values may not add to 100 percent due to rounding.
N/A Not Available.
1 Data for all years beginning in 1990 are available in Appendix H, *Noise Abatement*.
2 Runway 14-32 opened in late November 2006. (Runway 14-32 is unidirectional with no arrivals to Runway 14 and no departures from Runway 32.)

Preferential Runway Advisory System (PRAS)

To provide an equitable distribution of Logan Airport's noise impacts on surrounding communities, in 1982 Massport developed the Preferential Runway Advisory System (PRAS). The system was enhanced in 1990 and in subsequent years. The two primary objectives of PRAS are to distribute noise on an annual basis and to provide short-term relief from continuous operations over the same neighborhoods at the ends of the runways.

PRAS consisted of two parts: (1) a set of specific runway use goals to address the PRAS objectives, and (2) a computer program that would provide runway configuration recommendations to air traffic controllers based on weather, traffic, and PRAS goals. In February 2004, the PRAS system was suspended due to an upgrade of FAA radar system during the consolidation of the Boston Terminal Control Center at the new facility in Merrimack, New Hampshire and has not since restarted.

During Phase 2 of the recently concluded BLANS, the Logan Airport Community Advisory Committee (CAC) voted to abandon PRAS because it had not achieved the intended noise abatement.[13] Phase 3 of the BLANS focused on the development of an updated Runway Use Program. Operational tests of a new program began in November 2014 and continued through September 2016. The BLANS project ended in 2016 without the Logan Airport CAC agreeing on a new Runway Use Program. A final BLANS project report was issued in April 2017.[14]

Although the PRAS system was discontinued, the PRAS goals remain a benchmark to assess the equity of noise impacts, and Massport continues to present an assessment of runway use data relevant to the PRAS goals. Under the PRAS, each runway end has a specific annual utilization goal, defined separately for departures and arrivals. The goals are defined in terms of effective usage, which applies a factor of 10 to nighttime (10:00 PM to 7:00 AM) operations, equivalent to increasing nighttime exposure by 10 dB so that a change in effective utilization is roughly proportional to the change in DNL.

Table 6-5 provides a comparison of effective runway use[15] in 2016 to that of 2015 and 2014, and to the PRAS goals. The 2016 utilizations shown in bold indicate improvements toward the goals for each runway compared to 2015. Two of the arrival percentages moved closer to the PRAS goals in 2016 compared to 2015 and two of the departure percentages moved toward the PRAS goals.

13 BLANS Level 3 Screening Analysis, FAA, December 2012, Page E-2.
14 The final report is available online at: http://www.bostonoverflight.com/.
15 Effective Runway use refers to runway use which applies a factor of 10 to the night operations similar to DNL.

Table 6-5 Effective Jet Aircraft Runway Use in Comparison to PRAS Goals

	PRAS Effective Usage Goals		2014 Effective Usage		2015 Effective Usage		2016 Effective Usage	
Runway End	**Arrivals**	**Departures**	**Arrivals**	**Departures**	**Arrivals**	**Departures**	**Arrivals**	**Departures**
4R/L	21.1%	5.6%	28.1%	4.9%	25.1%	4.1%	26.4%	3.8%
9	0.0%	13.3%	0.0%	24.2%	0.0%	22.3%	0.0%	23.9%
15R	8.4%	23.3%	2.1%	11.6%	1.9%	13.1%	0.7%	12.6%
22L/R	6.5%	28.0%	30.4%	29.2%	31.3%	30.8%	**28.0%**	**26.4%**
27	21.7%	17.9%	15.4%	15.0%	16.6%	14.6%	**20.4%**	**16.2%**
33L	42.3%	11.9%	23.4%	15.1%	24.5%	15.1%	24.0%	17.0%
14[1]	NA	NA	0.0%	<0.1%	0.0%	<0.1%	0.0%	0.0%
32[1]	NA	NA	0.6%	0.0%	0.5%	0.0%	0.6%	0.0%

Source: Massport Noise Office and HMMH, 2017.
Notes: PRAS goals are stated in terms of effective jet operations which exclude non-jet flights, but which multiply each nighttime (10:00 PM to 7:00 AM) operation by a factor of 10.
Bold text indicates runway use that is closer to PRAS goals from the prior year.
1 Runway 14-32 opened in late November 2006. (Runway 14-32 is unidirectional with no arrivals to Runway 14 and no departures from Runway 32.) PRAS goals have not yet been established for Runways 14 and 32.

Flight Tracks

As described in the *Noise Modeling Process* section, Massport used a data pre-processor RC for AEDT™. Appendix H, *Noise Abatement* provides a summary discussion of this software package. RC for AEDT™ is used to develop the AEDT inputs based on available radar tracks. Instead of using representative model tracks, RC for AEDT™ converts each radar track to an AEDT model track and then models the scaled operation on that track.[16] This allows Massport to account for runway closures and/or temporary or permanent airspace changes which occur during the year.

For this *2016 EDR*, 388,857 flight tracks were modeled to calculate the noise levels surrounding Logan Airport for calendar year 2016. **Figures 6-3** through **6-9** provide examples of flight tracks used with RC for AEDT™ to develop the 2016 contours.[17] The figures show arrivals and departures from a representative sample throughout the year separately for each of three aircraft categories: air carrier jets, RJs, and non-jets. Additional figures and associated text at the end of this chapter describe the RNAV[18] standard instrument departure procedure and any changes that were in effect during 2016. In addition to the RNAV procedures recommended from the BLANS study, other RNAV procedures implemented at Logan Airport (such as the RNAV arrivals into

16 This method provides a one to-one correspondence of radar tracks to model tracks and ensures that the lateral and vertical dispersion of aircraft types are consistent with the radar data.

17 The flight tracks shown in these figures are a representative sample, selected uniformly from the complete track set to match the overall annual runway use.

18 RNAV enables aircraft to fly on any desired flight path within the coverage of ground- or space-based navigation aids, or within the limits of the capability of aircraft self-contained systems, or a combination of both capabilities.

the terminal airspace) are part of a national FAA initiative which is being implemented to improve safety and efficiency in the airspace system. These procedures result in consolidated flight paths and greater predictability along the flight route. Similar procedures have been implemented at Denver, Minneapolis, Baltimore-Washington, Houston, Dallas, Chicago Midway, and Seattle Airports.

- **Figure 6-3** displays air carrier jet departures following the recommended departure routes. The departure procedures reflect FAA RNAV routes that have been implemented since 2010. The Runway 33L RNAV procedure was first implemented by FAA in June 2013.
- **Figure 6-4** displays air carrier jet arrivals. The RNAV arrival procedures are very evident in the 2016-modeled data with a narrowing of the flight tracks into concentrated areas.
- **Figure 6-5** displays the RJ departures following the RNAV departure routes with flights remaining north of the Hull peninsula and passing over the Nahant Causeway.
- **Figure 6-6** displays the RJ arrivals that utilize both east and west sides of the Airport for arrivals. Arrivals to Runway 32 are also displayed on this graphic.
- **Figure 6-7** displays the non-jet departures that tend to turn early off the runways and do not follow the jet departure routes. Non-jet departures from Runways 4L, 22R, 33L, and 27 are allowed to turn over populated areas whereas the jet aircraft are not. This also keeps the non-jet aircraft out of the jet departure paths allowing for efficient jet departures.
- **Figure 6-8** displays the non-jet arrivals and includes the Boston Harbor route for non-jet aircraft arriving to Runway 4L. The graphic also displays the non-jet arrivals to Runways 22R and 33R in addition to the other runways, which also accommodate jets.
- **Figure 6-9** displays the night jet arrivals using the Light Visual Approach[19] to Runway 33L. This is a procedure developed from the BLANS project, which is available only during visual conditions in which pilots can follow a route offshore to reduce noise impacts. These flights remain offshore and avoid overflying Cohasset and Hull at night. Flights arriving to Runway 33L from the west pass over Saugus and Nahant at a higher altitude and then head south over Boston Harbor to intersect with the visual approach procedure. Of 8,885 nighttime arrivals to Runway 33L in 2016, approximately 700 used this procedure. In the fall of 2013, JetBlue Airways conducted a test of an RNAV visual approach procedure[20] which coincides with the route of the standard visual approach. This procedure gives aircraft with advanced navigational capabilities a more stabilized approach to the visual Runway 33L. This procedure is now available to authorized airlines only and is seen in the concentrated approach path in **Figure 6-9**.

Meteorological Data

AEDT has several settings that reflect aircraft performance profiles and sound propagation based on meteorological data. Meteorological settings include average temperature, barometric pressure, and relative humidity at the Airport. Massport obtained weather data for 2016 from the National Climatic Data Center, and an annual average was used in modeling all 2016 operations.

19 A Visual Approach procedure can only be used when weather conditions permit and the pilots follow visual landmarks to follow the procedure.

20 Boston-Logan Runway 33 Left Area Navigation (RNAV) Visual Flight Procedure Test CATEX, approved June 26, 2013.

FIGURE 6-3 Air Carrier Departure Flight Tracks

0 0.5 1 2 Miles

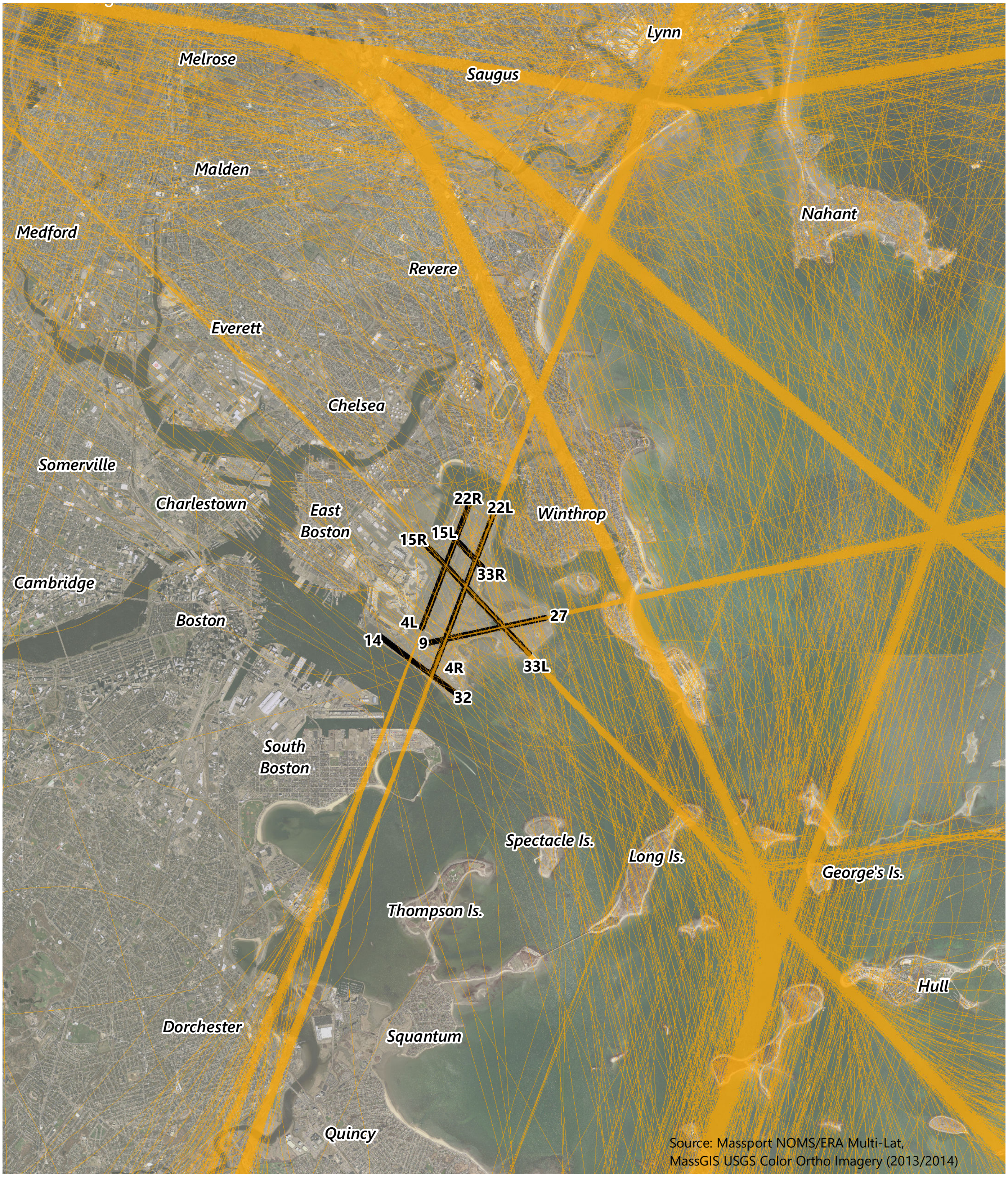


FIGURE 6-4 Air Carrier Arrival Flight Tracks

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0 0.5 1 2 Miles

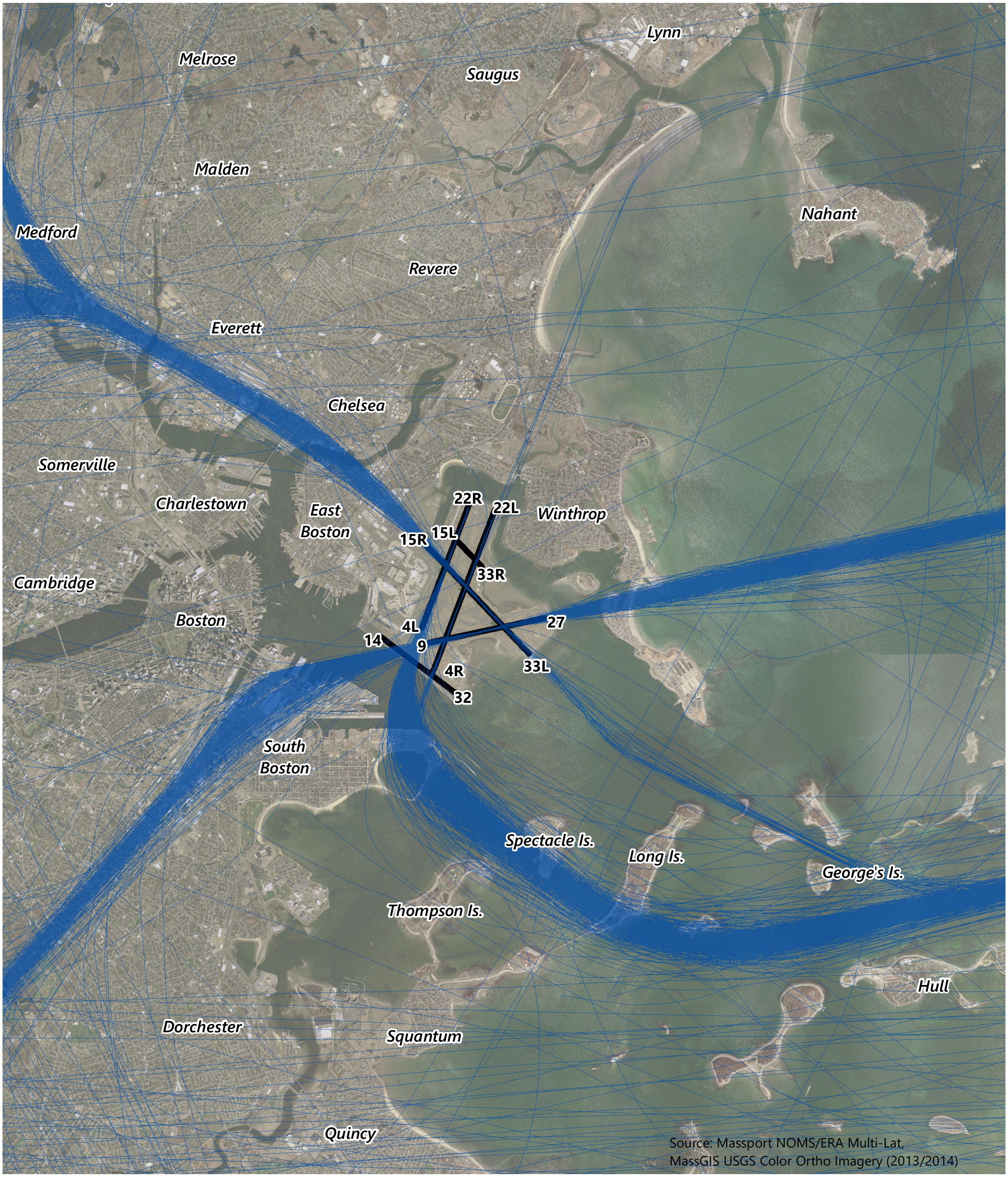


FIGURE 6-5 Regional Jet Departure Flight Tracks | **2016 Environmental Data Report**

0 0.5 1 2 Miles

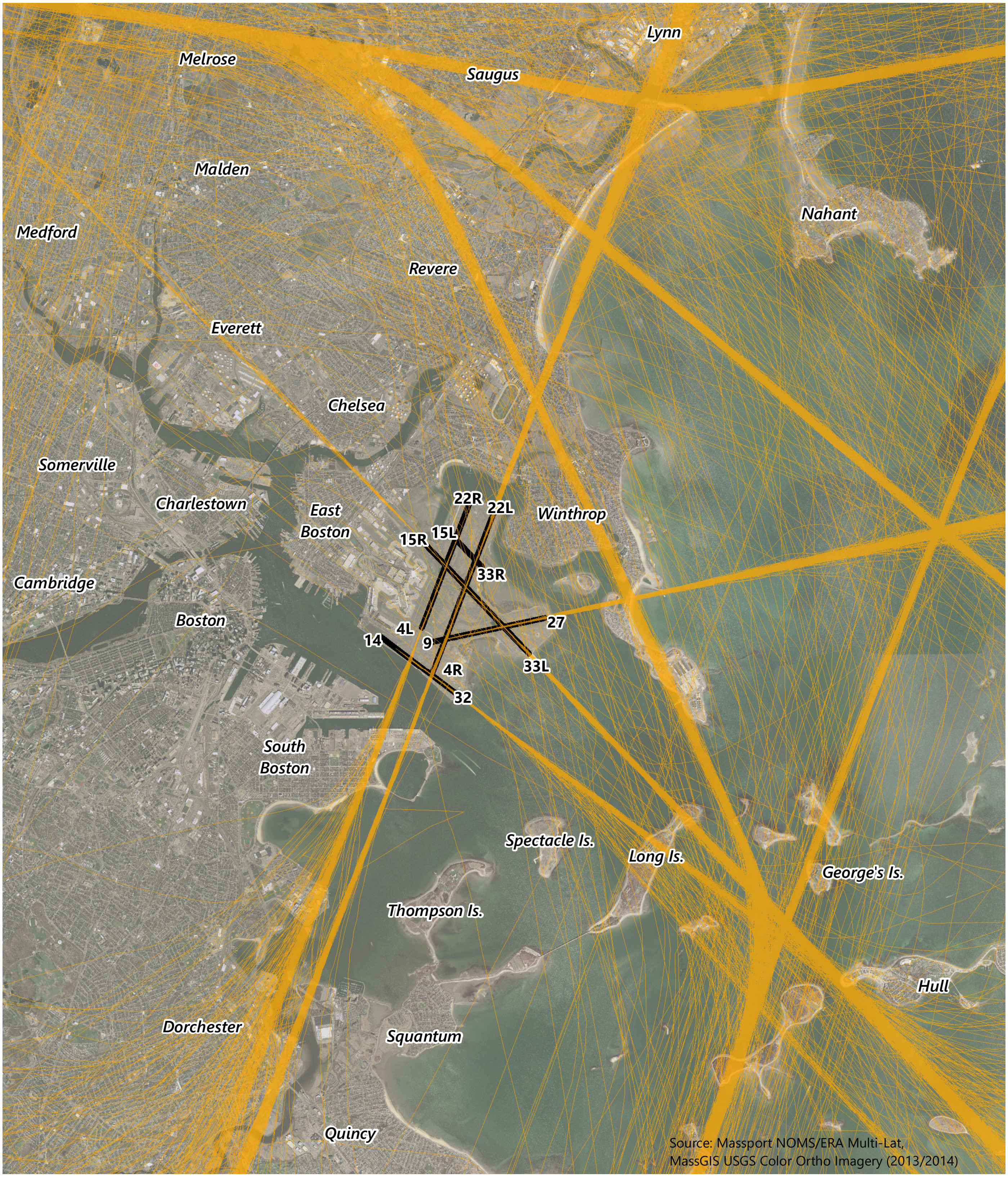


FIGURE 6-6 Regional Jet Arrival Flight Tracks

2016 Environmental Data Report

0 0.5 1 2 Miles

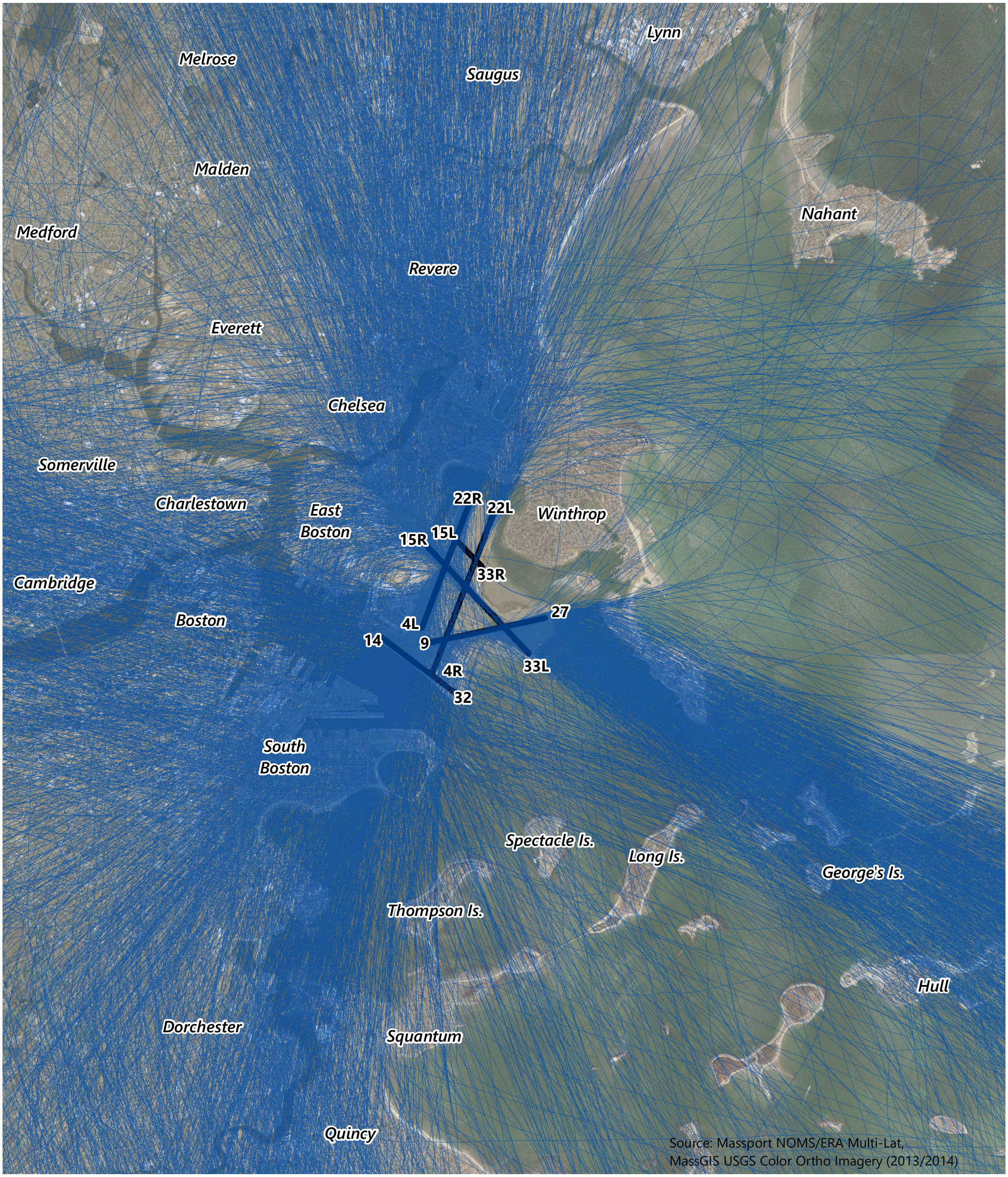


FIGURE 6-7 Non-Jet Departure Flight Tracks

2016 Environmental Data Report

Note: Non-jet tracks are non-RNAV.

0 0.5 1 2 Miles

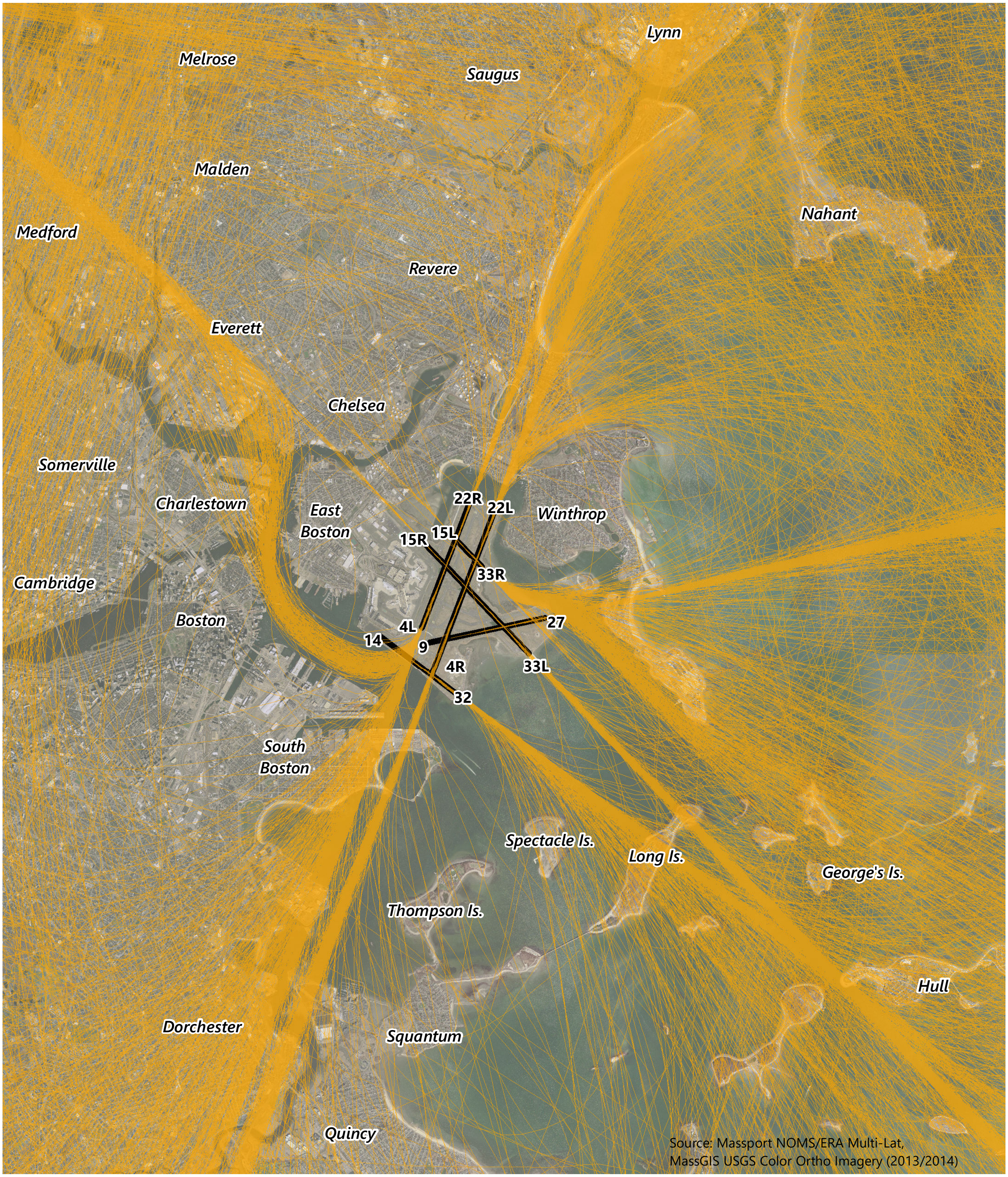
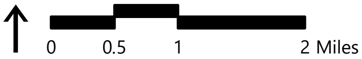


FIGURE 6-8 Non-Jet Arrival Flight Tracks | **2016 Environmental Data Report**

Note: Non-jet tracks are non-RNAV.



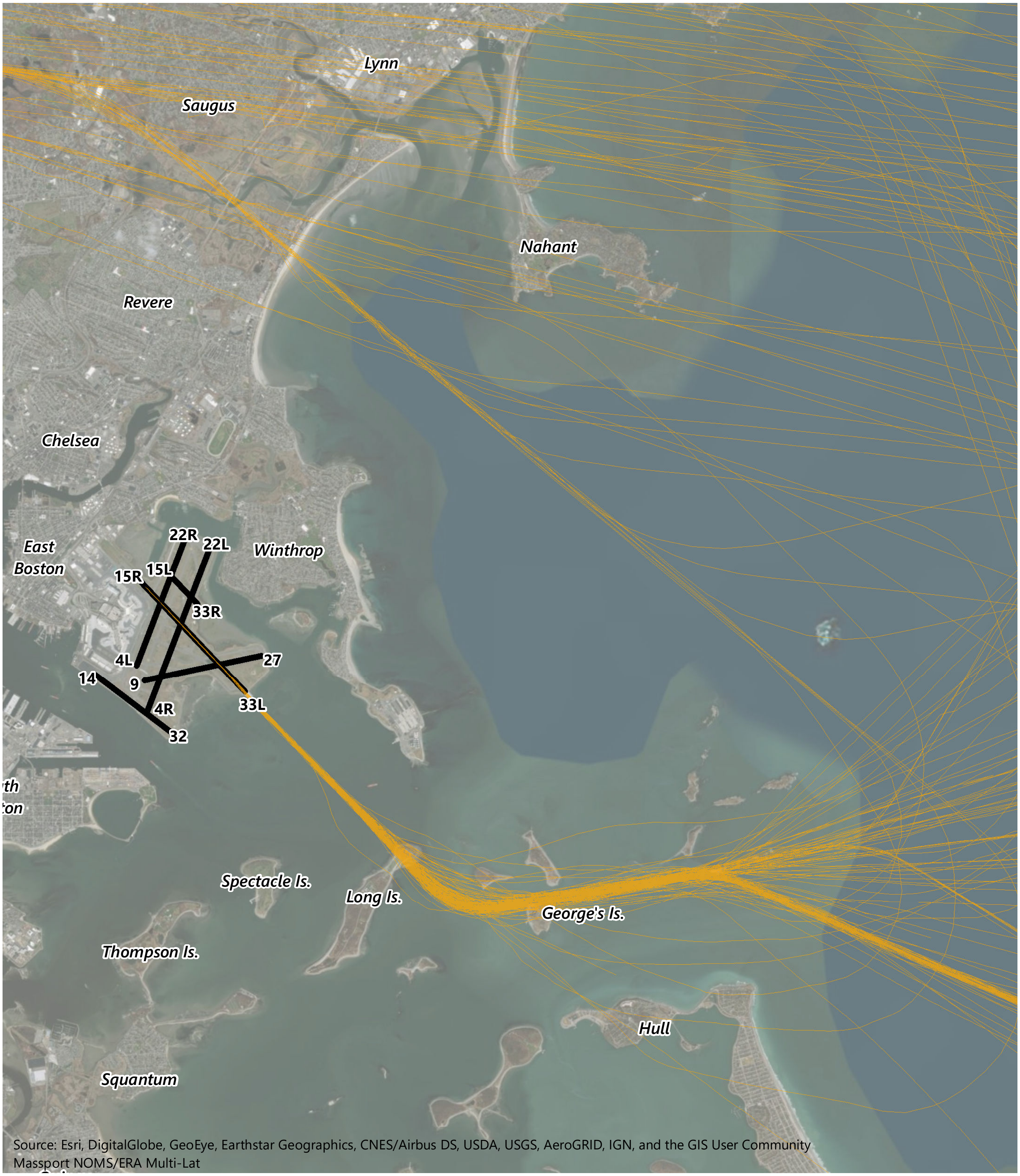


FIGURE 6-9 **Runway 33L Night (10PM - 7AM) Light Visual Approach Arrival Flight Tracks**

2016 Environmental Data Report

0 0.5 1 2 Miles

Noise Levels in 2016

The following section describes the results of noise modeling in AEDT for 2016. Population impacts are discussed and historical data are provided for context.

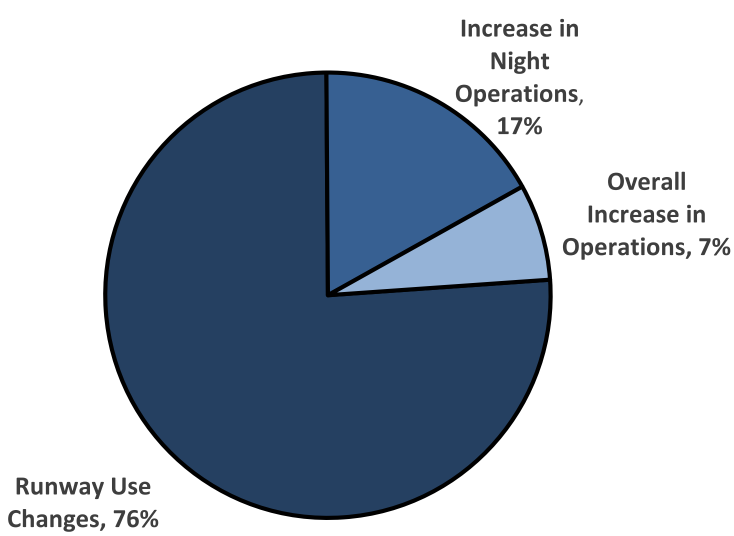
Day-Night Noise Contours for 2016

The 2016 DNL contours were prepared using the most recent version of FAA's INM model and the new AEDT model to demonstrate the effects of the difference between the two models. The differences between the AEDT noise contours for 2016 and the INM noise contours for 2015 can be attributed to a combination of changes in aircraft operations and differences in the noise model from 2015 to 2016. These are explained separately below.

Aircraft operation effects

Compared to 2015, aircraft operations at Logan Airport in 2016 were different in overall volume, proportion of nighttime operations, and runway use. **Figure 6-10** shows the relative influence of these factors on changes in the noise contour.

Figure 6-10 Reason for Changes in Number of People Exposed to DNL Values Greater than or Equal to 65 dB (2015 INM to 2016 INM)



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

Figure 6-11 shows DNL 65 dB contours for 2015 and 2016, both modeled with the legacy INM software. The Logan Airport-specific adjustments to INM have been applied for both years, so any differences shown in this figure are due to changes in aircraft operations.

The FAA-required RNAV was in place for the third full year in 2016. With the RNAV procedures fully in use between 2015 and 2016, the contour lobes remain concentrated and elongated, and the overall shape of the 2016 contours is very similar to 2015 conditions.

The overall increase in the size of the contour reflects the increase in operations from 2015 to 2016. Two other factors influencing the noise contours were (1) the month-long closure of Runway 4L-22R, which shifted operations to Runway 9-27 and Runway 15R-33L, and (2) an increase in nighttime operations (9.3 percent increase from 2015 to 2016 versus 4.9 percent increase for overall operations). The combination of runway use and nighttime operations closely matches the increases in the contour:

Modeling effects

As noted in the section *Noise Modeling Process*, the AEDT model does not include the Logan-specific custom adjustments that were developed for INM modeling. The largest effect of these adjustments in the INM modeling is due to the over-water adjustment, which applies to departing aircraft at low altitudes. Therefore, its greatest effect on the noise contours is seen near runway ends where aircraft ramp up to maximum thrust for takeoff (start-of-takeoff roll, or SOTR). A second adjustment is the use of custom altitude profiles, which has the greatest effect where aircraft are ascending or descending. A third adjustment is the hill effect correction, which raises noise levels in the Orient Heights section of East Boston.

Figure 6-12 shows the DNL 65 dB contours for 2016, modeled with INM and AEDT.

Figure 6-13 displays the complete DNL contour set for 2016, modeled in AEDT.

Figure 6-14 provides a comparison of the DNL 65 dB contour for 2016 (AEDT) to historical 1990 and 1998 DNL 65 dB contours.

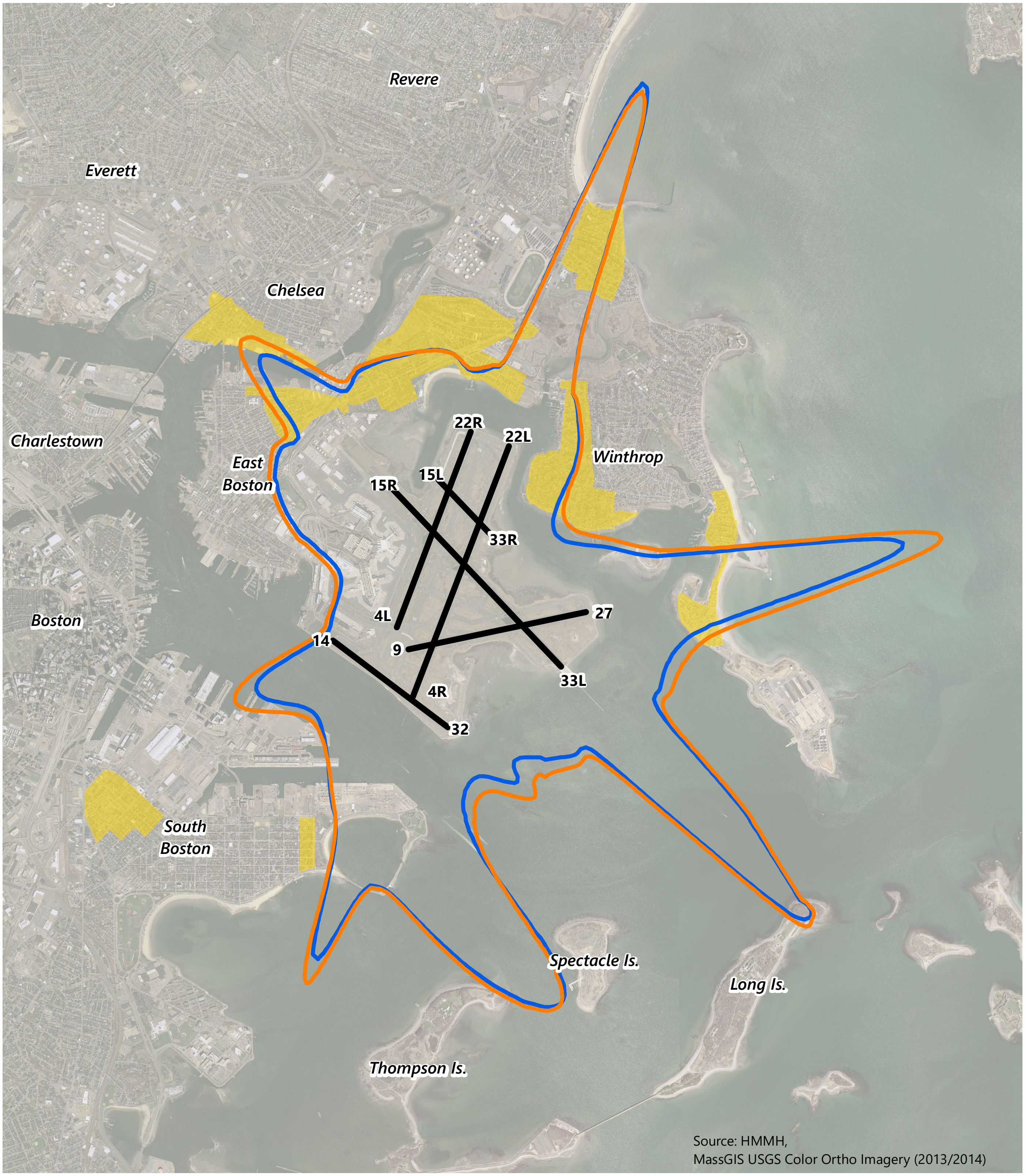


FIGURE 6-11 Comparison between 2015 (INM 7.0d) and 2016 (INM 7.0d) DNL 65 dB Contours

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2016 DNL Contour (INM 7.0d)
2015 DNL Contour (INM 7.0d)
Sound Insulation Areas

0 1750 3500 7000 Feet

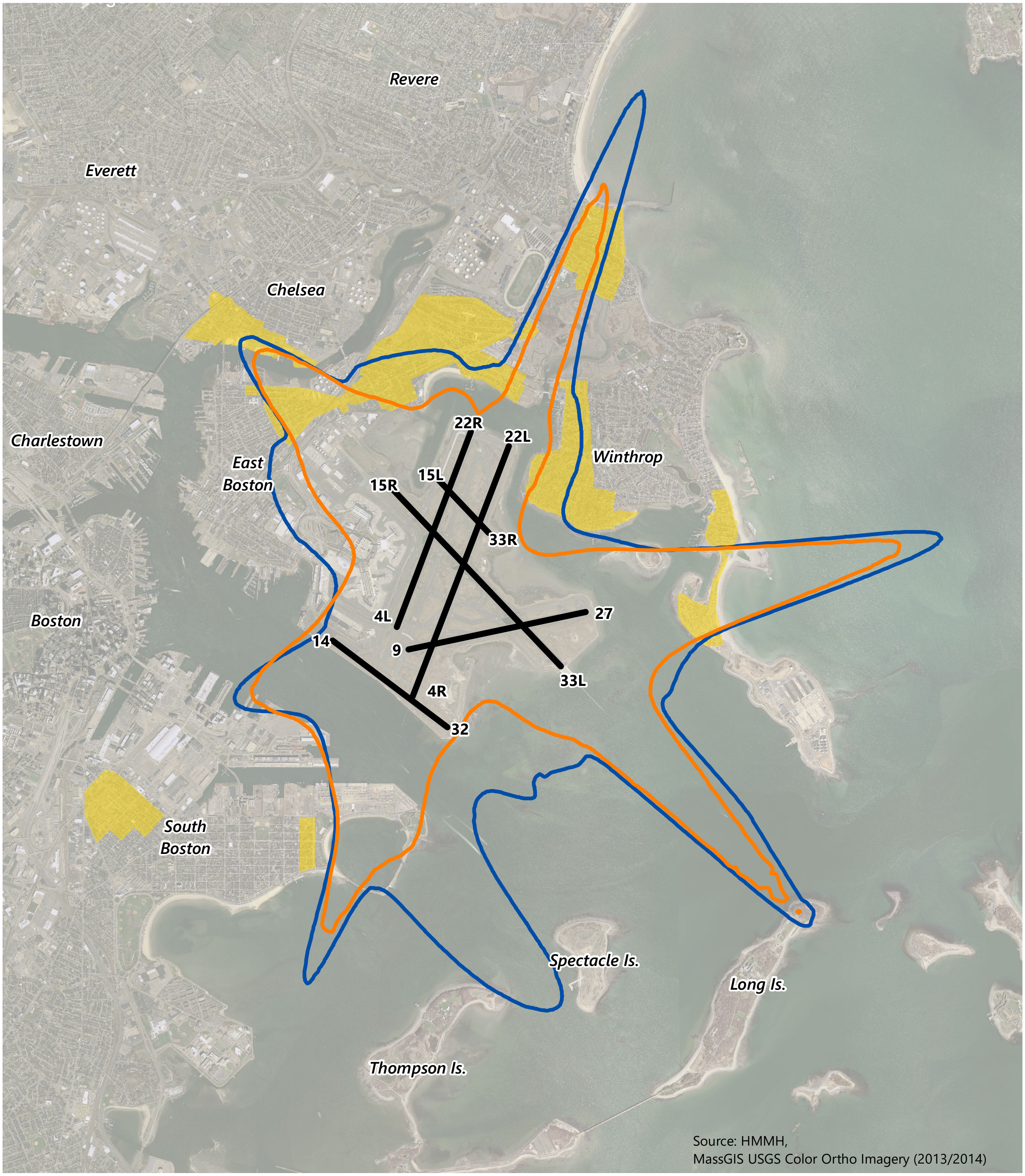


FIGURE 6-12 Comparison between 2016 (INM 7.0d) and 2016 (AEDT 2c) DNL 65 dB Contours

2016 Environmental Data Report

2016 DNL Contour (AEDT 2c)
2016 DNL Contour (INM 7.0d)
Sound Insulation Areas

0 1750 3500 7000 Feet

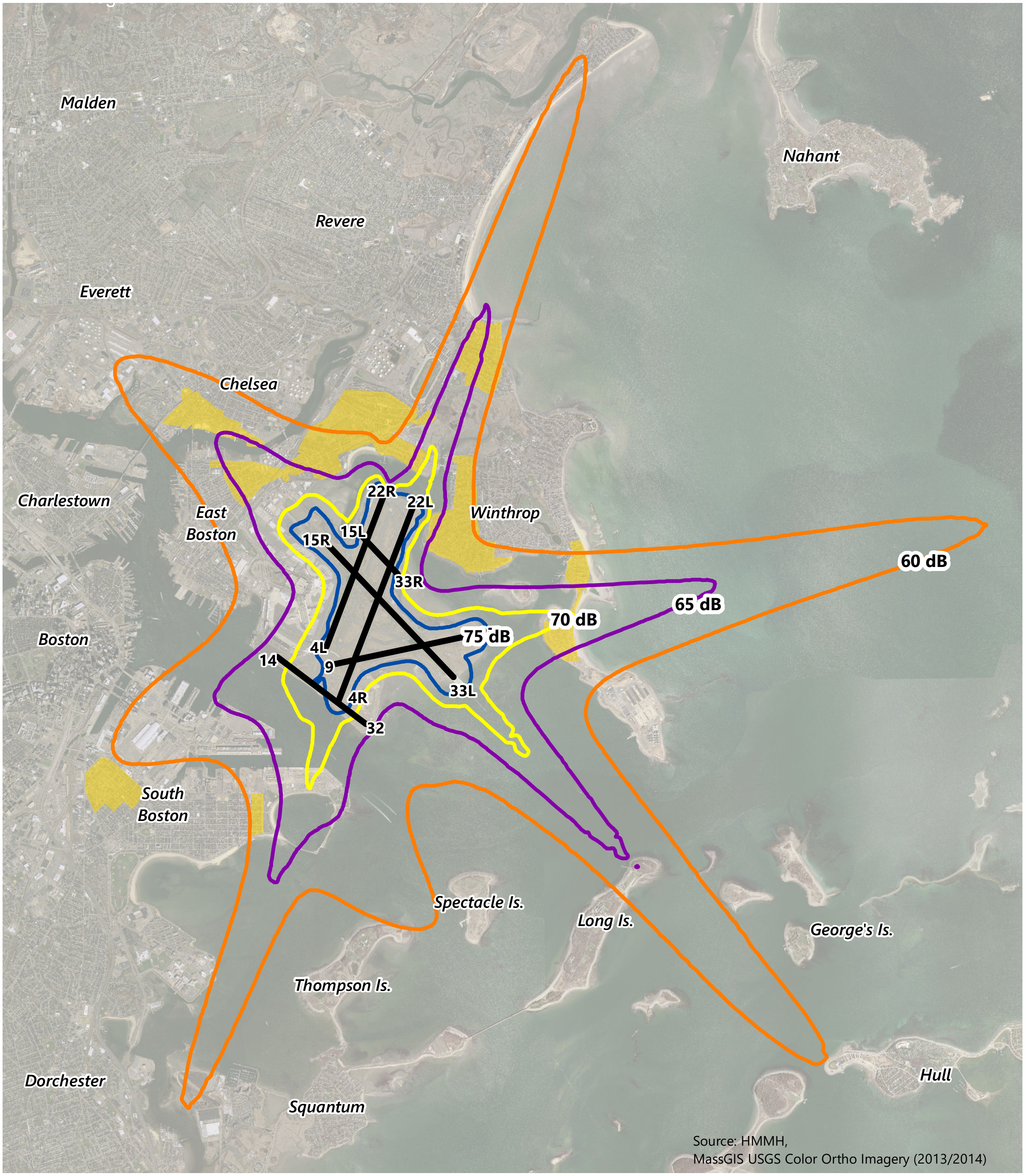
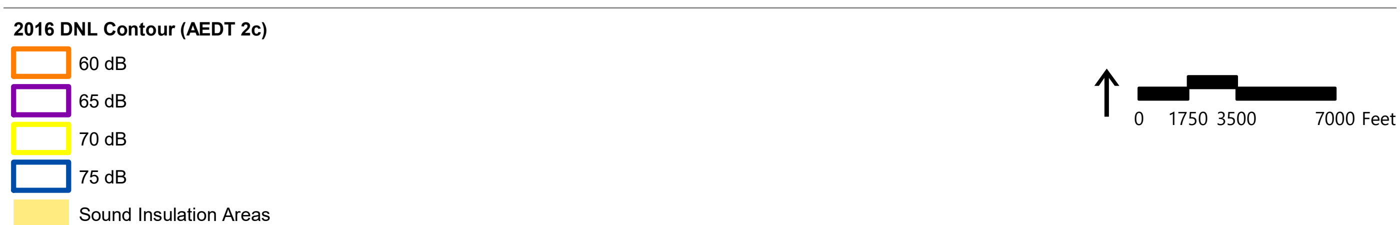


FIGURE 6-13 60-75 DNL Contours for 2016 Operations Using AEDT 2c



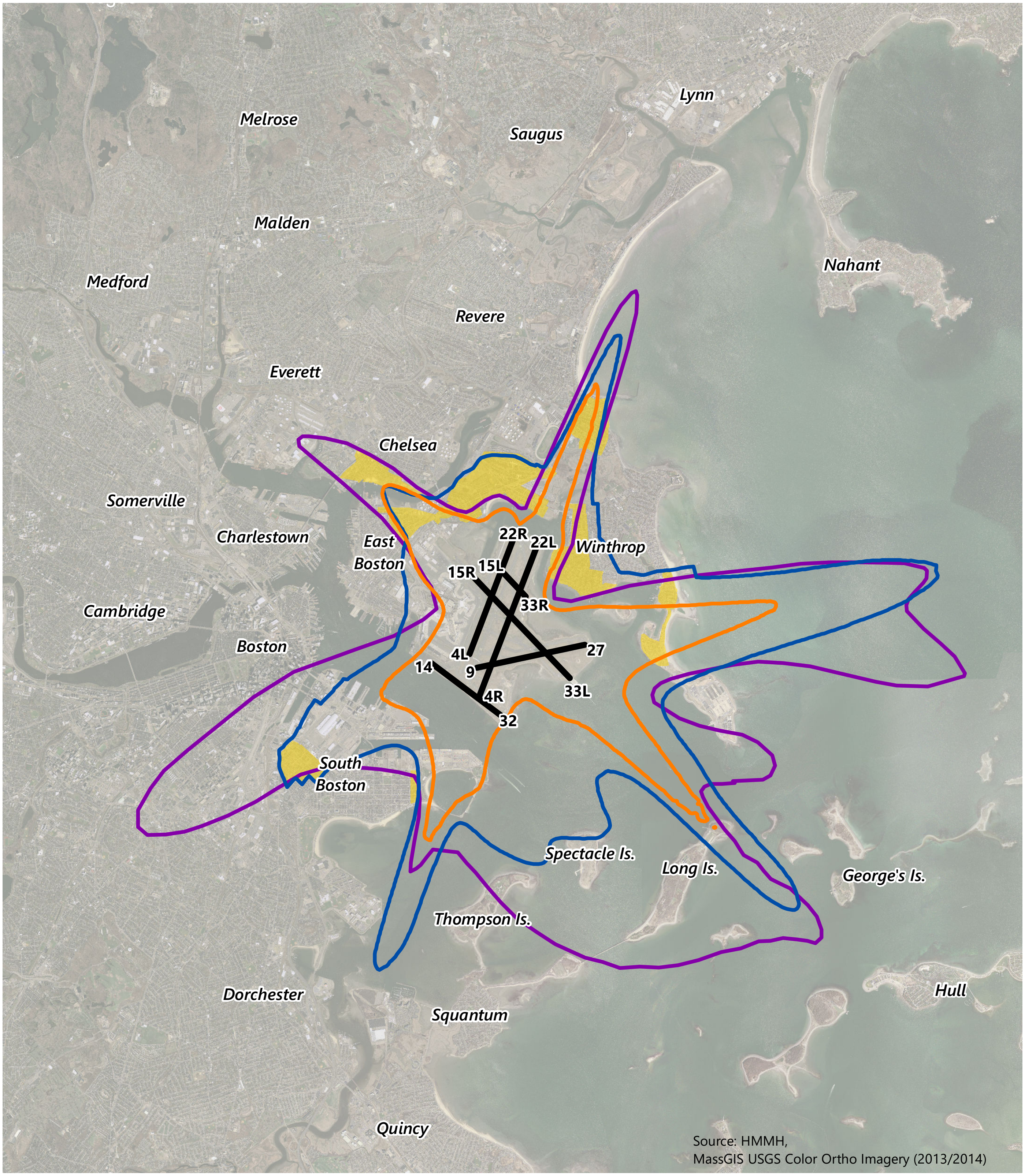


FIGURE 6-14 DNL 65 dB Contour Comparison with Historical Contour

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Population Impact Assessment

Population counts within selected 5 dB increments of exposure are reported each year to indicate how Logan Airport's noise environment changes over time. Population counts for 2016 are shown in **Table 6-6** by community and are compared to previous years. The 2010 U.S. Census data, previously reported in the *2010 EDR,* were used to determine population counts. Population counts from 2000 through 2009 are based on U.S. Census data for 2000. Appendix H, *Noise Abatement* presents counts for calendar year 2010 from both sets of Census data. The noise analysis is based upon the most recently FAA-approved INM and AEDT models (INM 7.0d and AEDT 2cSP2).

Both FAA and the U.S. Department of Housing and Urban Development consider DNL exposure levels above 65 dB to be incompatible with residential land use. **Table 6-6** compares impacted populations for each year. **Table 6-7** provides an additional breakdown of the estimated population in East Boston and South Boston residing within the DNL 65 dB contour.

Table 6-6 Noise-exposed Population by Community[1]

Boston[2]						Revere					
Year	Census	> 75 DNL	70-75 DNL	65[3]-70 DNL	Total (65+)[3] DNL	Year	Census	> 75 DNL	70-75 DNL	65[3]-70 DNL	Total (65+)[3] DNL
1990	1990	0	1,778	28,970	30,748	1990	1990	0	0	4,274	4,274
2000	2000	0	234	9,014	9,248	2000	2000	0	0	2,496	2,496
2010 (7.0b)	2010	0	0	689	689	2010 (7.0b)	2010	0	0	2,413	2,413
2011 (7.0c)	2010	0	0	331	331	2011 (7.0c)	2010	0	0	2,547	2,547
2012 (7.0c)	2010	0	0	439	439	2012 (7.0c)	2010	0	0	2,772	2,772
2012 (7.0d)	2010	0	0	421	421	2012 (7.0d)	2010	0	0	2,762	2,762
2013 (7.0d)	2010	0	0	612	612	2013 (7.0d)	2010	0	0	2,505	2,505
2014 (7.0d)	2010	0	34	4,151	4,185	2014 (7.0d)	2010	0	0	2,832	2,832
2015 (7.0d)	2010	0	110	7,255	7,365	2015 (7.0d)	2010	0	0	3,789	3,789
2016 (7.0d)	2010	0	110	9,674	9,784	2016 (7.0d)	2010	0	0	3,789	3,789
2016 (AEDT)	2010	0	0	4,031	4,031	2016 (AEDT)	2010	0	0	2,376	2,376

Table 6-6 Noise-exposed Population by Community[1] (Continued)

Chelsea

Year	Census	> 75 DNL	70-75 DNL	65[3]-70 DNL	Total (65+)[3] DNL
1990	1990	0	0	4,813	4,813
2000	2000	0	0	0	0
2010(7.0b)	2010	0	0	0	0
2011 (7.0c)	2010	0	0	0	0
2012 (7.0c)	2010	0	0	0	0
2012 (7.0d)	2010	0	0	0	0
2013 (7.0d)	2010	0	0	0	0
2014 (7.0d)	2010	0	0	0	0
2015 (7.0d)	2010	0	0	0	0
2016 (7.0d)	2010	0	0	120	120
2016 (AEDT)	2010	0	0	0	0

Winthrop

Year	Census	> 75 DNL	70-75 DNL	65[3]-70 DNL	Total (65+)[3] DNL
1990	1990	676	1,211	2,420	4,307
2000	2000	247	1,070	4,684	6,001
2010 (7.0b)	2010	0	130	598	728
2011 (7.0c)	2010	0	130	939	1,069
2012 (7.0d)	2010	0	200	1,325	1,525
2012 (7.0d)	2010	0	200	1,186	1,386
2013 (7.0d)	2010	0	130	1,060	1,190
2014 (7.0d)	2010	0	130	1,775	1,905
2015 (7.0d)	2010	0	320	2,623	2,943
2016 (7.0d)	2010	0	431	2,861	3,292
2016 (AEDT)	2010	0	130	913	1,043

Everett

Year	Census	> 75 DNL	70-75 DNL	65[3]-70 DNL	Total (65+)[3] DNL
1990	1980	0	0	0	0
2000	2000	0	0	0	0
2010 (7.0b)	2010	0	0	0	0
2011 (7.0c)	2010	0	0	0	0
2012 (7.0c)	2010	0	0	0	0
2012 (7.0d)	2010	0	0	0	0
2013 (7.0d)	2010	0	0	0	0
2014 (7.0d)	2010	0	0	0	0
2015 (7.0d)	2010	0	0	0	0
2016 (7.0d)	2010	0	0	0	0
2016 (AEDT)	2010	0	0	0	0

All Communities

Year	Census	> 75 DNL	70-75 DNL	65[3]-70 DNL	Total (65+)[3] DNL
1990	1980	676	2,989	40,477	44,142
2000	2000	247	1,304	16,194	17,745
2010 (7.0b)	2010	0	130	3,700	3,830
2011 (7.0c)	2010	0	130	3,817	3,947
2012 (7.0c)	2010	0	200	4,536	4,736
2012 (7.0d)	2010	0	200	4,369	4,569
2013 (7.0d)	2010	0	130	4,177	4,307
2014 (7.0d)	2010	0	164	8,758	8,922
2015 (7.0d)	2010	0	430	13,667	14,097
2016 (7.0d)	2010	0	541	16,444	16,985
2016 (AEDT)	2010	0	130	7,320	7,450

Source: Massport and HMMH, 2017.

Notes: Population counts for 2010 through 2016 are provided for the 2010 U.S. Census block data (as indicated).

1 Data for years prior to 2010 are available in Appendix H, *Noise Abatement*. 7.0b, 7.0c, and 7.0d refer to INMv7.0b, INMv7.0c, and INMv7.0d respectively. AEDT version 2cSP2 was used for 2016.

2 These values reflect the effect of the FAA-approved terrain adjustment in Orient Heights.

3 DNL 65 dB is the federally-defined noise criterion used as a guideline to identify when residential land use is considered incompatible with aircraft noise.

Table 6-7 Estimated Population within 65 dB[1] DNL Contour[2]

		Boston							
		East Boston	**South Boston**	**Total**	**Chelsea**	**Revere**	**Winthrop**	**Everett**	**Total**
1990	1980	NA	NA	30,748	4,813	4,274	4,307	0	44,142
2000	2000	8,979[3]	269	9,248[3]	0	2,496	6,001	0	17,745
2010 (INMv7.0b)	2010	689	0	689	0	2,413	728	0	3,830
2011 (INMv7.0c)	2010	331	0	331	0	2,574	1,069	0	3,947
2012 (INMv7.0c)	2010	439	0	439	0	2,772	1,525	0	4,736
2012 (INMv7.0d)	2010	421	0	421	0	2,762	1,386	0	4,569
2013 (INMv7.0d)	2010	612	0	612	0	2,505	1,190	0	4,307
2014 (INMv7.0d)	2010	4,185	0	4,185	0	2,832	1,905	0	8,922
2015 (INMv70.d)	2010	7,365	0	7,365	0	3,789	2,943	0	14,097
2015 (AEDT)[4]	2010	386	0	386	0	2,376	152	0	3,564
2016 (INMv7.0d)	2010	9,784	0	9,784	120	3,789	3,292	0	16,985
2016 (AEDT)	2010	4,031	0	4,031	0	2,376	1,043	0	7,450
Change from 2015 (INM) to 2016 (AEDT)		**(3,334)**	**0**	**(3,334)**	**0**	**(1,413)**	**(1,900)**	**0**	**(6,647)**
Change from 2015 (AEDT) to 2016 (AEDT)		**3,645**	**0**	**3,645**	**0**	**0**	**241**	**0**	**3,886**

Source: Massport and HMMH, 2017.

Notes: Population counts for 2000 are based on the 2000 U.S. Census block data and for 1990 from the 1980 U.S. Census block data. Population counts for 2010 through 2016 are provided for the 2010 U.S. Census block data (as indicated).
Changes in ( ) represent a decrease in estimated population.

1 DNL 65 dB is the federally-defined noise criterion used as a guideline to identify where residential land use is considered incompatible with aircraft noise.

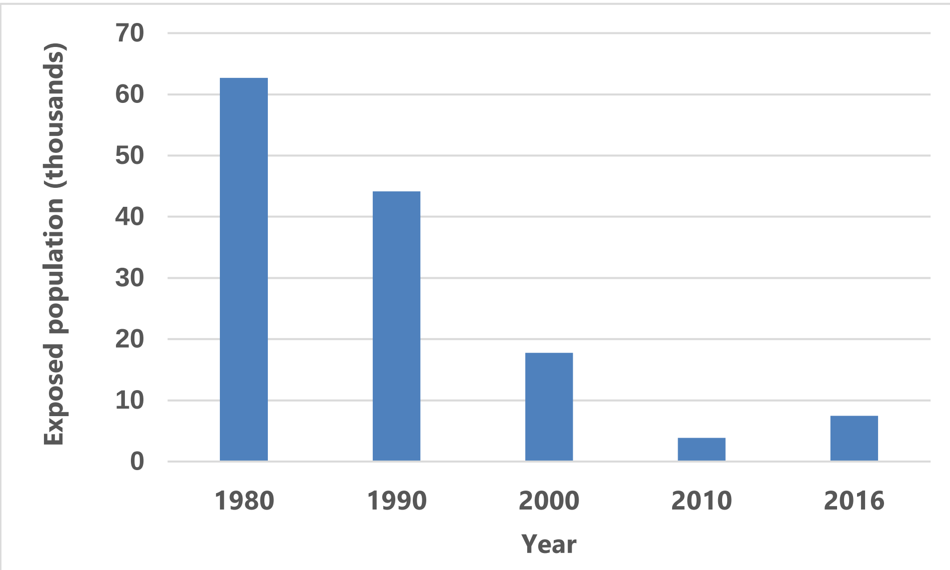
2 Data for years prior to 2010 are available in Appendix H, *Noise Abatement*.

3 These values reflect the effect of the FAA-approved terrain adjustment in Orient Heights.

4 Massport re-ran the *2015 EDR* contour in AEDT to use as a comparison in this table.

Figure 6-15 shows the long-term trend in population exposed to levels equal to or higher than DNL 65 dB since 1990.

Figure 6-15 DNL 65 dB Exposed Population Trend



Exposed populations vary depending on the model used. As discussed above in the previous section, *Day-Night Noise Contours for 2016*, adjustments implemented in INM are not yet available for AEDT, therefore the 2016 AEDT contours are smaller than the 2016 INM contours. Consequently, population calculations based on AEDT contours result in smaller exposed populations. The tables in this section provide population results for both models.

The discrepancies in population between the two models depend on two factors: (1) the size of the contours, and (2) the population in the areas where the contours differ. Referring to **Figure 6-12**, which shows the DNL 65 dB contours for the two models, there are two areas where the INM contour is significantly larger. One is offshore south of the Airport, where departures from Runway 22L turn to the southeast; however, this has no effect on population counts.

By contrast, the bulges in the INM contour near the Runway 15R and Runway 22L ends are largely over residential areas in East Boston and Winthrop. This results in a large discrepancy in impacted population between the two models.

2016 Affected Population (INM)

Comparing affected populations using INM for both 2015 and 2016 provides a clearer picture of how airport operations affected the community in 2016. The following discussion compares INM results for 2015 and 2016 (see **Tables 6-6 and 6-7**).

Due to the increase in operations in 2016 and changes in runway use, the total number of people exposed to DNL values equal to or greater than 65 dB increased to 16,985 people in 2016 from 14,097 people in 2015 (an increase of 2,888 people). The number of people residing within the DNL 70 dB contour increased from 430 people in 2015 to 541 people in 2016. The additional exposed population within the DNL 70 dB contour was exclusively in Winthrop. The 2016 INM levels remain below the number of people exposed in 2000 when 17,745 people were exposed to DNL noise levels equal to or greater than 65 dB and 1,551 people were exposed to DNL levels equal to or greater than 70 dB. All residences exposed to levels equal to or greater than the DNL 65 dB INM contour in 2016 have been eligible to participate in Massport's Residential Sound Insulation Program (RSIP) and to date residents that are qualified and have elected to participate in the program have been mitigated.

Due in part to the additional number of operations and an increase in departures from Runway 33L in 2016, East Boston had an increase in the number of people exposed to noise levels of DNL 65 dB or greater, from 7,365 in 2015 to 9,784 people in 2016. For historical context, 8,979 people were exposed to levels DNL 65 dB or greater in East Boston in 2000. Runway 33L operations also resulted in an exposed population of 120 in Chelsea for 2016, which in 2015 had no residents within the DNL 65 dB contour. The community with the second largest increase in exposed population is Winthrop, with 3,292 people within the DNL 65 dB contour for 2016, compared to 2,943 in 2015. This was primarily due to increased use of Runway 27 for departures and nighttime arrivals. Despite this increase, the exposed population in Winthrop is well below Year 2000's total of 6,001 people. In 2016, no people were exposed to DNL levels greater than 65 dB in South Boston. The number of people exposed in Revere was identical in 2015 and 2016, with 3,789 people within the DNL 65 dB contour (see **Table 6-6**).

As noted, the total population exposed to noise levels between DNL 70 to 75 dB increased in 2016 to 541 people compared to 430 people in 2015, which is less than levels from 2000. In 2016, there were no people exposed to levels higher than DNL 75 dB, unlike in 2000 when 247 people were exposed to levels higher than DNL 75 dB.

2016 Affected Population (AEDT)

As discussed in the previous section, *Day-night Contours for 2016*, the size of the 2016 AEDT contour is smaller than the 2016 INM contour due to adjustments used in the INM process for over-water effects, hill effects, and custom profiles for initial climb outs that were not approved by FAA for use in AEDT. The difference between INM and AEDT is particularly notable in the residential areas near the Runway 15R end, in East Boston, and the Runway 22R and 22L ends, affecting both East Boston and Winthrop. The extent of the contour peak in line with the Runway 22L end also shows a discrepancy between the two models, affecting the Revere neighborhood northeast of the Belle Isle Marsh Reservation.

As shown in **Table 6-7**, the population within the 2016 AEDT DNL 65 dB contour is 7,450, whereas the INM contour for 2016 surrounds a population of 16,985. Individual communities show a similar pattern, with exposed populations in East Boston of 4,031 (AEDT) versus 9,784 (INM), Revere with 2,376 (AEDT) versus 3,789 (INM), and Winthrop with 1,043 (AEDT) versus 3,292 (INM). Chelsea has no residents within the 2016 AEDT contour, whereas 120 are within the INM contour.

Comparing the population counts for 2016 (AEDT) with 2015 (INM), the 2016 numbers are lower, with 7,450 people within the DNL 65 dB contour for 2016, compared with 14,097 for 2015. The population within the DNL 70 dB contour fell from 430 in 2015 to 130 in 2016. For 2016, this population was exclusively in Winthrop, whereas in 2015 the 70-dB contour included residents of both Winthrop and East Boston.

Comparing Measured and Modeled Noise Levels

When changes in noise exposure are predicted through modeling, it is important to substantiate these modeled findings with actual noise measurements, such as those taken with Massport's permanent noise monitoring system. Massport's system continuously measures the noise levels at each of the 30 microphone locations around the Airport and environs, as shown in **Figure 6-16**. During normal operation, noise monitors at the microphone locations measure noise exposure levels as well as a variety of metrics associated with individual noise events that exceed preset threshold sound levels. Noise monitoring data are transmitted back to Massport's Noise Office, where daily DNL values and other noise metrics are computed for each location and summarized in various reports.

This *2016 EDR* compares the measured annual average DNL values from the monitors to AEDT-computed values of DNL at each of the specific noise monitor sites to check for reasonableness. Many sites produced small differences between measurements and predictions. However, results at more distant locations have often produced substantial differences of 10 dB or more, especially at measurement sites where DNL values were often less than 60 dB.

Differences between measured and modeled values have narrowed in recent years as both the noise monitoring and modeling processes have been refined. For 2016, these differences have increased moderately with the change to AEDT for modeling. As described in the section *Noise Modeling Overview* in this chapter, adjustments for over-water effects, hill effects, and custom altitude profiles, previously developed for modeling in INM, have not been implemented in the 2016 AEDT analysis. However, the overall difference between measured and modeled values remains small, with a difference in average values of DNL 3.1 dB, versus 2.6 dB for 2015 using the INM model.

FIGURE 6-16 Noise Monitor Locations

2016 Environmental Data Report

Permanent Noise Monitor

Airport Reference Point

0 17503500 7000 Feet

All sites have been verified by survey.
Locations not shown on map:
#19 Smith Lane, Swampscott
#20 Pond and Town Court, Lynn

Table 6-8 compares the measured 2015 DNL values to the measured 2016 DNL values at each location. In 2016, three locations had decreases of more than 2 dB while two had increases of more than 2 dB. The remaining 26 locations had changes in levels of less than 2 dB. The average measured value for 28 of the sites was 55.2 dB in 2016, unchanged from 2015. Sites 12 and 26 are excluded from the averages due to issues at each site. Site 12 was decommissioned in 2010 and will be relocated at a future date. Site 26 was damaged and unavailable for all of 2016, although it resumed operation in September 2017. To keep the sites used for the averages consistent between the two years, Sites 12 and 26 were excluded from the computations.

Several of the sites with the greatest variation from 2015 to 2016 were some of the most distant, for example Sites 18, 20, 27, and 28. Aircraft noise levels are lower at these sites, and therefore they can experience more variation due to local ambient noise from traffic, wind, etc. The large variation at Site 14 (decrease of 10 dB) is most likely due to external factors. This site was inactive for part of the year.

Noise level changes at various sites typically follow changes in runway use. With the one-month closure of Runway 4L-22R, traffic increased on Runway 9-27 and Runway 15R-33L. This can be seen in the Runway 33L departure RNAV route, which affects Sites 13, 15, 21, and 22, all of which experienced increases. Similarly, Site 5 in Winthrop experienced an increase due to increased arrivals and departures on Runway 27 and departures from Runway 9.

Distances reported in **Tables 6-8** and **6-9** are computed from the Airport Reference Point which is located along Runway 4L-22R near its intersection with Runway 15R-33L. This location is shown on **Figure 6-16**. The measured data are not used to calibrate the model but are shown here to compare to the modeled values and in general, they reveal similar trends.

Table 6-8 Measured Versus Measured - Comparison of Measured DNL Values From 2015 to 2016

Location	Site	Distance from Logan Airport (miles)	2015 Measured Aircraft (DNL)	2016 Measured Aircraft (DNL)	Difference 2016 minus 2015
South End – Andrews Street	1	3.7	56.0	57.5	1.5
South Boston – B and Bolton	2	2.9	57.9	59.3	1.4
South Boston – Day Blvd. near Farragut	3	2.5	59.2	58.5	(0.7)
Winthrop – Bayview and Grandview	4	1.6	71.0	67.1	(3.9)
Winthrop – Harborview and Faun Bar	5	1.9	63.4	64.1	0.7
Winthrop – Somerset near Johnson	6	0.8	64.0	64.6	0.6
Winthrop – Loring Road near Court	7	1.0	65.6	65.8	0.2
Winthrop – Morton and Amelia	8	1.6	59.2	59.6	0.4
East Boston – Bayswater near Annavoy	9	1.3	67.1	66.6	(0.5)
East Boston – Bayswater near Shawsheen	10	1.3	58.1	57.7	(0.4)
East Boston – Selma and Orient	11	1.8	55.1	55.7	0.6
East Boston Yacht Club	12	1.2	N/A	N/A	N/A
East Boston High School	13	1.9	61.7	63.3	1.6
East Boston – Jeffries Point Yacht Club	14	1.2	54.9	44.9	(10.0)
Chelsea – Admiral's Hill	15	2.8	61.3	61.5	0.2
Revere – Bradstreet and Sales	16	2.4	67.9	68.7	0.8
Revere – Carey Circle	17	5.3	60.4	60.4	0.0
Nahant – U.S.C.G. Recreational Facility	18	5.9	37.3	30.6	(6.7)
Swampscott – Smith Lane	19	8.7	40.4	39.5	(0.9)
Lynn – Pond and Towns Court	20	8.4	49.7	53.9	4.2
Everett – Tremont near Prescott	21	4.5	51.6	51.7	0.1
Medford – Magoun near Thatcher	22	6.0	52.0	53.5	1.5
Dorchester – Myrtlebank near Hilltop	23	6.3	55.4	56.2	0.8
Milton – Cunningham Park near Fullers	24	8.1	48.7	49.4	0.7
Quincy – Squaw Rock Park	25	4.2	42.0	41.1	(0.9)
Hull – Hull High School near Channel Street	26	6.0	59.8	N/A	N/A
Roxbury – Boston Latin Academy	27	5.3	54.3	56.2	1.9
Jamaica Plain – Southbourne Road	28	7.7	45.0	49.7	4.7
Mattapan – Lewenburg School	29	7.3	38.9	38.2	(0.7)
East Boston – Piers Park	30	1.5	47.9	49.8	1.9
Arithmetic Average			**55.2**	**55.2**	**0.0**

Source: HMMH, 2017.

Notes: Changes in ( ) represent a decrease in measured noise level.
Distance from Logan Airport calculated from the Airport Reference Point.
Sites 12 (East Boston Yacht Club) and 26 (Hull High School) are no longer operational. These sites are not included in the average values.

Table 6-9 compares the measured 2015 and 2016 DNL values at each measurement site to the modeled DNL values. The AEDT model was used to compute DNL noise levels at each noise monitoring site for 2016, and the 2015 values were computed using INM.

The average measured value for 28 of the sites is 55.2 dB in 2016 and the average modeled value is 58.2 dB in 2016 (Sites 12 and 26 are excluded from the averages due to issues at each site). The average of the difference between the measured versus modeled values for 2015 was 2.6 dB and 3.1 dB in 2016. In general, due to the modeled values being larger than the measured at most of the more distant monitors, the average difference will always be a positive value.

Using AEDT, Massport can compute the modeled DNL for the same periods for which the noise monitoring system was collecting data at each site. It is also able to capture runway use and airspace changes as they occur. The model, however, only computes noise from aircraft and while it includes terrain it does not include other factors such as local weather phenomena and the influence such as shielding from local buildings and trees.

As shown in **Table 6-9**, nine of the sites in 2016 have a difference between measured and modeled of 1 dB or less. In 2015 and 2016, for the majority of locations where modeled values exceed measured values, the measured levels are below DNL 60 dB. It is not unusual to experience differences between measured and modeled levels at the locations with lower measured DNL values. The monitor identification of aircraft noise events becomes more difficult, and long-distance effects can reduce levels that the model cannot duplicate. Differences at these sites farther from the Airport can easily increase the overall difference between measured and modeled results.

Table 6-9 Measured Versus Modeled - Comparison of Measured DNL Values to INM (2015) and AEDT (2016) modeled DNL Values

			2015		2016		2015	2016
Location	**Site**	**Distance from Logan Airport (miles)**	**Measured Aircraft – Only DNL**	**Modeled RC Results INMv7.0d (DNL)[1]**	**Measured Aircraft – Only DNL**	**Modeled RC Results AEDT (DNL)[1]**	**Difference Modeled minus Measured**	
South End – Andrews Street	1	3.7	56	54.2	57.5	55.9	(1.8)	(1.6)
South Boston – B and Bolton	2	2.9	57.9	59.1	59.3	59.7	1.2	0.4
South Boston – Day Blvd. near Farragut	3	2.5	59.2	60.5	58.5	60.7	1.3	2.2
Winthrop – Bayview and Grandview	4	1.6	71	72.1	67.1	71.8	1.1	4.7
Winthrop – Harborview and Faun Bar	5	1.9	63.4	63.5	64.1	64.6	0.1	0.5
Winthrop – Somerset near Johnson	6	0.8	64	64.1	64.6	61.9	0.1	(2.7)
Winthrop – Loring Road near Court	7	1.0	65.6	72.5	65.8	67.0	6.9	1.2
Winthrop – Morton and Amelia	8	1.6	59.2	63.9	59.6	61.3	4.7	1.7
East Boston – Bayswater near Annavoy	9	1.3	67.1	72.4	66.6	67.9	5.3	1.3
East Boston – Bayswater near Shawsheen	10	1.3	58.1	65.2	57.7	62.3	7.1	4.6
East Boston – Selma and Orient[2]	11[2]	1.8	55.1	57.8	55.7	57.3	2.7	1.6
East Boston Yacht Club	12	1.2		70.3		65.3		
East Boston High School	13	1.9	61.7	62.6	63.3	64.5	0.9	1.2
East Boston – Jeffries Point Yacht Club	14	1.2	54.9	57.2	44.9	61.0	2.3	16.1
Chelsea – Admiral's Hill	15	2.8	61.3	61.2	61.5	61.6	(0.1)	0.1
Revere – Bradstreet and Sales	16	2.4	67.9	68.7	68.7	67.7	0.8	(1.0)
Revere – Carey Circle	17	5.3	60.4	60.5	60.4	59.7	0.1	(0.7)
Nahant – U.S.C.G. Recreational Facility	18	5.9	37.3	44.9	30.6	46.1	7.6	15.5

Table 6-9 Measured Versus Modeled - Comparison of Measured DNL Values to INM (2015) and AEDT (2016) modeled DNL Values (Continued)

			2015		2016		2015	2016
Location	**Site**	**Distance from Logan Airport (miles)**	**Measured Aircraft – Only DNL**	**Modeled RC Results INMv7.0d (DNL)[1]**	**Measured Aircraft – Only DNL**	**Modeled RC Results AEDT (DNL)[1]**	**Difference Modeled minus Measured**	
Swampscott – Smith Lane	19	8.7	40.4	45.3	39.5	45.9	4.9	6.4
Lynn – Pond and Towns Court	20	8.4	49.7	55.1	53.9	54.8	5.4	0.9
Everett – Tremont near Prescott	21	4.5	51.6	53.9	51.7	54.5	2.3	2.8
Medford – Magoun near Thatcher	22	6.0	52.0	52.5	53.5	53.8	0.5	0.3
Dorchester – Myrtlebank near Hilltop	23	6.3	55.4	54.4	56.2	54.7	(1.0)	(1.5)
Milton – Cunningham Park near Fullers	24	8.1	48.7	54.0	49.4	54.2	5.3	4.8
Quincy – Squaw Rock Park	25	4.2	42.0	47.8	41.1	49.5	5.8	8.4
Hull – Hull High School near Channel Street	26	6.0	59.8	58.8		59.3	(1.0)	
Roxbury – Boston Latin Academy	27	5.3	54.3	53.4	56.2	54.5	(0.9)	(1.7)
Jamaica Plain – Southbourne Road	28	7.7	45.0	49.5	49.7	51.2	4.5	1.5
Mattapan – Lewenburg School	29	7.3	38.9	46.6	38.2	48.2	7.7	10.0
East Boston – Piers Park	30	1.5	47.9	54.8	49.8	58.3	6.9	8.5
Arithmetic Average [3]			**55.6**	**58.3**	**55.2**	**58.2**	**2.6**	**3.1**

Source: HMMH, 2017.
Note: 2015 and 2016 Modeled results were computed for the whole year.
Distance from Logan Airport calculated from the Airport Reference Point.
1 INMv7.0d with adjusted database. (Database modifications as described in the *Logan Airport 1994/1995 Generic Environmental Impact Report*.)
2 Includes FAA-approved terrain adjustment modifying normal INMv7.0d result for Site 11.
3 Sites 12 and 26 are not included in the average values.

Supplemental Metrics

To further describe the noise environment, this *2016 EDR* includes supplemental noise metrics: cumulative noise index (CNI), dwell and persistence, and times above a noise threshold.

Cumulative Noise Index

Massport reports total annual fleet noise at Logan Airport, as defined in the Logan Airport Noise Rules by a metric referred to as CNI. CNI is a single number representing the sum of the entire set of single-event noise energy from each operation experienced at Logan Airport over a full year of operation. CNI is weighted similarly to DNL so that activity occurring at night is penalized by adding an extra 10 dB to each modeled event. This penalty is equivalent to multiplying the number of nighttime events of each aircraft by a factor of 10.

The Logan Airport Noise Rules define CNI in units of EPNdB[21] and require that the index be computed for the fleet of commercial aircraft operating at Logan Airport throughout the year. In addition, in EDRs and ESPRs, Massport reports partial CNI values of noise at Logan Airport, so that various subsets of the fleet (cargo, night operations, passenger jets, etc.) are identified. Using the expanded data available from the NOMS, all available aircraft registration data were used to select the proper noise certification levels from the latest aircraft noise registration database.[22]

The Noise Rules, adopted by Massport following public hearings held in February 1986, established a CNI limit of 156.5 EPNdB. The CNI generally has decreased since 1990, remaining below that cap, and typical changes from one year to the next have been within a few tenths of a decibel. Since its 2010 minimum of 151.9 dB, the CNI has increased only moderately, and has decreased in each of the past two years. In 2016, the CNI decreased by 0.1 dB to 152.6 EPNdB, remaining well below the cap of 156.5 EPNdB. This decrease for 2016 occurred even though operational levels and night operations increased. This is the result of using quieter aircraft in 2016. The partial CNI was lower or unchanged across all categories for 2016 when compared to 2015, with the exception of a 0.1 dB increase in the category of Nighttime Passenger operations.

Partial Cumulative Noise Index Calculations

Partial CNI values were obtained by summing the noise from particular segments of Logan Airport's total operations. They are useful for identifying the greatest contributors to overall noise. As shown in **Table 6-10**, the sectors of the fleet with the highest numbers of partial CNI indicate a greater contribution to total noise. **Table 6-10** also indicates that for 2016:

- The passenger jets' contribution was unchanged in 2016 despite increased operations.
- While the daytime CNI contribution decreased, the nighttime CNI was unchanged. This is due to a combination of an increase in from passenger contribution offset by a decrease in cargo contribution.

21 EPNdB is the noise metric used to certify aircraft by FAA.

22 Type-certificate data sheet for noise database available from the European Aviation Safety Agency; http://www.easa.europa.eu/document-library/noise-type-certificates-approved-noise-levels.

Table 6-10 Cumulative Noise Index (EPNdB)[1]

Logan Airport CNI Cap – 156.5 EPNdB						
Full CNI (Entire Commercial Jet Fleet)	**1990**	**2000**	**2010**	**2015**	**2016**	**Change (2015-2016)**
	156.4	**154.7**	**151.9**	**152.7**	**152.6**	**(0.1)**
Total Passenger Jets	155.2	153.6	150.9	152.0	152.0	0.0
Total Cargo Jets	150.1	148.2	145.1	144.2	143.8	(0.4)
Total Daytime	152.5	149.5	146.8	147.2	147.0	(0.2)
Total Nighttime	154.4	153.1	150.3	151.2	151.2	0.0
Total Stage 2 Jets	N/A	124.7	113.6	N/A	N/A	N/A
Total Stage 3 Jets	N/A	154.7	151.9	152.7	152.6	(0.1)
Daytime Stage 2	N/A	122.6	103.6	N/A	N/A	N/A
Nighttime Stage 2	N/A	120.5	113.1	N/A	N/A	N/A
Daytime Stage 3	N/A	149.5	146.8	147.2	147.0	(0.2)
Nighttime Stage 3	N/A	153.1	150.3	151.2	151.2	0.0
Passenger Jet Stage 2	N/A	124.2	N/A	N/A	N/A	N/A
Passenger Jet Stage 3	N/A	153.6	150.9	152.0	152.0	0.0
Cargo Jet Stage 2	N/A	114.8	113.6	N/A	N/A	N/A
Cargo Jet Stage 3	N/A	148.2	145.1	144.2	143.8	(0.4)
Daytime Passenger	N/A	149.3	146.6	147.0	146.8	(0.2)
Nighttime Passenger	N/A	151.6	149.0	150.3	150.4	0.1
Daytime Cargo	137.1	137.5	134.5	134.4	133.8	(0.6)
Nighttime Cargo	149.9	147.8	144.7	143.7	143.4	(0.3)
Daytime Passenger Stage 2	N/A	122.3	N/A	N/A	N/A	N/A
Daytime Passenger Stage 3	N/A	149.2	146.6	147.0	146.8	(0.2)
Nighttime Passenger Stage 2	N/A	119.8	N/A	N/A	N/A	N/A
Nighttime Passenger Stage 3	N/A	151.6	149.0	150.3	150.4	0.1
Daytime Cargo Stage 2	N/A	111.1	103.6	N/A	N/A	N/A
Daytime Cargo Stage 3	N/A	137.5	134.4	134.4	133.8	(0.6)
Nighttime Cargo Stage 2	N/A	112.3	113.1	N/A	N/A	N/A
Nighttime Cargo Stage 3	N/A	147.8	144.7	143.7	143.4	(0.3)

Source: HMMH, 2017.
Notes: General aviation and non-jet aircraft are not included in the calculation.
N/A Not available.
1 Data for years prior to 2014 are available in Appendix H, *Noise Abatement*.

Table 6-11 provides the number of flight operations, the resulting CNI by airline for 2015 and 2016, and the partial CNI per operation for 2015 and 2016. The table shows the relative contribution of each airline to total CNI and reflects the contributions of individual aircraft noise levels and the frequency with which they occur. The table is sorted by the partial CNI per operation for 2016 and shows a mix of international carriers and cargo operators at the top of this list. This is due to the higher proportion of nighttime operations among these carriers, as well as the operation of larger and/or older aircraft. JetBlue Airways, with the largest number of operations, has the highest CNI per airline at 146.1 EPNdB in 2015 and 146.4 EPNdB in 2016, but its partial CNI by operation is well below the other major airlines in part due to its use of newer, quieter aircraft. FedEx has less than one twentieth of the operations of JetBlue Airways but its total CNI per airline is 142.9 EPNdB in 2015 and 142.3 EPNdB in 2016, only 4 dB below JetBlue Airways. The partial CNI by operation for FedEx is among the highest of all airlines due to its use of older DC10 and MD11 aircraft and operations at night. These are the primary aircraft in the FedEx fleet and account for half of its nighttime operations. The noisier signatures of these aircraft combined with the 10-dB nighttime DNL penalty results in the proportionally larger FedEx contribution to the CNI.

Regional carriers generally contribute the least to the partial CNI per operation whereas the international carriers, which operate larger aircraft and generally have more operations at night, are just below the cargo operators in rank. The relative positions for the domestic carriers are due mainly to their fleet characteristics and number of night operations. Southwest Airlines has over 10,000 fewer operations than Delta Air Lines and many fewer than JetBlue Airways; however, 21.0 percent of its operations are at night as compared to JetBlue Airways, which had only 15.5 percent at night. Delta Air Lines only has 14.8 percent of its operations at night but it flies an older and larger fleet consisting of MD-80s and Boeing 767s.

Table 6-11 Annual Operations by Partial CNI by Airline and per Operation, 2015 and 2016

Airlines with more than 100 flights in 2016	Operations	Total Airline CNI (EPNdB)	Operations	Total Airline CNI (EPNdB)	Partial CNI (EPNdB) per Operation		Airline Category
	2015	2015	2016	2016	2015	2016	
El Al Israel Airlines Ltd.	152	129.2	296	132.1	107.3	107.3	International
FedEx	3,523	142.9	3,896	142.3	107.4	106.4	Cargo
Cathay Pacific	279	130.0	454	132.1	105.6	105.5	International
United Parcel Service	1,538	137.5	1,834	138.0	105.7	105.3	Cargo
British Airways	2,575	138.7	2,702	139.0	104.6	104.6	International
Lufthansa	1,687	134.5	1,728	134.7	102.2	102.3	International
ATI	302	126.0	502	128.0	101.2	101.0	Cargo
Turkish Airlines	726	131.0	658	129.2	102.4	101.0	International
Emirates Airlines	914	131.1	1,382	132.0	101.4	100.6	International
Alitalia	562	127.9	558	128.0	100.4	100.5	International
Sun Country Airlines	1,414	130.7	1,374	131.1	99.2	99.7	Regional

Table 6-11 Annual Operations and Partial CNI by Airline and per Operation, 2015 and 2016 (Continued)

Airlines with more than 100 flights in 2016	Operations	Total Airline CNI (EPNdB)	Operations	Total Airline CNI (EPNdB)	Partial CNI (EPNdB) per Operation		Airline Category
	2015	2015	2016	2016	2015	2016	
Virgin Atlantic	702	130.5	715	128.0	102.0	99.5	International
SATA Int'l Airlines	542	127.4	630	127.1	100.0	99.1	International
Southwest Airlines	21,514	142.5	24,436	142.9	99.1	99.0	Domestic
United Airlines	24,644	142.7	25,052	143.0	98.7	99.0	Domestic
Qatar Airways	N/A	N/A	552	126.4	N/A	99.0	International
Air France	910	131.2	900	128.2	101.6	98.6	International
Alaska Airlines	3,027	133.4	3,256	133.7	98.6	98.5	Domestic
Swiss Air	711	127.8	1,020	128.5	99.3	98.4	International
Norwegian Air Shuttle	N/A	N/A	656	125.9	N/A	97.7	International
Virgin America	3,426	133.1	3,724	133.3	97.8	97.6	Domestic
Air Berlin	N/A	N/A	192	120.1	N/A	97.3	International
Japan Airlines	728	125.6	736	125.7	96.9	97.1	International
Delta Air Lines	33,909	142.1	33,935	142.4	96.8	97.0	Domestic
Iberia Air Lines	336	122.2	412	123.2	97.0	97.0	International
TAP - Air Portugal	N/A	N/A	378	122.7	N/A	96.9	International
JetBlue Airways	85,852	146.1	91,736	146.4	96.7	96.8	Domestic
Spirit Airlines	4,896	133.0	7,245	134.5	96.1	95.9	Domestic
Aer Lingus	1,973	129.9	2,066	129.0	97.0	95.8	International
Aeromexico	345	118.5	580	123.2	93.1	95.5	International
Sky Regional Airlines	3,784	128.8	2,738	129.8	93.0	95.4	International
American Airlines	48,355	144.1	55,782	142.6	97.2	95.1	Domestic
Icelandair	1,365	124.8	1,358	126.5	93.5	95.1	International
Shuttle America Corp	5,290	130.8	6,546	133.0	93.6	94.9	Regional
Air Canada	1,718	129.5	2,713	128.9	97.1	94.6	International
US Airways Express	4,669	129.0	1,458	125.8	92.3	94.2	Regional
GoJet Airlines	1,309	123.3	2,783	128.3	92.2	93.9	Domestic
Compañía Panameña	646	121.9	638	121.8	93.8	93.8	International
Hainan Airlines Co. Ltd.	744	125.7	961	123.2	97.0	93.4	International
Scandinavian Airlines	N/A	N/A	500	120.4	N/A	93.4	International

Table 6-11 Annual Operations and Partial CNI by Airline and per Operation, 2015 and 2016 (Continued)

Airlines with more than 100 flights in 2016	Operations	Total Airline CNI (EPNdB)	Operations	Total Airline CNI (EPNdB)	Partial CNI (EPNdB) per Operation		Airline Category
	2015	2015	2016	2016	2015	2016	
Endeavor Air	N/A	N/A	1,377	123.7	N/A	92.3	Domestic
Pinnacle Airlines	7,284	131.2	6,260	130.1	92.5	92.2	Regional
AWAC - US Air Express	4,998	128.7	5,010	128.1	91.7	91.1	Regional
Mesa Airlines	437	120.0	486	117.3	93.5	90.5	Regional
Delta Connection	4,923	127.1	4,032	126.3	90.1	90.3	Domestic
Air Canada Jazz	5,037	127.1	5,832	127.4	90.0	89.7	Regional
SkyWest Airlines	548	119.5	108	108.8	92.2	88.4	Domestic
WOW Air, LLC.	445	118.7	678	116.4	92.3	88.1	International

Source: Massport and HMMH, 2017.
Notes:
N/A Not available; Airline had no operations at Logan Airport.
1 Operations for some carriers differ to those in Chapter 2, *Activity Levels* and Chapter 7, *Air Quality/Emissions Reduction* because this table only includes jet aircraft and not turboprops, and because it includes both scheduled and unscheduled air carriers.

Dwell and Persistence Reduction Goals

Another supplemental measure of noise impact relates to the length of time noise impacts occur. To provide temporary relief to neighborhoods affected by regular overflights during single or multi-day periods, the PRAS Advisory Committee established two short-term goals for the system in addition to the annual goals:

- Provide relief from excessive dwell. Exceedance is defined as more than seven hours of operations over a given area during any day between the hours of 7:00 AM and midnight.
- Provide relief from excessive persistence. Exceedance is defined as more than 23 hours of operations over an area between 7:00 AM and midnight during a period of three consecutive days.

In contrast to the annual goals that count the number of equivalent operations on a runway, dwell and persistence are measured by the number of hours that a given location or area is subject to jet aircraft overflights. The PRAS Advisory Committee designated eight runway end combinations for computing the effects of dwell and persistence on the communities, as shown in **Table 6-12**.

Table 6-12 Representative Neighborhoods near Logan Airport Affected by Runway Use

Runway	Representative Affected Neighborhoods
4L and 4R Arrivals	South Boston (Farragut St.), Dorchester, Quincy, Milton, Weymouth, and Braintree
32 and 33L Arrivals	Boston Harbor, Hull, Cohasset, Hingham, Scituate, and other South Shore locations
14 and 15R Departures	Boston Harbor, Hull, Cohasset, Hingham, Scituate, and other South Shore locations
22L and 22R Departures	South Boston (Farragut Street), Boston Harbor, Hull, Cohasset, Hingham, Scituate, and other South Shore locations
27 Departures	South Boston (Fan Pier), Roxbury, Jamaica Plain, South End, West Roxbury, Roslindale, Brookline, Hyde Park, and other points South and West
4L and 4R Departures plus 22L and 22R Arrivals	East Boston (Bayswater, Orient Heights), Winthrop (Court Road), Revere, and Nahant
9 Departures plus 27 Arrivals	Winthrop (Point Shirley), Boston Harbor, and other points North
33 Departures plus 15 Arrivals	East Boston (Eagle Hill), Chelsea, Everett, Medford, Somerville, Arlington, Cambridge, and other points South and West

Source: Massport.

As required by Massport's commitments for the Logan Airside Improvements Planning Project,[23] this *2016 EDR* reports on noise dwell and persistence levels. Higher levels of dwell or persistence for over-water areas represent a benefit since this produces a corresponding decrease in total hours over populated areas. **Figures 6-17** and **6-18** illustrate the annual hours of dwell and persistence by runway end for 2010 through 2016. The Runway 33L Safety Area Improvement project construction, which altered annual runway use during 2011 and 2012, is evident in the figures as those two years are lower in the arrivals to Runway 15R and departures from Runway 33L runway end and higher in most of the remaining runway ends. Use of the runways returned to pre-construction levels in 2013.

The most marked difference in both metrics was the decrease in hours of Runway 27 arrivals and Runway 9 Departures, which no longer dominate the statistics as they have in most years. Another notable feature is the decrease in hours of Runway 22R/L arrivals and Runway 4R/L departures, returning to approximately their 2014 levels after a spike in 2015.

Increases are evident in operations involving Runways 14, 15R/L, and 33R/L, rising from very low levels to hours that are more in balance with other operations.

23 Federal Aviation Administration. 2002. *Logan Airside Improvements Planning Project Final EIS*. http://www.bostonoverflightnoisestudy.com/docs/2002_FAA_EIS_Executive%20Summary.pdf.

Figure 6-17 Comparison of Annual Hours of Dwell Exceedance by Runway End, 2010 to 2016

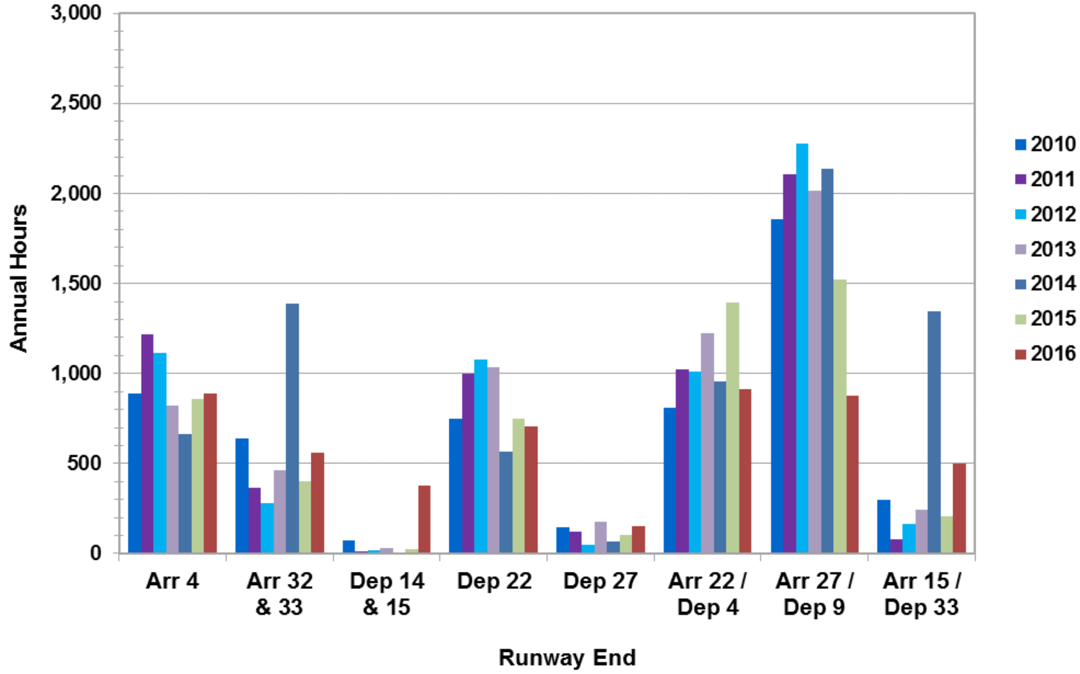
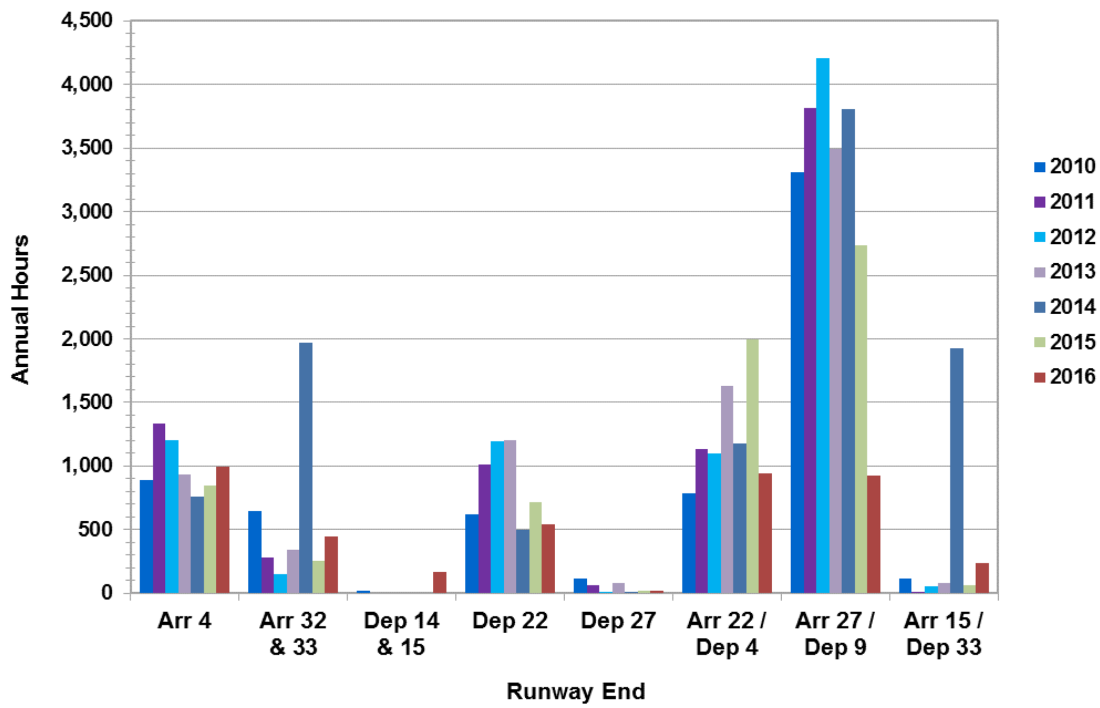


Figure 6-18 Comparison of Annual Hours of Persistence Exceedance by Runway End, 2010 to 2016



Time Above (TA)

The third supplemental noise metric reported in this *2016 EDR* is the amount of time that aircraft noise is above each of three predefined threshold sound levels. The measure is referred to generally as TA, and the threshold sound levels used in the analysis are 65, 75, and 85 dBA. Like DNL values, for 2016 these times are computed using the FAA-approved AEDT. The calculations are made at each of Massport's permanent noise monitoring locations and are based on an average 24-hour day during the year as well as for the average nine-hour nighttime period from 10:00 PM to 7:00 AM. The threshold sound levels of 65, 75, and 85 dBA reflect different degrees of speech interference depending on factors such as whether people are outdoors, indoors with their windows open, or indoors with windows closed.

Tables 6-13 and **6-14** present a summary of the calculated TA values for 2015 (INM) and 2016 (AEDT).

Table 6-13 Time Above (TA) dBA Thresholds in a 24-Hour Period for Average Day

			Minutes above Threshold						Modeled DNL[1]	
			2015			2016			2015	2016
Location	Site	Distance (mi)	85 dBA	75 dBA	65 dBA	85 dBA	75 dBA	65 dBA		
Winthrop – Bayview and Grandview	4	1.6	10.8	37.1	80.2	8.1	43.0	106.0	72.1	71.8
Winthrop – Harborview and Faun Bar	5	1.9	0.1	12.5	69.7	0.1	15.3	83.0	63.5	64.6
Winthrop – Somerset near Johnson	6	0.8	0.1	4.1	100.5	0.0	1.4	53.9	64.1	61.9
Winthrop – Loring Road near Court	7	1.0	2.5	25.5	156.4	1.0	10.8	84.2	72.5	67.0
Winthrop – Morton and Amelia	8	1.6	0.0	4.1	64.0	0.1	3.7	32.9	63.9	61.3
East Boston – Bayswater near Annavoy	9	1.3	2.4	30.1	85.6	1.2	20.3	72.1	72.4	67.9
East Boston – Bayswater near Shawsheen	10	1.3	0.2	6.6	52.5	0.1	5.2	45.7	65.2	62.3
East Boston – Selma and Orient	11	1.8	0.0	0.7	9.6	0.0	1.2	14.7	57.8	57.3
East Boston Yacht Club	12	1.2	1.3	35.1	164.3	0.0	8.2	124.6	70.3	65.3
East Boston High School	13	1.9	0.2	7.1	29.3	0.3	10.9	40.5	62.6	64.5

Table 6-13 Time Above (TA) dBA Thresholds in a 24-Hour Period for Average Day (Continued)

			Minutes above Threshold						Modeled DNL[1]	
			2015			2016			2015	2016
Location	**Site**	**Distance (mi)**	**85 dBA**	**75 dBA**	**65 dBA**	**85 dBA**	**75 dBA**	**65 dBA**		
East Boston – Jeffries Point Yacht Club	14	1.2	0.0	0.6	10.5	0.0	0.6	47.6	57.2	61.0
East Boston – Piers Park	30	1.5	0.0	0.3	4.7	0.0	0.2	16.0	54.8	58.3
Chelsea – Admiral's Hill	15	2.8	0.1	5.4	25.4	0.1	4.7	32.2	61.2	61.6
Revere – Bradstreet and Sales	16	2.4	1.8	20.3	51.0	1.1	19.4	50.8	68.7	67.7
Revere – Carey Circle	17	5.3	0.0	1.2	35.8	0.0	0.6	37.2	60.5	59.7
Nahant – U.S.C.G. Recreational Facility	18	5.9	0.0	0.0	0.3	0.0	0.0	0.6	44.9	46.1
Everett – Tremont near Prescott	21	4.5	0.0	0.2	9.2	0.0	0.1	12.4	53.9	54.5
Medford – Magoun near Thatcher	22	6.0	0.0	0.1	7.0	0.0	0.2	9.5	52.5	53.8
Swampscott – Smith Lane	19	8.7	0.0	0.0	0.8	0.0	0.0	0.9	45.3	45.9
Lynn - Pond and Towns Court	20	8.4	0.0	0.0	11.9	0.0	0.0	11.3	55.1	54.8
South End – Andrews Street	1	3.7	0.0	0.2	10.6	0.0	0.1	14.4	54.2	55.9
South Boston – B and Bolton	2	2.9	0.0	3.0	18.0	0.0	2.2	22.5	59.1	59.7
South Boston – Day Blvd. near Farragut	3	2.5	0.0	3.8	55.8	0.0	2.2	60.6	60.5	60.7
Roxbury – Boston Latin Academy	27	5.3	0.0	0.1	9.2	0.0	0.1	11.9	53.4	54.5
Jamaica Plain - Southbourne Road	28	7.7	0.0	0.0	2.8	0.0	0.0	3.3	49.5	51.2
Mattapan – Lewenburg School	29	7.3	0.0	0.0	0.5	0.0	0.0	0.3	46.6	48.2
Dorchester – Myrtlebank near Hilltop	23	6.3	0.0	0.0	14.5	0.0	0.0	12.0	54.4	

Table 6-13 Time Above (TA) dBA Thresholds in a 24-Hour Period for Average Day (Continued)

			Minutes above Threshold						Modeled DNL[1]	
			2015			2016			2015	2016
Location	**Site**	**Distance (mi)**	**85 dBA**	**75 dBA**	**65 dBA**	**85 dBA**	**75 dBA**	**65 dBA**		
Milton – Cunningham Park near Fullers	24	8.1	0.0	0.0	12.9	0.0	0.0	10.5	54.0	54.2
Quincy – Squaw Rock Park	25	4.2	0.0	0.0	0.4	0.0	0.0	0.4	47.8	49.5
Hull – Hull High School near Channel Street	26	6.0	0.0	0.2	25.9	0.0	0.2	26.9	58.8	59.3
Average TA Value			**0.7**	**6.7**	**37.2**	**0.4**	**5.0**	**34.6**	**58.6[2]**	**58.5[2]**

Source: HMMH, 2017.
Notes: Distance from Logan Airport calculated from the Airport Reference Point.
dBA = A-weighted decibel
1 2015 modeled with INM 7.0d, 2016 modeled with AEDT 2c SP2.
2 Arithmetic average includes all noise monitoring sites.

Table 6-14 Time Above (TA) dBA Thresholds in a Nine Hour Night Period for Average Day[1]

			Minutes above Threshold						Modeled DNL[2]	
			2015			2016			2015	2016
Location	**Site**	**Distance (mi)**	**85 dBA**	**75 dBA**	**65 dBA**	**85 dBA**	**75 dBA**	**65 dBA**		
Winthrop – Bayview and Grandview	4	1.6	1.1	3.5	8.0	1.1	5.0	13.9	72.1	71.8
Winthrop – Harborview and Faun Bar	5	1.9	0.0	1.2	6.7	0.0	1.6	9.6	63.5	64.6
Winthrop – Somerset near Johnson	6	0.8	0.1	1.4	18.0	0.0	0.3	9.5	64.1	61.9
Winthrop – Loring Road near Court	7	1.0	0.6	4.6	27.4	0.2	1.6	14.1	72.5	67.0
Winthrop – Morton and Amelia	8	1.6	0.1	0.9	12.9	0.0	0.5	6.3	63.9	61.3
East Boston – Bayswater near Annavoy	9	1.3	0.5	6.3	17.9	0.2	3.9	12.4	72.4	67.9

Table 6-14 Time Above (TA) dBA Thresholds in a Nine Hour Night Period for Average Day[1] (Continued)

			Minutes above Threshold						Modeled DNL[2]	
			2015			2016			2015	2016
Location	**Site**	**Distance (mi)**	**85 dBA**	**75 dBA**	**65 dBA**	**85 dBA**	**75 dBA**	**65 dBA**		
East Boston – Bayswater near Shawsheen	10	1.3	0.1	1.3	12.1	0.0	0.6	8.2	65.2	62.3
East Boston – Selma and Orient	11	1.8	0.0	0.0	1.2	0.0	0.1	2.0	57.8	57.3
East Boston Yacht Club	12	1.2	0.6	7.2	30.3	0.0	1.9	19.3	70.3	65.3
East Boston High School	13	1.9	0.1	1.3	4.7	0.1	1.9	6.2	62.6	64.5
East Boston – Jeffries Point Yacht Club	14	1.2	0.0	0.0	2.4	0.0	0.1	9.3	57.2	61.0
East Boston – Piers Park	30	1.5	0.0	0.0	1.0	0.0	0.0	3.9	54.8	58.3
Chelsea – Admiral's Hill	15	2.8	0.0	1.0	4.1	0.0	1.0	4.8	61.2	61.6
Revere – Bradstreet and Sales	16	2.4	0.4	4.7	11.3	0.3	4.0	9.7	68.7	67.7
Revere – Carey Circle	17	5.3	0.0	0.2	8.5	0.0	0.1	7.8	60.5	59.7
Nahant – U.S.C.G. Recreational Facility	18	5.9	0.0	0.0	0.0	0.0	0.0	0.1	44.9	46.1
Everett – Tremont near Prescott	21	4.5	0.0	0.0	1.9	0.0	0.0	2.2	53.9	54.5
Medford – Magoun near Thatcher	22	6.0	0.0	0.0	1.3	0.0	0.1	1.8	52.5	53.8
Swampscott – Smith Lane	19	8.7	0.0	0.0	0.1	0.0	0.0	0.1	45.3	45.9
Lynn - Pond and Towns Court	20	8.4	0.0	0.0	3.2	0.0	0.0	2.7	55.1	54.8
South End – Andrews Street	1	3.7	0.0	0.0	2.1	0.0	0.0	3.4	54.2	55.9
South Boston – B and Bolton	2	2.9	0.0	0.7	3.3	0.0	0.6	5.0	59.1	59.7
South Boston – Day Blvd. near Farragut	3	2.5	0.0	0.2	6.0	0.0	0.1	7.0	60.5	60.7

Table 6-14 Time Above (TA) dBA Thresholds in a Nine Hour Night Period for Average Day[1] (Continued)

			Minutes above Threshold						Modeled DNL[2]	
			2015			2016			2015	2016
Location	Site	Distance (mi)	85 dBA	75 dBA	65 dBA	85 dBA	75 dBA	65 dBA		
Roxbury – Boston Latin Academy	27	5.3	0.0	0.0	1.8	0.0	0.0	2.8	53.4	54.5
Jamaica Plain - Southbourne Road	28	7.7	0.0	0.0	0.6	0.0	0.0	0.9	49.5	51.2
Mattapan – Lewenburg School	29	7.3	0.0	0.0	0.0	0.0	0.0	0.1	46.6	48.2
Dorchester – Myrtlebank near Hilltop	23	6.3	0.0	0.0	1.5	0.0	0.0	1.5	54.4	54.7
Milton – Cunningham Park near Fullers	24	8.1	0.0	0.0	1.6	0.0	0.0	1.4	54.0	54.2
Quincy – Squaw Rock Park	25	4.2	0.0	0.0	0.0	0.0	0.0	0.0	47.8	49.5
Hull – Hull High School near Channel Street	26	6.0	0.0	0.1	6.9	0.0	0.1	7.6	58.8	59.3
Average TA Value			**0.1**	**1.1**	**6.2**	**0.1**	**0.8**	**5.8**	**58.6[3]**	**58.5[3]**

Source: HMMH, 2017.
Notes: Distance from Logan Airport calculated from the Airport Reference Point.
dBA = A-weighted decibel
1 Nine-hour nighttime period from 10:00 PM – 7:00 AM.
2 2015 modeled with INM 7.0d, 2016 modeled with AEDT 2c SP2.
3 Arithmetic average includes all noise monitoring sites.

Noise Abatement

Massport's noise abatement program continues to play a critical role in helping to limit and monitor noise impacts. Massport's emphasis on noise abatement has focused on the benefits of better analysis tools and improved modeling techniques to identify the causes of noise problems. Massport also continues to coordinate with FAA and the Logan Airport CAC on matters related to runway use and the on-going BLANS project.

Installed in 2008, the upgraded NOMS system includes vastly improved analysis and mapping capabilities, better quality flight tracking data, use of multilateration radar (a separate and unique source of operational data), and direct correlation of noise events with radar flight paths and complaints (a feature that the prior system did not have). This latter capability has improved the ability of the system to differentiate between aircraft and community noise sources. All measured data and complaint information in this report were generated through the new NOMS. In 2015, the NOMS system switched its primary feed of radar data at

Logan Airport to FAA's NextGen radar feed. This has led to improved aircraft identification and better-quality flight tracks.

Other continuing elements of Massport's noise mitigation program are discussed below.

- The Massport Noise Abatement Office was initiated in 1977 and it maintains the noise section of the Massport website.[24] The website provides information on Massport's sound insulation program, the Airport's noise monitoring system, various abatement measures, and other information of interest to the public.
- Operational restrictions on certain runways, limit engine runup locations, late night runway preference and noise abatement turns.
- One of the most extensive residential and school sound insulation programs in the nation. To date, Massport has installed sound insulation in 5,467 residences, including 11,515 dwelling units, and 36 schools in East Boston, Roxbury, Dorchester, Winthrop, Revere, Chelsea, and South Boston.
- Historically, the percentage of eligible homeowners who have responded and whose dwellings are ultimately treated varies significantly by community from a high of nearly 90 percent in Revere to a low of about 50 percent in South Boston. Eighty to 85 percent of homeowners in East Boston and Winthrop have historically participated. Approximately 8 percent of applicants also choose the Room-of-Preference option that allows the owner to identify a room (usually a bedroom or living room) for extra acoustical treatment.
- Massport will continue to work with FAA to soundproof eligible homes. Massport will apply to FAA for funds to treat eligible properties, as needed. As of 2015, FAA requires airports to use the AEDT model to establish eligibility. Massport is working with FAA on the AEDT model as applied to Logan Airport operations, and intends to submit an AEDT-derived noise exposure map to be kept on file with FAA.
- Development of annual noise contours (**Figure 6-12** compares the DNL 65 dB contours for 2015 INMv7.0d and 2016 AEDT 2cSP2).
- A website that features an internet flight tracking system known as PublicVue.[25] The PublicVue site allows the user to view flight tracks in near-real time, replay flight tracks, and enter noise complaints.
- Summary reports of operations by airline, runway, aircraft type, and other parameters that help the Noise Office track potential changes in the noise environment. **Tables 6-11** and **6-13** are examples of these reports.
- Where appropriate as part of the BLANS process, FAA designed (with Massport in an advisory role) RNAV departure procedures off most runways to avoid highly populated areas and the use of an over-water visual approach at night to keep aircraft offshore as much as possible.
- Massport supports, where possible, the Massport Community Advisory Committee (CAC). The Massport CAC is a state-legislated body that works with Massport on a range of Authority-wide topics,

24 Logan Airport Noise Abatement Website. http://www.massport.com/logan-airport/about-logan/noise-abatement/.
25 Massport. *Flight Monitor.* http://www.massport.com/logan-airport/about-logan/noise-abatement/flight-monitor/.

including environmental issues. Further information about the Massport CAC can be found at http://massportcac.org/.

- Massport supported FAA RNAV initiatives to develop RNAV arrivals and the Runway 33L departure RNAV procedure.
- Massport strives to participate in research to reduce community noise levels whether through the Airport Cooperative Research Program (ACRP) or with FAA, such as the RNAV evaluation project currently underway.

Airline Fleet Improvements

Commercial air carrier and cargo operators are deploying the newest engine technology at Logan Airport. **Table 6-15** reports the percent of the airlines' fleet which is Stage 3 or Stage 4 equivalent. The majority of major U.S. airlines at Logan Airport are using a fleet composed of 100 percent originally manufactured Stage 3 or Stage 4 aircraft. All new carriers at Logan Airport in 2016 are using Stage 4 equivalent aircraft. The new FAA Stage 5 requirements are already satisfied by 18 percent of jet operations for 2016.

Massport recently initiated terminal and airfield improvements designed to safely handle the next generation of larger and more efficient Group VI aircraft including the Airbus A380, the world's largest and quietest commercial aircraft. Use of these larger aircraft will help to continue the trend of carrying more passengers in fewer flights.

Table 6-15 Airline Operations (percent) in Original Stage 3 or Equivalent Stage 4 Aircraft[1] (2015 to 2016)

Airlines with more than 100 flights	Number of Flights		Percentage of Original Stage 3 and 4 Operations[2]			
	2015	2016	2015 Stage 3	2015 Stage 4 Equiv.	2016 Stage 3	2016 Stage 4 Equiv.
JetBlue Airways	85,852	91,736	0%	100%	0%	100%
American Airlines	48,355	55,782	0%	100%	0%	100%
Delta Air Lines	33,909	33,935	8%	93%	7%	93%
United Airlines	24,644	25,052	0%	100%	0%	100%
Southwest Airlines	21,514	24,436	25%	79%	18%	82%
Spirit Airlines	4,896	7,245	0%	100%	0%	100%
Shuttle America Corp	5,290	6,546	0%	100%	0%	100%
Pinnacle Airlines	7,284	6,260	0%	100%	0%	100%
Air Canada Jazz	5,037	5,832	0%	100%	0%	100%
AWAC - US Air Express	4,998	5,010	0%	100%	0%	100%
Delta Connection/Atlantic SE	4,923	4,032	0%	100%	0%	100%
Federal Express	3,523	3,896	74%	30%	64%	36%
Virgin America	3,426	3,724	0%	100%	0%	100%
Alaska Airlines	3,027	3,256	0%	100%	0%	100%
GoJet Airlines	1,309	2,783	0%	100%	0%	100%
Sky Regional Airlines Inc	3,784	2,738	0%	100%	0%	100%
Air Canada	1,718	2,713	0%	100%	0%	100%
British Airways	2,575	2,702	0%	100%	0%	100%
Aer Lingus	1,973	2,066	2%	97%	1%	99%
United Parcel Service	1,538	1,834	0%	100%	0%	100%
Lufthansa	1,687	1,728	0%	100%	0%	100%
US Airways Express/Republic	4,669	1,458	0%	100%	0%	100%
Emirates Airlines	914	1,382	0%	100%	0%	100%
Endeavor Air	N/A	1,377	N/A	N/A	0%	100%
Sun Country Airlines	1,414	1,374	0%	100%	0%	100%
Icelandair	1,365	1,358	0%	100%	0%	100%
Swiss Air	711	1,020	0%	100%	0%	100%
Hainan Airlines Co. Ltd.	744	961	0%	100%	0%	100%
Air France	910	900	0%	100%	0%	100%
Japan Airlines	728	736	0%	100%	0%	100%
Virgin Atlantic	702	715	0%	100%	0%	100%
WOW Air, LLC.	445	678	N/A	100%	0%	100%
Turkish Airlines	726	658	0%	100%	0%	100%
Norwegian Air Shuttle	N/A	656	N/A	N/A	0%	100%
Compañía Panameña de Aviación S.A.	646	638	0%	100%	0%	100%

Table 6-15 Airline Operations (percent) in Original Stage 3 or Equivalent Stage 4 Aircraft[1] (2015 to 2016) (Continued)

Airlines with more than 100 flights	Number of Flights 2015	Number of Flights 2016	Percentage of Original Stage 3 and 4 Operations[2] 2015 Stage 3	2015 Stage 4 Equiv.	2016 Stage 3	2016 Stage 4 Equiv.
SATA International Airlines	542	630	1%	99%	0%	100%
Aeromexico	345	580	0%	100%	0%	100%
Alitalia	562	558	0%	100%	0%	100%
Qatar Airways	N/A	552	N/A	N/A	0%	100%
ATI	302	502	0%	100%	0%	100%
Scandinavian Airlines of North America, Inc.	N/A	500	N/A	N/A	0%	100%
Mesa Airlines	437	486	0%	100%	0%	100%
Cathay Pacific	279	454	0%	100%	0%	100%
Iberia Air Lines of Spain	336	412	0%	100%	0%	100%
TAP - Air Portugal	N/A	378	N/A	N/A	0%	100%
El Al Israel Airlines Ltd.	152	296	100%	0%	100%	0%
Air Berlin	N/A	192	N/A	N/A	0%	100%
SkyWest Airlines	548	108	0%	100%	0%	100%

Source: Massport, 2017.
N/A Not Available
1 Operations for some carriers differ with those in Chapter 2, *Activity Levels*, and Chapter 7, *Air Quality/Emissions Reduction* because the table only includes jet aircraft, not turboprops, and it includes scheduled and unscheduled air carriers.
2 Original Stage 3 means originally manufactured as a certificated Stage 3 aircraft under FAR Part 36. Stage 4 equivalent means the aircraft is either certificated Stage 4 or certificated Stage 3 and meets Stage 4 requirements.

Noise Complaint Line

In 2016, Massport received 38,046 noise complaints from 83 communities, more than double the 2015 total of 17,685 noise complaints from 84 communities. The community of Milton generated 83 percent of this increase. The number of individual complainants increased by 19 percent. This increase is substantial, but much smaller than the 115 percent increase in calls, indicating that noise annoyance continues to grow among a concentrated population rather than spreading to a larger population. This is consistent with a recent survey of U.S. airports that finds noise complaints concentrated among relatively small numbers of complainants[26] (see Appendix H, *Noise Abatement*). The increase in complaints continues to be primarily related to FAA's RNAV departure procedures.

26 Dourado, E. and Russell, R. October 2016. *Airport Noise NIMBYism: An Empirical Investigation.* Mercatus Center at George Mason University. https://www.mercatus.org/system/files/dourado-airport-noise-mop-v1.pdf.

Table 6-16 is a summary of noise complaints from the Massport Noise Abatement Office. The summary table presents the fifteen communities with the greatest number of complaints for 2016, along with the number of callers and the corresponding numbers from 2015. The communities listed below represent 91 percent of the complaints in 2016 and 72 percent of the complaints in 2015. All remaining communities are summed together into a single line above the grand total. Appendix H, *Noise Abatement* has a full listing of the complaints by community.

Table 6-16 Noise Complaint Line Summary

	2015		2016		Change (2014 to 2015)
Town	Calls	Callers	Calls	Callers	
Arlington	1,851	92	1,968	87	117
Belmont	715	95	501	63	(214)
Cambridge	1,697	136	2,154	128	457
Dorchester	115	20	326	36	211
Hull	1,136	152	1,266	220	130
Jamaica Plain	288	60	434	76	146
Lynn	424	13	323	15	(101)
Medford	508	116	1,784	177	1,276
Milton	4,991	343	21,796	466	16,805
Nahant	50	19	339	12	289
Roslindale	285	55	588	103	303
Somerville	1,910	191	1,804	153	(106)
South Boston	263	48	577	42	314
Wenham	285	2	416	9	131
Winchester	733	24	489	16	(244)
Total (Only for Towns listed above)	**15,251**	**1,366**	**34,765**	**1,603**	**19,514**
Total Complaints from Other Towns	**2,434**	**537**	**3,280**	**657**	**846**
Overall Totals	**17,685**	**1,903**	**38,045**	**2,260**	**20,360**

Source: Massport, 2017.
Notes: Changes in ( ) represent a decrease in noise complaints.
Only the top ten communities for each year are listed above. The complete list of complaints is in Appendix H, *Noise Abatement*.

Boston Logan Airport Noise Study (BLANS)

FAA's Record of Decision (ROD) approving construction of the unidirectional Runway 14-32 required that FAA, Massport, and the Logan Airport CAC jointly undertake a study to determine whether changes to existing noise abatement flight track corridors might further reduce noise impacts. In addition, the Massachusetts Environmental Policy Act (MEPA) Certificate for the *Boston-Logan Airside Improvements Planning Environmental Impact Report (EIR)* directed Massport to work with FAA and local communities on a review of the Logan Airport PRAS. FAA has been implementing RNAV procedures at airports across the country such as Seattle and Minneapolis-St. Paul. These noise studies were able to influence the design of these RNAV procedures for implementation at Logan Airport.

Phase 1

FAA noise study was conducted in multiple phases. Phase 1, which was known as the Boston Overflight Noise Study (BONS), was initiated in the winter of 2004 and was completed in fall of 2007. During Phase 1, 55 airspace and operational alternatives to reduce noise related to Logan Airport overflights were identified and screened for safety, operational, and noise benefits. Of the 55 alternatives, 13 measures were identified as potentially implementable in the near term. This phase was completed in 2007 and a NEPA Categorical Exclusion was issued by FAA in October 2007 for several flight path changes mostly along the northeast and southeast shores from the Airport.[27]

The conventional and radar vectored[28] changes which could be implemented without airspace changes were implemented in February 2008. RNAV and other changes began taking place in 2009 when FAA completed design of these procedures. RNAV procedures were published by FAA on October 22, 2009 and were implemented in 2010.

Eight new RNAV procedures were implemented by FAA in 2010 and 2011 for Runways 4R, 9, 15R, 22R, and 22L. Under these procedures, aircraft immediately depart the Airport similar to existing procedures but then aircraft follow a precise path over Boston Harbor, then aircraft cross the shoreline and return over land at a higher altitude than previous procedures. In 2013, Runways 27 and 33L were added to these procedures:

- Starting on 2/1/2010 all six RNAV procedures were in use from Runway 9;
- Starting on 5/3/2010 all six RNAV procedures were in use from Runway 4R;
- Starting on 11/18/2010 all six RNAV procedures were in use from Runways 15R, 22R, and 22L;
- Starting on 3/10/2011 all eight RNAV procedures were in use from Runways 4R, 9, 15R, 22R, and 22L;
- Starting on 3/7/2013 all eight RNAV procedures were in use Runways 4R, 9, 15R, 22R, 22L, and 27; and
- Starting on 6/5/2013 all eight RNAV procedures were in use Runways 4R, 9, 15R, 22R, 22L, 27, and 33L.

27 FAA Documented Categorical Exclusion Record of Decision, October 16, 2007.

28 Radar vector is the heading issued to aircraft to provide guidance by radar.

On December 14, 2011, three new RNAV standard terminal arrival routes were also implemented by FAA. These concentrate arrivals on routes leading into Logan Airport's airspace and improve efficiency of arrivals. These have little effect on the noise environment close to the Airport and the DNL contours. However, usage of these procedures has increased since they were introduced and this increased usage is evident in the modeled flight track graphics.

The Runway 33L departure was the last RNAV departure procedure to be implemented at Logan Airport in June 2013. FAA completed a separate Environmental Assessment (EA) in January 2013. FAA issued a Finding of No Significant Impact/Record of Decision (FONSI/ROD) for the Runway 33L RNAV Standard Instrument Departure Final EA on June 4, 2013. FAA also committed to a six-month and 12-month post-implementation review of the RNAV procedure. The reviews were posted by FAA in April 2014 and September 2014.[29] Both reviews concluded that the BOS Runway 33L RNAV standard instrument departure is performing as designed with aircraft successfully flying within the confines of the procedure's design. All other major Logan Airport runways that are capable of accommodating RNAV procedures have been implemented by FAA previously and are in operation today. Since the modeling is based on the radar data tracks, all changes as they have been implemented have been included in the EDR modeling for each year.

Implementation of several of these FAA RNAV procedures has increased noise complaints in some towns surrounding Logan Airport where the flight tracks have become more concentrated. However, overflights are reduced in areas away from these routes, and aircraft are generally passing at higher altitudes.

Phase 2

Phase 2 of BLANS, which began in late 2007, included consideration of 53 proposed arrival, departure, and ground noise measures. After the first level of screening completed in 2009, 32 measures advanced to the next level of screening. Nine of these measures address ground noise issues, six are approach measures, and 11 address departure measures. The remaining measures address local air traffic issues such as helicopters and altitudes for flights executed under visual flight rules (VFR). The Level 2 screening was completed in 2011 and of the 32 measures, 10 were passed on to Level 3, five were determined as completed, and 17 were eliminated. The Level 3 analysis, which consists of noise modeling for each individual measure along with a change analysis against the future baseline, was completed in 2012. The Level 3 Screening Report was published by FAA in December 2012. Two of the flight measures were modified resulting in 12 measures evaluated (two measures are related to ground movements and 10 are related to flight procedures). Of these measures, eight were recommended for implementation by the Logan Airport CAC (the two ground movements and six flight procedures) and four flight procedures were rejected. FAA and Massport reviewed the Logan Airport CAC recommendations and determined that the two ground measures would meet the criteria for implementation; however, FAA determined that none of the flight procedures would meet the criteria for noise abatement under BLANS.

29 Federal Aviation Administration. *Environmental Reviews: Performance Based Navigation.* http://www.faa.gov/air_traffic/environmental_issues/ared_documentation/#Performance_Based_Navigation_PBN.

The two approved measures, with their status, are described below:[30]

- **Preferred Location for Run-ups away from Communities**. Massport has already tested this measure and identified a new location at the end of Runway 32 to be used when operationally feasible.
- **Holding Area for Delayed Departures**. Massport is prepared to commit to working with FAA to seek approval and funding (subject to FAA operations/safety approval, environmental review, Massport capital budget process, availability of FAA funds) for construction of a hold pad to allow for short-term staging of aircraft at or near the midpoint of the airfield. Massport has initiated its Runway Incursion Mitigation (RIM) program with FAA. A hold pad will be studied as part of this multi-year effort.

In addition, Massport and FAA agreed to implement supplemental programmatic measures recommended by the Logan Airport CAC. One example is Massport's commitment to establish an airport/community noise advisory group. The state of Massachusetts established the Massport CAC though legislation that will meet on a regular basis to continue dialogue on Airport-related noise concerns.

Phase 3

Phase 3 began in August 2013 and evaluated various runway use measures with the goal of developing a runway use program that can be implemented at Logan Airport to further reduce noise. The Logan Airport CAC voted to abandon the PRAS in April 2012 with the goal of using Phase 3 to look at runway use measures that can be successfully implemented. Massport will continue to report PRAS goals and information until a new program is in place.

In November 2014, FAA began the first of up to four runway use tests designed to change runway use during periods of the day to better distribute activity. This test recommends different runway configurations between 6:00 AM and 9:30 AM than the configurations used between 9:00 PM and midnight.

- Test 1 was completed in May 2015.
- Test 2 began in May 2015 and ran until November 2015. In this test, FAA controllers switched the runway configurations at two different points during the day (when weather and safety permitted) to provide respite to communities from excessive overflights.
- Test 3 consisted of information gathering on various aspects of existing runway use, focusing on nighttime operations.

The Logan Airport CAC could not agree on a recommended runway use program. Therefore, the study ended without a recommendation, and a final report on the BLANS program was issued in April 2017.[31]

30 BLANS Level Three Screening Analysis, FAA, December 2012, Page E-3.
31 The final report is available online at: http://www.bostonoverflight.com/.

FAA and Massport RNAV Pilot Project

Over the last several years, the implementation of new Performance Based Navigation (PBN) procedures – including RNAV – has resulted in a concentration of flights. On October 7, 2016, FAA signed a Memorandum of Understanding (MOU) with Massport[32] to frame the process for analyzing opportunities to reduce noise through changes or amendments to PBN. Massport has been working with FAA and others to develop test projects that are designed to help address the concentration of noise from PBN. To more clearly understand the implications of flight concentration, Massport has proposed several ideas for a test program with FAA; this program will study possible strategies to address neighborhood concerns. FAA has agreed to study Massport's ideas for a test program. This is a first-in-the-nation project between FAA and an airport operator that includes analyzing the feasibility of changes to some RNAV approaches and departures from Logan Airport. FAA and Massport are committing to: (1) analyze the feasibility; (2) measure and model the benefits and impacts of changing some RNAV approaches; and (3) test and develop an implementation plan, which will include environmental analysis and community/public outreach.

The preliminary areas of study could include:

1. Using higher altitudes for arrivals, where applicable;
2. Using higher altitudes for departures, where applicable;
3. Determining the feasibility of reducing the persistent level of noise from RNAV departures through a case study analysis of a major departure procedure from Runway 33L;
4. RNAV separation requirements – currently departure and arrival procedures require a separation of 3 miles for head-to-head operations;
5. Analyzing alternative RNAV designs that would bring aircraft over more compatible land use; and
6. Using real-world single-event noise data from communities under RNAV tracks to develop a supplemental metric to measure and track the concentration of flights due to RNAV technology. These metrics would improve data collection for communities and FAA and would better identify the community support, or opposition to proposed procedural changes. The proposed pilot testing will use these supplemental metrics.

The project has been structured in two phases, or "blocks". Block 1 recommendations are those that would not result in shifting noise from one area to another, and that would not have significant operational/technical implications. Block 2 recommendations could result in noise increases in some areas, or face technical barriers that would require further review. An early outcome of the Block 1 process was the development of an RNAV visual approach to Runway 33L. This approach would be similar to the JetBlue Airways RNAV visual to Runway 33L already in place but would be a published procedure for all airlines to use. A copy of the Massport request to FAA from April 2017 is included in Appendix H, Noise Abatement. Since the letter was sent, FAA and Massport have further refined the procedure. A report on Block 1 recommendations was completed in December 2017, and the Massport CAC voted to approve and recommend implementation of the Block 1 procedures. On December 20, 2017, Massport sent a request for FAA review and implementation of the Block 1

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

recommendations to FAA. A copy of the letter is provided in Appendix H, Noise Abatement. FAA review of Block 1 recommendations began in 2018. The technical team, led by the Massachusetts Institute of Technology (MIT), has begun work on Block 2.

Reduced Engine Taxiing

Single or reduced engine taxiing has the potential to reduce noise at Logan Airport. When used, the largest benefit is achieved by reducing the use of the engines on the side of the aircraft closest to the community. However, this is not always practicable due to airline procedures, taxiway routings, and safety considerations. Massport has reached out to the airlines and encouraged the use of this procedure whenever practicable. The letter sent to airport users for 2016 from Massport is published in Appendix L, *Reduced/Single Engine Taxiing at Logan Airport Memorandum*.

In 2009, MIT in cooperation with Massport and FAA conducted a survey of pilots at Logan Airport and found that the procedure was widely used on arrivals but not frequently used on departures.[33] Key reasons cited for not using the procedure were safety-related or practical reasons such as a short taxi time. The survey indicated that for the procedure to be considered for arrivals, the taxi-in time would have to exceed 10 minutes and for departures, exceed 20 minutes. The average taxi-out times for Logan Airport for 2016 exceeded 20 minutes only during the 5:00 to 6:00 PM and 7:00 and 8:00 PM periods, and for 2015 exceeded 20 minutes only during the 7:00 to 8:00 AM and the 5:00 to 8:00 PM periods. During 2015 and 2016, the average taxi-in time never exceeded 10 minutes. The average taxi-out time at Logan Airport for 2016 increased to 18.1 minutes from 17.9 minutes in 2015. The average taxi-in time increased to 7.2 minutes from 6.8 minutes. Overall, the average taxi/delay time for 2016 increased to 12.8 minutes from 12.3 minutes in 2015.[34] These small changes year to year occur due to several factors such as changes in schedules, weather, and use of the runways. Mandatory single engine taxiing was also one of the proposed measures in the BLANS but was rejected by FAA due to safety concerns, and it is currently being implemented as a voluntary measure, when conditions are appropriate.

Airbus A320 Vortex Generators

Logan Airport also encourages operators to use idle or reduced reserve thrust during landing, and to retrofit Airbus A319/320/321 family of aircraft with vortex generators which reduce tonal noise on approach. These actions are detailed in a letter included in Appendix L, *Reduced/Single Engine Taxiing Memoranda*, which Massport issued to air carriers at Logan Airport. All Airbus A319/320/321 built after 2014 already come equipped with this improvement. As airlines transition to the newer models of the A320 family, the number of aircraft operating at Logan Airport without the vortex generators is expected to decrease.

Noise Abatement Management Plan

Massport's noise abatement goals are achieved through the implementation of multiple elements. **Table 6-17** lists these goals and the associated plan elements and reports on progress toward achieving these goals.

33 The full report was published in the *2009 EDR* in Appendix L, *Survey of Airline Pilots Regarding Fuel Conservation Procedures for Taxi Operations*.

34 FAA Aviation System Performance Metrics: Avg. Taxi Time: Standard Report.

Table 6-17 Noise Abatement Management Plan

Noise Abatement Goal	Plan Elements	2016 Progress Report
Limit total aircraft noise	Limit on Cumulative Noise Index (CNI)	The CNI value for 2016 was 152.6 EPNdB which is well below the cap of 156.5 EPNdB.
	Stage 3 percentage Requirement in Noise Rules	In 2016,100 percent of Logan Airport's total commercial jet traffic satisfied Stage 3 noise criteria or better. The newest Stage 5 category was represented by 18 percent of these operations.
Mitigate noise impacts	Residential Sound Insulation Program (RSIP)	No additional dwelling units were sound insulated in 2016, leaving the total of treated dwelling units at 11,515 since the start of the program in 1986. See Appendix H, *Noise Abatement* for additional details.
	School Sound Insulation Program	Thirty-six eligible schools have been sound insulated since this program began.
	Noise Abatement Arrival and Departure Procedures	Flight track monitoring and data analysis were used to verify adherence to noise abatement flight procedures. See Appendix H, *Noise Abatement* for copies of the 2015 and 2016 Monitoring Reports.
	Preferential Runway Advisory System (PRAS) Runway End Use Goals	Massport continues to report on runway use compared to PRAS goals.
	Runway Restrictions	Noise-based use restrictions 24 hours per day on departures from Runway 4L and arrivals on Runway 22R were continued.
	Reduced-Engine Taxiing	Voluntary use of reduced-engine taxiing is encouraged when appropriate and safe. See Appendix L, *Reduced/Single Engine Taxiing at Logan Airport Memorandum* for information.
Improve Noise Monitoring System	Replace Existing Noise Monitors, Install Multilateration Antennas for Flight Track Monitoring, and Install New Robust Software	The noise monitoring system is completely installed and in use at Logan Airport. The noise monitors provide 1/3 octave band data at all sites to aide with aircraft identification. Noise events, flight events, and complaints are all linked. In 2015, Massport upgraded to FAA's NextGen data feed.
Minimize nighttime noise	Nighttime Stage 2 Aircraft Prohibition	With FAA's ban on all Stage 2 operations for all of 2016, this prohibition is no longer necessary.
	Nighttime Runway Restrictions	Prohibitions on use of Runway 4L for departures and Runway 22R for arrivals between 11:00 PM and 6:00 AM were continued.
	Maximization of Late-Night Over-Water Operation	Efforts to maximize late-night over-water operations were continued. Use of Runway 15R for departures and Runway 33L for arrivals continued.
	Nighttime Engine Run-up and auxiliary power unit (APU) Restrictions	Restriction on nighttime engine run-ups and use of APUs was continued.

Table 6-17 Noise Abatement Management Plan (Continued)

Noise Abatement Goal	Plan Elements	2016 Progress Report
Address/respond to noise issues and complaints	Noise Complaint Line	Massport continued operation of Noise Complaint Line, (617) 561-3333.
	Special Studies	Massport continued to provide technical assistance and analysis using noise monitoring system to support FAA and others in monitoring jet departure tracks from Runway 27 and Runway 33L. The BLANS Phase 3 was completed in 2016. Massport and FAA are conducting an RNAV evaluation project designed to identify ways to reduce noise from the RNAV procedure (which concentrates flights).

Source: Massport.

7

Air Quality/Emissions Reduction

Introduction

The Massachusetts Port Authority (Massport) is a national leader in studying, tracking, and reporting on the air quality environment of Boston-Logan International Airport (Logan Airport or the Airport), and in implementing measures to reduce emissions. Recognized as early as 2008 with an environmental award for Logan Airport's Emissions Reduction Program, Massport annually prepares an inventory of Airport-related emissions of the U.S. Environmental Protection Agency (EPA) criteria pollutants (and their precursors) including carbon monoxide (CO), nitrogen oxides (NO_x), particulate matter (PM),[1] and volatile organic compounds (VOCs). An emissions inventory of greenhouse gases (GHGs) is also included.

One central element of Massport's emissions reduction initiative is a comprehensive strategy to diversify and enhance ground transportation options for passengers and employees. The ground transportation strategy is designed to help reduce automobile-related air emissions and improve air quality by providing a broad range of high occupancy vehicle (HOV), public transit, and shared-ride options for travel to and from Logan Airport. The strategy also aims to reduce drop-off/pick-up by providing parking on-Airport for passengers choosing to drive or with limited HOV options. Continuing improvements to support HOV include: pilot Back Bay Logan Express service (since May 2014), free Massachusetts Bay Transportation Authority (MBTA) Silver Line outbound boarding (from Logan Airport), a new 1,100-car parking garage at the Framingham Logan Express, reduced holiday travel parking rates at Logan Express facilities, and support for private coach bus and van operators.

Massport also supports the use of alternative fuels by taxis; provides an on-Airport public-use, compressed natural gas (CNG) station; provides electric plug-ins for ground service equipment (GSE); and installs and maintains 400 Hz Power and pre-conditioned air at airplane gates to help reduce aircraft emissions. Further, Massport continues to invest in energy efficiency measures, such as the installation of solar panels and constructing facilities to meet the U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED®) standards. Together, these improvements help to reduce emissions associated with Logan Airport. This chapter describes air quality conditions at Logan Airport in 2016, and compares them to those in 2015 and previous years.

1 PM less than or equal to 10 microns (PM_{10}) and PM less than or equal to 2.5 microns ($PM_{2.5}$) are subsets of PM.

Regulatory Framework

The federal Clean Air Act (CAA), National Ambient Air Quality Standards (NAAQS), and similar state laws govern air quality issues in Massachusetts. The NAAQS and the Massachusetts State Implementation Plan (SIP), which describes measures that the state will take to maintain and attain NAAQS compliance, regulate air quality issues in the Boston metropolitan area and the state. These regulations are discussed in the sections that follow.

National Ambient Air Quality Standards (NAAQS)

The U.S. Environmental Protection Agency (EPA) established NAAQS for a group of criteria air pollutants to protect public health, the environment, and quality of life from the detrimental effects of air pollution. These NAAQS are set for the following seven pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM_{10}, $PM_{2.5}$), and sulfur dioxide (SO_2). The NAAQS primary standards (designed to protect human health) and secondary standards (designed to protect human welfare) are summarized in **Table 7-1**.

Based on air monitoring data, and in accordance with CAA, all areas within Massachusetts are presently designated as either attainment and/or maintenance with respect to the NAAQS.[2,3] These regulatory designations for the Boston metropolitan area (including the area around Logan Airport) are listed in **Table 7-2**.

The Boston area is currently designated as "Attainment/Maintenance" for CO, indicating that it is in transition back to "Attainment" for this pollutant. Historically, the entire Boston area was designated as "Attainment" for all other criteria pollutants except O_3, for which it was designated as "Moderate/ Nonattainment" based on the former 1997 Eight-Hour O_3 NAAQS (see **Table 7-2**). This O_3 Nonattainment area encompassed 10 counties in Massachusetts: Barnstable, Bristol, Dukes, Essex, Middlesex, Nantucket, Norfolk, Plymouth, Suffolk, and Worcester.[4]

In May 2012, EPA issued a "Clean Data Finding" for the Boston metropolitan area signifying that the area had attained the 1997 NAAQS for O_3. This re-designated the area as "Attainment/Maintenance," so long as the area continued to demonstrate attainment based on ongoing monitoring data. In addition, the "Anti-Backsliding" requirements of CAA (a rule established to ensure that air quality is not deteriorated due changes in the NAAQS) still obligates the Massachusetts Department of Environmental Protection (MassDEP) to enforce certain elements of the SIP that were established to attain the 1997 NAAQS.

In April 2012, EPA also implemented the newer, stricter, 2008 eight-hour O_3 NAAQS. Since that time, there have been no violations of this standard and this trend has continued through 2016. Based on these recent findings, MassDEP submitted the SIP for O_3 to EPA in 2014 for "Adequacy Review" and the outcome is still pending; thus, the Boston metropolitan area is presently designated as "Attainment/Unclassifiable" with respect to the 2008 standard.

2 Environmental Protection Agency. *Nonattainment Areas for Criteria Pollutants (Green Book).* https://www.epa.gov/green-book.

3 An area with air quality better than the NAAQS is designated as attainment; an area with air quality worse than the NAAQS is designated as nonattainment; and an area that is in transition from nonattainment to attainment is designated as attainment/maintenance. An area may also be designated as unclassifiable when there is a temporary lack of data to form a basis for determining attainment status. Nonattainment areas can be further classified as extreme, severe, serious, moderate, and marginal by the degree of non-compliance with the NAAQS.

4 Logan Airport is located in Suffolk County.

Finally, EPA has again revised (that is, made stricter) the O_3 standard which became effective in 2015. The new Attainment/Nonattainment designations for this standard will be made in 2018 based upon the previous three years of state-wide monitoring data. The status of the Boston metropolitan area in terms of this pending designation will be reported in the *2017 Environmental Status and Planning Report (ESPR)*. The *2016 EDR* provides information on ultrafine particles (UFPs). At this time, there are no state or federal air quality standards for outdoor levels of UFPs. Massport is actively tracking the research and regulatory status of this pollutant, and will comply with future UFP standards if promulgated by EPA.

Massachusetts State Implementation Plan

The Massachusetts SIP is a state's regulatory plan for bringing nonattainment areas into compliance with the NAAQS. As discussed previously, the entire Boston metropolitan area was formerly designated as "Moderate" Nonattainment for the 1997 eight-hour O_3 standard, but has since received a "Clean Data Finding" from EPA classifying the area as "Attainment/Maintenance." Additionally, and as stated above, the area has since been designated Attainment/Unclassifiable for the 2008 eight-hour O_3 standard, and, accordingly the SIP preparation relative to this standard is pending. For the former CO attainment/maintenance designation, MassDEP has also developed another 10-year Maintenance Plan which is presently in place. The most current SIPs applicable to the Boston area are summarized in **Table 7-3**.

The number of commercial and employee parking spaces allowed at Logan Airport is regulated by the Logan Airport Parking Freeze (310 Code of Massachusetts Regulations 7.30), which is an element of the Massachusetts SIP under the Federal Clean Air Act (42 U.S.C. §7401 et seq. [1970]). The intent of the Logan Airport Parking Freeze is to reduce air emissions by shifting air passengers to travel modes that require fewer vehicle trips. However, survey data since the 1970s has consistently shown that constrained parking has the unintended consequence of shifting air passengers to travel modes with higher numbers of vehicle trips, despite Massport's extensive efforts to provide and encourage the use of HOV travel modes. As one element of its comprehensive transportation strategy, Massport proposed to increase the Logan Airport Parking Freeze Cap by 5,000 on-Airport commercial parking spaces at Logan Airport. The goal of the Logan Airport Parking Project is to reduce the number of air passengers choosing more environmentally harmful drop-off/pick-up modes, which generate up to four vehicle trips instead of two. As part of the process to amend the Logan Airport Parking Freeze, MassDEP conducted a stakeholder process, which was followed by a public process to amend the Parking Freeze regulation. MassDEP issued the amended regulation on June 30, 2017 approving the requested parking cap increase. On December 5, 2017, EPA proposed a rule approving the revision of the Massachusetts SIP incorporating the amended Logan Airport Parking Freeze Cap. This amendment was finalized on March 6, 2018 and went into effect on April 5, 2018. For additional information, see Chapter 5, *Ground Access to and from Logan Airport*.

Table 7-1 National Ambient Air Quality Standards

Pollutant	Averaging Time	Standard ppm	Standard µg/m³	Notes
Carbon Monoxide (CO)	1 hour	35	40,000	Not to be exceeded more than once a year.
	8-hour	9	10,000	Not to be exceeded more than once a year.
Lead (Pb)	Rolling 3-Month Average	—	0.15	Not to exceed this level. Final rule October 2008.
	Quarterly	—	1.5	The 1978 standard (1.5 µg/m³ as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.
Nitrogen Dioxide (NO_2)	1 hour	0.100	188	The three-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 0.100 ppm.
	Annual	0.053	100	Not to exceed this level.
Ozone (O_3)	8-hour[1]	0.070	—	Annual fourth-highest daily maximum 8-hour concentration, average over 3 years.
Particulate Matter with a diameter $\leq$ 10µm (PM_{10})	24-hour	—	150	Not to be exceeded more than once a year on average over three years.
Particulate Matter with a diameter $\leq$ 2.5µm ($PM_{2.5}$)	24-hour	—	35	The three-year average of the 98th percentile for each population-oriented monitor within an area is not to exceed this level.
	Annual (Primary)	—	12	The three-year average of the weighted annual mean from single or multiple monitors within an area is not to exceed this level.
Sulfur Dioxide (SO_2)	1 hour	0.075	196	Final rule signed June 2, 2010. The three-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed this level.
	3-hour	0.5	1,300	Not to be exceeded more than once a year.

Source: EPA, 2017 (https://www.epa.gov/criteria-air-pollutants).
Notes:
1 Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O_3 standard additionally remain in effect in some areas. Revocation of the 2008 standard and transitioning to the new standard will be achieved over the next three years.
ppm Parts per million.
µg/m³ Micrograms per cubic meter.

Table 7-2 Attainment/Nonattainment Designations for the Boston Metropolitan Area

Pollutant	Designation
Carbon monoxide (CO)	Attainment/Maintenance[1]
Nitrogen Dioxides (NO_2)	Attainment
Ozone (Eight-hour, 1997 Standard)	Attainment/Maintenance[1]
Ozone (Eight-hour, 2008 Standard)	Attainment/Unclassifiable[2]
Ozone (Eight-hour, 2015 Standard)	To be determined[3]
Particulate matter (PM_{10})	Attainment
Particulate matter ($PM_{2.5}$)	Attainment
Sulfur Dioxide (SO_2)	Attainment
Lead (Pb)	Attainment

Source: EPA, 2017 (https://www.epa.gov/green-book).
Notes:
1 The Boston area was previously designated nonattainment for this pollutant but has since attained compliance with the National Ambient Air Quality Standards (NAAQS).
2 Attainment/Unclassifiable means that the initial data shows attainment but additional data is needed to verify longer term conditions.
3 Attainment designation will be determined by October 1, 2018.

Table 7-3 State Implementation Plan (SIP) for Boston Area

Standard	Title	Status	Comments
Carbon Monoxide	Maintenance Plan	Published in 2014	This Maintenance Plan is required for any area that was formerly designated as non-attainment to show that it will not regress to this status.
Ozone	2008 SIP	Submitted to EPA in 2014 – pending	As of April 2014, MassDEP has determined that the Boston area is still compliant with the 2008 standard, thus the SIP status is currently pending.[1]

Source: MassDEP (http://www.mass.gov/eea/agencies/massdep/air/reports/state-implementation-plans.html).
Notes: The number of commercial and employee parking spaces allowed at Logan Airport is regulated by the Logan Airport Parking Freeze (310 Code of Massachusetts Regulations 7.30 and 40 CFR 52.1120), which is an element of the SIP under the Federal Clean Air Act.
1 In 2007, EPA promulgated a new eight-hour NAAQS for ozone. Informally called the “2008 standard” to differentiate it from the former “1997 standard,” this new standard is stricter (i.e., lower) than the former standard.

Logan Airport Air Quality Permits for Stationary Sources of Emissions

Massport was originally granted a Title V Air Quality Operating Permit for Logan Airport in September 2004 and the most recent renewal was granted in January 2013 which still applied in 2016. This permit covers all of the Massport-operated stationary sources including the Central Heating and Cooling Plant, snow melters, fuel dispensers, boilers, emergency electrical generators, and fuel storage tanks.

Assessment Methodology

For the purposes of the EDR, the analysis of air emissions associated with Logan Airport operations includes the source categories described below, each of which has its own assessment methodology, database, and assumptions. For this *2016 EDR*, Massport has used the Federal Aviation Administration (FAA)'s new Aviation Environmental Design Tool (AEDT)[5] for air quality modeling of aircraft-related emissions, which has replaced the legacy Emissions and Dispersion Modeling System (EDMS).

Aviation Environmental Design Tool (AEDT)

The AEDT model is FAA's recently approved computer model for calculating emissions from aircraft-related sources (e.g., aircraft engines, auxiliary power units (APUs), GSE, etc.). As discussed in Chapter 6, *Noise Abatement*, AEDT is also designed to assess airport noise and replaces the legacy models namely the EDMS and the Integrated Noise Model (INM). The AEDT model was developed to incorporate the most updated and best-available science, resulting in differences when comparing AEDT and EDMS results.

With respect to computing air emissions, AEDT has many of the same, or similar, attributes and functions as EDMS. These include the preparation of emission inventories and conducting atmospheric dispersion modeling. In both cases, the types of pollutants analyzed manly comprise EPA criteria pollutants (and their precursors). Greenhouse gases (GHGs) and hazardous air pollutants (HAPs) can also be included as part of the emissions inventory. Overall, the adjustments made to AEDT contribute to the most accurate and up-to-date representation of aircraft emissions modeling.

There are important differences between AEDT and EDMS when estimating airport emissions in general, and aircraft engine emissions, in particular. Many updates and corrections have been incorporated into AEDT, resulting in differences when comparing results from AEDT with EDMS. An overview of the primary differences between the two models is briefly described below:

- **Input Data** – Among the EDMS and AEDT input data, aircraft take-off weight has an effect on emissions. Because these values differ somewhat between the two models, aircraft-related emissions also differ during the take-off mode of operation. EDMS allows adjustments to take-off weights to any value in the range. AEDT does not allow adjustment to the take-off weights.

5 AEDT is a software system that models aircraft performance in space and time to estimate fuel consumption, emissions, noise, and air quality consequences. AEDT is a comprehensive tool that provides information to FAA stakeholders on each of these specific environmental impacts. AEDT facilitates environmental review activities by consolidating the modeling of these environmental impacts in a single tool. AEDT is designed to model individual studies ranging in scope from a single flight at an airport to scenarios at the regional, national, and global levels (https://aedt.faa.gov/).

- **Aircraft Operational Modes** – The aircraft operational modes differ between the models. AEDT provides a more detailed output than EDMS. This results in a variance in aircraft operational characteristics and a difference in emissions as a result of the more detailed times in mode for AEDT.
  - In EDMS, the four primary operational modes are: (i.) Take-off, (ii.) Climb out, (iii.) Cruise, and (iv.) Taxi/Idle.
  - In AEDT, the operating modes are more numerous and include: (i.) Take-off, (ii.) Climb Taxi, (iii.) Climb Ground, (iv.) Climb below 1,000 feet, (v.) Climb Below Mixing Height, (vi.) Climb Below 10,000 feet, (vii.) Cruise Above 10,000 feet, (viii.) Descend Below 10,000 feet, (ix.) Descend Below Atmospheric Mixing Height, (x.) Descend Below 1,000 feet, (xi.) Descend to Ground, (xii.) Descend Taxi, and (xiii.) Full Flight.
- **Times-In-Modes (TIM)** – Due in part to the variances in operational modes described above combined with the changes in how the aircraft climb out and cruise times are calculated, there are resultant differences in the TIMs between the two models – particularly for the airborne flight segments of the Landing-and-Takeoff (LTO) cycles. This TIM difference has an effect on total emissions over the LTO. The TIM updates to AEDT, compared to EDMS, allow for a more accurate and up-to-date representation of emissions.
- **Emission Factors** – Both AEDT and EDMS contain an array of aircraft engine emission factors that are differentiated mainly by engine model, fuel type, and operational mode. Although the majority of factors are the same in both models, there are also differences between the two. For example, the emission factors for TIO-540-J2B2 engine of the Cessna 402 is marginally different between the two models. Although a small difference, when these aircraft are a large proportion of the overall fleet combined with numerous LTOs – the resultant emissions are compounded and can vary significantly between the two models depending on the fleet mix.
- **Missing Aircraft/Engine Combinations** – Mostly pertaining to newer aircraft, there are some aircraft/engine combinations that exist in EDMS but do not exist in AEDT. For example, the A350-900/Trent XWB combination in EDMS does not exist in AEDT. The only engine option for this aircraft is the Trent 772. Also, the B787-900/Trent 1000-A combination exists in EDMS but not in AEDT. Therefore, a different engine is used in AEDT for such aircraft. The EDMS engine database is no longer being updated, and the AEDT engine database is the most current. Therefore, the AEDT aircraft/engine combinations are considered the most appropriate.

AEDT computes somewhat higher emissions of NO_x, VOC, and CO in comparison to EDMS model results. However, for the PM_{10}/$PM_{2.5}$ estimates, the results are reversed with EDMS producing higher modeled emissions than AEDT.[6] The AEDT model was developed to incorporate the most updated and best-available science, resulting in differences between AEDT and EDMS results.

6 It is important to note that the differences in aircraft emissions discussed above may not occur in all applications of AEDT and EDMS at other airports, nor will the differences necessarily be of the same magnitude. Rather, these observations are provided here to reveal the potential differences between the two models.

The differences between the AEDT and EDMS aircraft emissions results, illustrated in **Table 7-4,** are largely due to variances in operational modes between the two models and a slight change in engine emission factors. Since its release, FAA continues to enhance the AEDT model by expanding its capabilities, correcting computational errors, and making it more "user-friendly." These improvements are reflected in periodic releases of the model which are expected to continue for the foreseeable future.

Table 7-4 AEDT/EDMS Aircraft Emissions Inventory Comparison

	Pollutant (kg/day)			
Model	**VOC**	**NOx**	**CO**	**$PM_{10}/PM_{2.5}$**
2016 EDMS	760	4,293	6,144	70
2016 AEDT	798	4,897	6,166	60
% Difference between 2016 EDMS and AEDT	**5.0%**	**14.0%**	**0.4%**	**(14.3%)**

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

2016 Assessment Methodology

- **Aircraft Emissions** – FAA's AEDT is now the EPA-preferred and the FAA-required model for calculating aircraft-related emissions. The most recent version of AEDT, Version 2c Service Pack 2 (AEDT 2c SP2), was used in support of the 2016 air quality analysis. For consistency with prior EDRs, FAA's EDMS model findings were also used for comparison purposes to discern which changes are attributable to the model differences or to changes in operations and other factors.

  As for past years, the actual 2016 aircraft fleet mix at Logan Airport was used as input to AEDT and the legacy EDM model. In a few instances where the aircraft/engine type combinations operating at Logan Airport were not available in the AEDT database, guidance appropriate substitutions were made based on the closest match of aircraft and engine types. **Tables I-4** and **I-5** in Appendix I, *Air Quality/Emissions Reduction* contain the data that were used to program the models, including the aircraft and engine types, numbers of LTOs, and aircraft taxi/delay times for 2016. As is customary, the Logan Airport aircraft fleet was grouped into four categories: commercial air carriers, commuter aircraft, general aviation (GA), and cargo aircraft.

  According to these data, from 2015 to 2016 total LTOs increased by 4.9 percent with air carrier LTOs increasing by 10.2 percent, commuter LTOs decreasing by 12.9 percent, air cargo LTOs increasing by about 10.2 percent, and GA increasing by 9.4 percent.

  Updated aircraft taxi/delay times are based on data obtained from the FAA Aviation System Performance Metrics (ASPM) database for 2016.[7] According to this database, the average aircraft taxi/delay times at Logan Airport decreased from 25.9 to 25.3 minutes from 2015 to 2016 or 2.3 percent.

- **Ground Service Equipment**- Estimates of GSE emissions were based on AEDT emission factors and continue to reflect emission reductions attributable to Massport's Alternative Fuel Vehicle (AFV)

7 FAA Aviation System Performance Metrics (ASPM) database for 2016 (https://aspm.faa.gov/).

Program and the conversion of Massport and/or tenant GSE and fleet vehicles to CNG or electricity. GSE emission factors decreased measurably for most equipment in 2016 when compared to 2015. Other AEDT input data are based on the updated Logan Airport-specific GSE time-in-mode survey conducted in 2017, combined with the most recent GSE fuel use (gasoline, diesel, CNG, liquid petroleum gas, and electric) data from Massport's Vehicle Aerodrome Permit Application Program for Logan Airport. To compare EDMS to AEDT, the EDMS model used EDMS-specific emission factors for 2016, similar to the AEDT-specific emission factors used in the AEDT model for 2016.

- **Motor Vehicles** - Motor vehicle emission factors were obtained from the new, and most recent, version of EPA's MOVES model (MOVES2014a) combined with MassDEP-recommended motor vehicle fleet mix data, operating conditions, and other Massachusetts-specific input parameters.[8] In general, the emission factors obtained from MOVES2014a for 2016 were lower for VOCs, NO_x, CO, and PM when compared to 2015. The MOVES input/output files are included in Appendix I, *Air Quality/Emissions Reduction*. In addition, Chapter 5, *Ground Access to and from Logan Airport* of this *2016 EDR* provides a discussion of the on-Airport vehicle miles traveled (VMT) data used for this analysis. On-Airport VMT and vehicle speed data were predicted by the traffic simulation model, VISSIM.[9] (Refer to Chapter 5, *Ground Access to and from Logan Airport* for more information.)
- **Other Sources** - Emissions associated with fuel storage and handling, the Central Heating and Cooling Plant, snow melters, generators, space heaters, and fire training at Logan Airport were based on annual fuel throughput records for 2016, combined with appropriate EPA emission factors (for example, compilation of *Air Pollution Emission Factors* (*AP-42*) or emission factors obtained from NO_x Reasonably Available Control Technology compliance testing). When comparing 2016 to 2015, No. 2 fuel oil and natural gas usage from boiler usage increased by 76.7 percent and decreased 7.3 percent, respectively. The large increase in No. 2 fuel oil usage is primarily attributable to seasonal fluctuations and reporting based on material deliveries and not actual fuel burned. Diesel fuel used for snow melters decreased by 76.2 percent in 2016 due to a decrease from record snow levels reported in 2015. Emissions from other sources[10] represent 33.4 percent of total VOC emissions and 4 percent, or less, of total NO_x, CO, and $PM_{10}/PM_{2.5}$ emissions.

In November 2014, Massport converted the Central Heating and Cooling Plant fuel oil system from No. 6 to No. 2 fuel oil. During the conversion, the plant retained the ability to burn natural gas, which it burns approximately 97 percent of the time. Converting the Central Heating and Cooling Plant fuel oil system allows Massport to reduce energy use and air emissions while maintaining the ability to use backup fuel oil in the event of a disruption of natural gas service.

- **Particulate Matter** - Estimates of PM emissions associated with Logan Airport activities were first reported in the *2005 EDR* in response to the then recent availability of an FAA-updated method (*First Order Approximation*) for computing aircraft $PM_{10}/PM_{2.5}$ emission factors. $PM_{10}/PM_{2.5}$ emissions are now routinely reported in the EDRs including this *2016 EDR*.

8 The U.S. EPA MOVES model is an advancement to the former MOBILE6 model as it contains the most up-to-date emission factors, emission control measures, and other area-specific parameters for motor vehicle fleets nationwide (including the Boston area). For consistency with the Massachusetts State Implementation Plan (SIP), MOVES is also recommended for use by MassDEP.

9 PTV America. (2011). Verkehr In Städen Simulationsmodell- VISSIM version 5.40 [computer software]. Portland, OR.

10 Other sources include Central Heating and Cooling Plant, emergency generators, snow melters and live fire training facility.

- **Greenhouse Gases** - GHG emissions are calculated in much the same way as criteria pollutants (and their precursors). This includes the use of input data such as activity levels or material throughput rates (such as, fuel usage, VMT, electrical consumption, etc.) that are applied to appropriate emission factors (for example, in units of GHG emissions per gallon of fuel). Again, these input data were either based on Massport records or data derived from the models. Emission factors were obtained from the U.S. Energy Information Administration, the Intergovernmental Panel on Climate Change (IPCC), and EPA.

Consistent with prior EDR years, the 2016 GHG emissions inventory includes aircraft operations within the taxi-idle/delay mode and up to the top of the 3,000–foot LTO cycle. GHG emissions associated with GSE, following the guidance issued by the Airport Cooperative Research Program, ACRP Report 11, *Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories,* APUs, motor vehicles, a variety of stationary sources, and electricity usage were also included.

Massport has direct ownership or control over a very small percentage (approximately 12.5 percent in 2016) of Logan Airport-related GHG emissions and their sources (mostly limited to Massport fleet vehicles, stationary sources, and electrical consumption within Massport buildings). As with most commercial service airports, the vast majority of the GHG emission sources are owned, controlled, or generated by the airlines, other airport tenants, and the general public (motor vehicles).

In all cases, Massport undertakes a variety of programs to reduce non-Massport emissions through its support of HOV initiatives, including: subsidizing free outbound Silver Line Service from Logan Airport, supporting use of alternative fuels by airport taxis, providing an on-Airport CNG station, and providing electric plug-ins for GSE, 400 Hz Power, and pre-conditioned air at airplane gates.

Emissions Inventory in 2016

This section provides the results of the 2016 Logan Airport emissions inventory for the pollutants CO, NO_x, PM_{10}/$PM_{2.5}$, and VOCs using the AEDT and MOVES2014a models and standard emission factors for stationary sources. The following section reports on aircraft-related emissions using the AEDT model and compares it to the EDMS model for aircraft-related emissions. Emissions of O_3 are not directly computed as it is a secondary pollutant formed by the interactions of NO_x and VOCs throughout the region. Emissions of SO_2 and Pb are also not computed, as Logan Airport emission sources are very small generators of these two EPA criteria pollutants.

As stated above, the aircraft emissions inventory was computed based on the actual number of aircraft operations (LTOs), fleet mix, and operational times-in-mode at the Airport in 2016. Similarly, emissions associated with GSE, APUs, motor vehicles, fuel storage and transfer facilities, and a variety of stationary sources (such as, steam boilers, snow melters, live-fire training, and emergency generators) associated with Logan Airport were also computed based on actual conditions.

As in previous EDRs, the 2016 emissions inventory for Logan Airport is used for short-term comparisons to the *2015 EDR* results as well as for long-term comparisons to previous EDRs and ESPRs extending back to 1990. For ease of review, the tables and figures containing the 2016 results also show the results for 1990 and 2000 and then annually for 2010 to 2015. In this way, the changes in Logan Airport air quality conditions can be evaluated in both the short- and long-term time frames and on a common basis.

Table 7-5 AEDT/EDMS Total Emissions Inventory Comparison

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

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

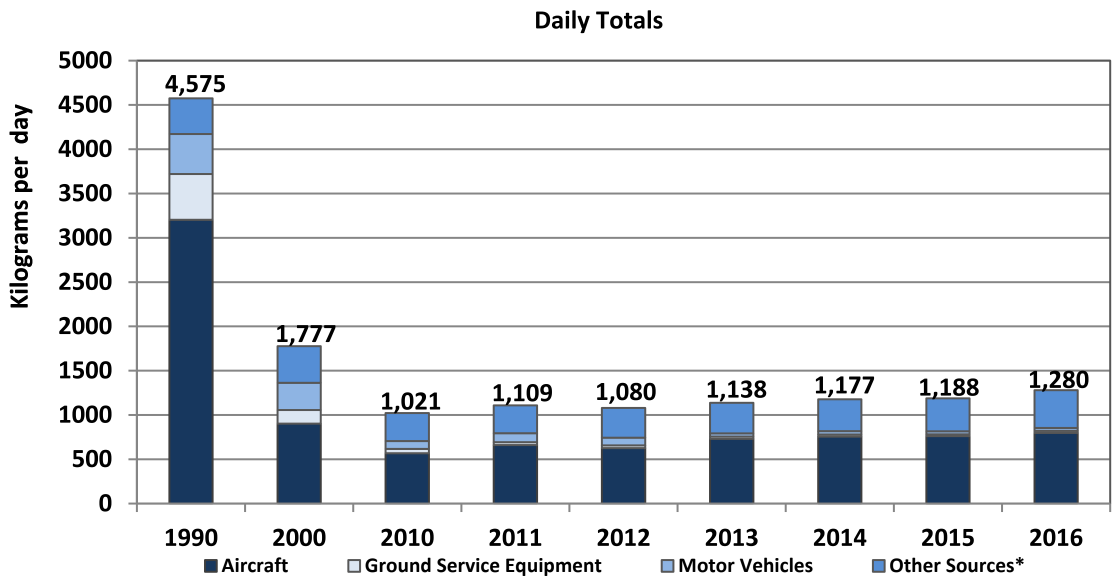
As shown in **Table 7-5**, AEDT estimates greater amounts of aircraft emissions of VOCs, NO_X, and CO in comparison to EDMS. However, EDMS estimates higher PM_{10} and $PM_{2.5}$. These model differences are discussed above.

Volatile Organic Compounds

In 2016, total VOC emissions at Logan Airport were 515 tons per year (tpy) (or 1,280 kg/day) – an increase of 7.7 percent from 2015 levels. This change is mostly due to the increase in VOC emissions associated with the fuel storage and handling at the Airport, and an increase in aircraft-related VOC emissions due to modeling changes. The long-term trend for VOC emissions over the past twenty-five years reveals a substantial decrease in these emissions associated with the Airport. **Figure 7-1** depicts the overall, long-term downward trend in VOC emissions at Logan Airport and **Figure 7-2** shows the percent breakdown of these emissions by source category in 2016. Similarly, **Table 7-6** shows the computed VOC emissions in kg/day for each emission source from 1990, 2000, and 2010 to 2016. Other key findings from this analysis include the following:

- Total aircraft-related VOC emissions increased by 4.9 percent in 2016 (AEDT) compared with 2015 (EDMS). Comparing the 2016 EDMS results to the 2016 AEDT results, aircraft-related VOC emissions increased by 5.0 percent. The increase in 2016 compared to 2015 was largely due to differences in mode calculations between AEDT and EDMS as well as variations in engine emission factors in some cases.
- GSE-related VOC emissions were approximately 14.3 percent higher in 2016 than in 2015. This was largely due to the increase in aircraft LTOs and the increase in APU operating times for narrow body air carriers and commuter aircraft, based on the updated GSE time-in-mode survey.
- VOC emissions from motor vehicles in 2016 decreased by about 8.8 percent from 2015 levels, despite an increase in on-Airport VMT. This decrease was mostly attributable to lower motor vehicle emission factors.
- VOC emissions from stationary and other non-mobile sources (fuel storage/handling, Central Heating and Cooling Plant, snow melter usage, firefighter training) increased by approximately 14.8 percent from 2015 to 2016. This change was mostly due to the increase in evaporative emissions from refueling activities.

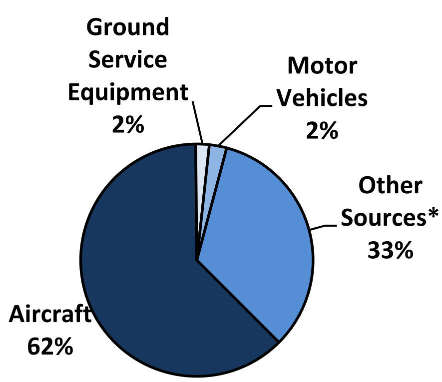
Figure 7-1 Modeled Emissions of VOCs at Logan Airport, 1990, 2000, and 2010-2016



Source: Massport and KBE 2017.
Notes: * Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.) and fueling sources. In 2016, aircraft-related emissions were calculated using AEDT.

As shown in **Figure 7-2**, in 2016 aircraft continued to represent the largest source (62.3 percent) of VOC emissions associated with Logan Airport, followed by stationary sources (33.4 percent), motor vehicles (2.4 percent), and GSE (1.9 percent).

Figure 7-2 Sources of VOC Emissions, 2016



Source: Massport and KBE 2017.
Notes: *Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.) and fueling sources. In 2016, aircraft-related emissions were calculated using AEDT.

Table 7-6 Estimated VOC Emissions (in kg/day) at Logan Airport, 1990, 2000, and 2010-2016[1]

Aircraft/GSE Model:	Logan Dispersion Modeling System (LDMS)	EDMS v4.03	EDMS v5.1.2	EDMS v5.1.3				EDMS v5.1.4.1					AEDT Version 2c SP2
Motor Vehicle Model:	**MOBILE 5a**	**MOBILE 6.0**	**MOBILE 6.2.03**					**MOVES 2010b**	**MOVES 2014**		**MOVES 2014a**		
Year:	**1990**	**2000**	**2010**		**2011**	**2012**	**2013**		**2014**		**2015**	**2016**	
Aircraft Sources													
Air carriers	2,175	514	292	292	305	378	448	447	480	480	491	504	553
Commuter aircraft	681	140	129	125	110	91	91	91	85	85	87	79	74
Cargo aircraft	303	207	70	70	69	63	44	44	48	48	47	56	61
General aviation	44	42	81	81	176	93	149	149	144	144	135	121	110
Total aircraft sources	3,203	903	572	568	660	626	732	731	757	757	761	760	798
Ground Service Equipment[2]	518	153	49	49	33	30	26	26	23	23	21	24	24
Motor Vehicles													
Ted Williams Tunnel through-traffic	N/A	12	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]
Parking/curbside[4]	192	89	20	20	20	18	17	5	3	4	4	3	3
On-airport vehicles	258	206	68	68	81	70	67	31	16	34	30	28	28
Total motor vehicle sources	450	307	86	86	101	88	84	36	19	38	34	31	31

Source: Massport

Notes: Years 2010, 2013 and 2016 were computed with previous years EDMS version to provide for a common basis of comparison. Years 2013 and 2014 were also computed with the previous year motor vehicle emission factors model.

kg/day kilograms per day. 1 kg/day is equivalent to approximately 0.40234 tons per year (tpy).

N/A Not Available.

1 See Appendix I*, Air Quality/Emissions Reduction* for 1993 to 2009 emission inventory results.

2 GSE emissions include aircraft APUs as well as vehicles and equipment converted to alternative fuels.

3 Due to the new roadway configuration and opening of the Ted Williams Tunnel there was no Ted Williams Tunnel through-traffic (which is defined as traffic passing through but not destined for the Airport) at Logan Airport beginning in 2003.

4 Parking/curbside is based on VMT analysis.

5 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

Table 7-6 Estimated VOC Emissions (in kg/day) at Logan Airport, 1990, 2000, and 2010-2016[1] (Continued)

Aircraft/GSE Model:	Logan Dispersion Modeling System (LDMS)	EDMS v4.03	EDMS v5.1.2	EDMS v5.1.3				EDMS v5.1.4.1					AEDT Version 2c SP2
Motor Vehicle Model:	**MOBILE 5a**	**MOBILE 6.0**	**MOBILE 6.2.03**					**MOVES 2010b**	**MOVES 2014**		**MOVES 2014a**		
Year:	**1990**	**2000**	**2010**		**2011**	**2012**	**2013**		**2014**		**2015**	**2016**	
Other Sources													
Fuel storage/handling	400	412	311	311	311	332	340	340	354	354	366	422	422
Miscellaneous sources[5]	4	2	5	5	4	4	5	5	5	5	6	5	5
Total other sources	404	414	316	316	315	336	345	345	359	359	372	427	427
Total Airport Sources	4,575	1,777	1,025	1,021	1,109	1,080	1,187	1,138	1,158	1,177	1,188	1,242	1,280

Source: Massport

Notes: Years 2010, 2013 and 2016 were computed with previous years EDMS version to provide for a common basis of comparison. Years 2013 and 2014 were also computed with the previous year motor vehicle emission factors model.

kg/day kilograms per day. 1 kg/day is equivalent to approximately 0.40234 tons per year (tpy).

N/A Not Available.

1 See Appendix I, *Air Quality/Emissions Reduction* for 1993 to 2009 emission inventory results.

2 GSE emissions include aircraft APUs as well as vehicles and equipment converted to alternative fuels.

3 Due to the new roadway configuration and opening of the Ted Williams Tunnel there was no Ted Williams Tunnel through-traffic (which is defined as traffic passing through but not destined for the Airport) at Logan Airport beginning in 2003.

4 Parking/curbside is based on VMT analysis.

5 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

Oxides of Nitrogen

In 2016, total NO_x emissions from all Airport-related sources were estimated to be 2,132 tpy (5,300 kg/day), which represents an increase of 24.4 percent from 2015 levels. This increase is largely due to modeling changes from EDMS to AEDT as discussed above. However, this occurrence should also be taken within the context of an overall, and long-term, decrease of 8.2 percent from 1999 levels. **Figure 7-3** illustrates these short- and long-term trends in NO_x emissions and **Table 7-7** shows the NO_x contribution for each emission source in 1990, 2000, and 2010 through 2016.

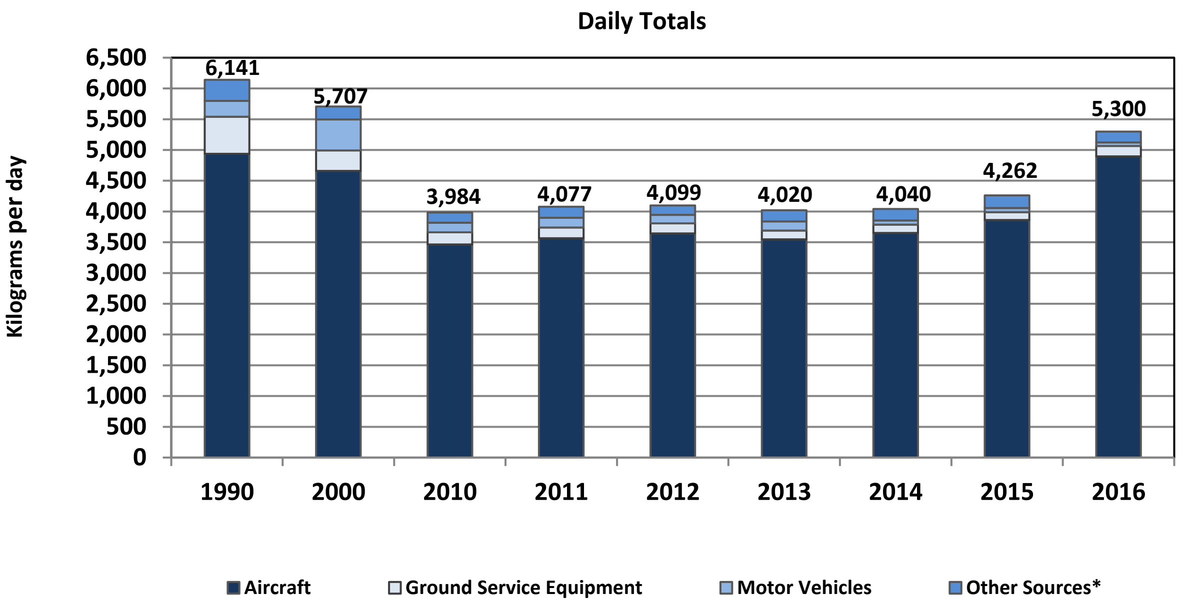
Other findings related to the 2016 NO_x emissions inventory results include the following:

- When compared to 2015 values, total aircraft-related NO_x emissions were 26.8 percent higher in 2016. Comparing the 2016 EDMS results to the 2016 AEDT results, aircraft-related NO_x emissions increased by 14.0 percent in AEDT. The increase from 2015 to 2016 was largely due to differences in how AEDT and EDMS calculate operational modes as well as minor differences in some engine emission factors and the corresponding increase in aircraft operations.
- GSE emissions of NO_x rose by 30.5 percent in 2016 compared to 2015, due mostly to an increase in aircraft operations and increased APU operating times for narrow body air carriers and commuter aircraft based on the updated GSE time-in-mode survey.
- NO_x emissions from motor vehicles in 2016 decreased by approximately 13.6 percent from 2015 levels. This reduction was largely attributable to lower NO_x motor vehicle emission factors.
- Stationary sources showed a decrease of approximately 13.1 percent in NO_x emissions in 2016 compared to 2015. This was due to decreased usage of the Massport boilers during this period compared to the previous year of unusually heavy snowfall and sustained cold weather which caused an increase in comfort heating system use.

As with VOCs, the overall, long-term trend over the past two decades reveals a substantial decrease in total NO_x emissions associated with Airport activities.

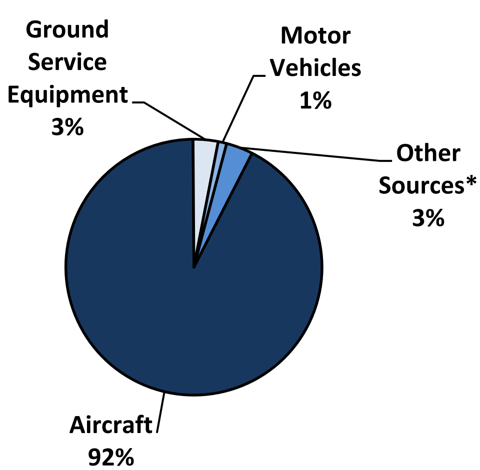
As shown in **Figure 7-4**, aircraft emissions continued to represent the largest source (92.4 percent) of NO_x at Logan Airport, followed by stationary sources (3.4 percent), GSE (3.2 percent), and motor vehicles (1.1 percent).

Figure 7-3 Modeled Emissions of NO_X at Logan Airport, 1990, 2000, and 2010-2016



Source: Massport and KBE 2017.
Notes: * Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, firefighter training, etc.). In 2016, aircraft-related emissions were calculated using AEDT.

Figure 7-4 Sources of NO_X Emissions, 2016



Source: Massport and KBE 2017.
Notes: * Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.). In 2016, aircraft-related emissions were calculated using AEDT.

Table 7-7 Estimated NOx Emissions (in kg/day) at Logan Airport, 1990, 2000, and 2010-2016[1]

Aircraft/GSE Model:	Logan Dispersion Modeling System (LDMS)	EDMS v4.03	EDMS v5.1.2	EDMS v5.1.3				EDMS v5.1.4.1					AEDT Version 2c SP2
Motor Vehicle Model:	**MOBILE 5a**	**MOBILE 6.0**	**MOBILE 6.2.03**					**MOVES 2010b**		**MOVES 2014**	**MOVES 2014a**		
Year:	**1990**	**2000**	**2010**		**2011**	**2012**	**2013**		**2014**		**2015**	**2016**	
Aircraft Sources													
Air carriers	4,554	4,202	3,031	3,037	3,128	3,154	3,090	3,158	3,245	3,245	3,470	3,912	4,476
Commuter aircraft	133	125	203	204	199	182	168	152	155	155	139	97	126
Cargo aircraft	237	284	197	197	196	192	188	188	203	203	201	224	228
General aviation	13	49	29	26	43	115	46	48	48	48	53	60	67
Total aircraft sources	4,937	4,660	3,460	3,464	3,566	3,644	3,492	3,546	3,651	3,651	3,862	4,293	4,897
Ground Service Equipment[2]	603	333	198	198	173	164	145	145	134	134	128	167	167
Motor Vehicles													
Ted Williams Tunnel through-traffic	N/A	26	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	– 3	– 3
Parking/curbside[4]	25	52	12	12	11	10	9	16	11	6	7	6	6
On-airport vehicles	232	425	144	144	148	128	117	131	90	62	59	51	51
Total motor vehicle sources	257	503	156	156	159	137	126	147	101	68	66	57	57

Source: Massport

Notes: Years 2010, 2013, and 2016 were computed with previous years EDMS version to provide for a common basis of comparison. Years 2013 and 2014 were also computed with the previous year motor vehicle emission factors model.

kg/day kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy).

N/A Not Available.

1 See Appendix I, *Air Quality/Emissions Reduction* for 1993 to 2009 emission inventory results.

2 GSE emissions include APUs as well as vehicles and equipment converted to alternative fuels.

3 Due to the new roadway configuration and opening of the Ted Williams Tunnel (TWT) there was no TWT through-traffic at Logan Airport beginning in 2003.

4 Parking/curbside data is based on VMT analysis.

5 Fuel storage/handling facilities are not a source of NOx emissions.

6 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

Table 7-7 Estimated NOx Emissions (in kg/day) at Logan Airport, 1990, 2000, and 2010-2016[1] (Continued)

Aircraft/GSE Model:	**Logan Dispersion Modeling System (LDMS)**	**EDMS v4.03**	**EDMS v5.1.2**	**EDMS v5.1.3**				**EDMS v5.1.4.1**					**AEDT Version 2c SP2**
Motor Vehicle Model:	**MOBILE 5a**	**MOBILE 6.0**	**MOBILE 6.2.03**					**MOVES 2010b**		**MOVES 2014**	**MOVES 2014a**		
Year:	**1990**	**2000**	**2010**		**2011**	**2012**	**2013**		**2014**		**2015**	**2016**	
Other Sources													
Fuel storage/handling[5]	0	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous sources[6]	344	211	166	166	179	154	182	182	187	187	206	179	179
Total other sources	344	211	166	166	179	154	182	182	187	187	206	179	179
Total Airport Sources	6,141	5,707	3,980	3,984	4,077	4,099	3,945	4,020	4,073	4,040	4,262	4,696	5,300

Source: Massport

Notes: Years 2010, 2013, and 2016 were computed with previous years EDMS version to provide for a common basis of comparison. Years 2013 and 2014 were also computed with the previous year motor vehicle emission factors model.

kg/day kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy).

N/A Not Available.

1 See Appendix I, *Air Quality/Emissions Reduction* for 1993 to 2009 emission inventory results.

2 GSE emissions include APUs as well as vehicles and equipment converted to alternative fuels.

3 Due to the new roadway configuration and opening of the Ted Williams Tunnel (TWT) there was no TWT through-traffic at Logan Airport beginning in 2003.

4 Parking/curbside data is based on VMT analysis.

5 Fuel storage/handling facilities are not a source of NOx emissions.

6 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

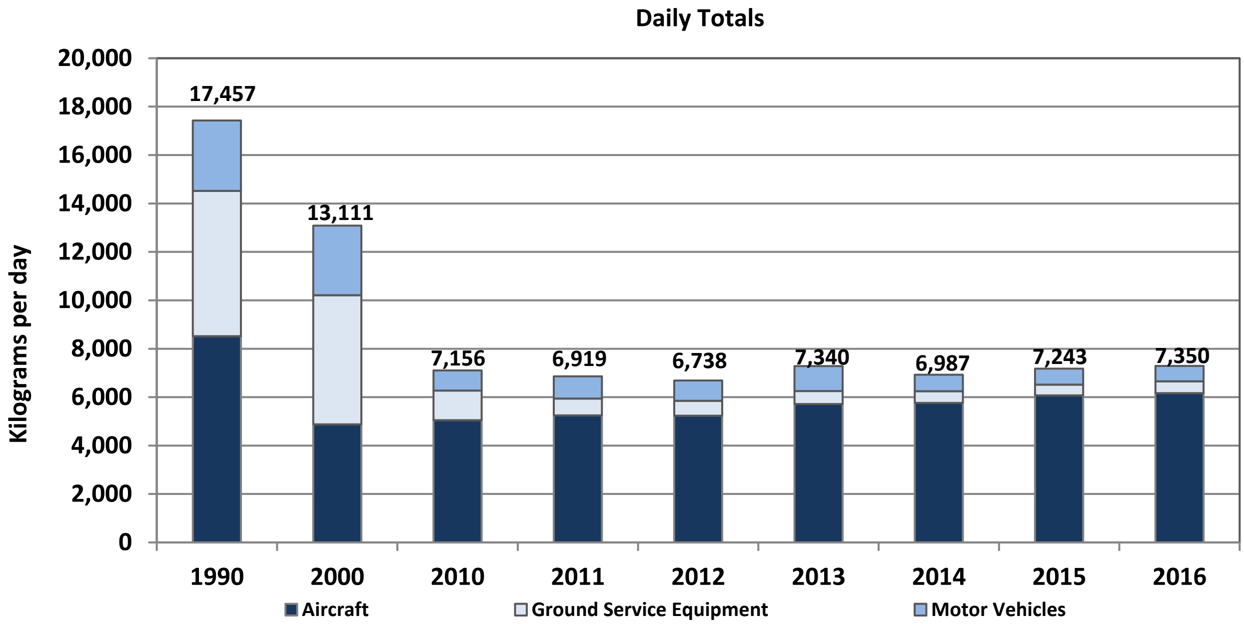
Carbon Monoxide

Total CO emissions at Logan Airport in 2016 were 2,957 tpy (7,350 kg/day) a 1.5 percent higher than 2015 levels. However, **Figure 7-5** shows the continued long-term downward trend (57.9 percent overall reduction from 1990 levels) in CO emissions associated with Airport activities. **Table 7-8** also shows the breakdown of these emissions, by source category for the years 1990, 2000, and 2010 to 2016. Other notable findings of the CO emissions inventory include:

- Aircraft-related CO emissions increased in 2016 by 1.5 percent compared to 2015 levels, mostly due to the increase in aircraft LTOs. Comparing the 2016 results between EDMS to AEDT models, aircraft-related CO emissions increased by 0.4 percent using AEDT.
- GSE CO emissions increased by approximately 11.5 percent in 2016 compared to 2015, due mostly to the increase in aircraft LTOs and increased APU operating times for narrow body air carriers and commuter aircraft based on the updated GSE time-in-mode survey.
- CO emissions from motor vehicles decreased in 2016 by approximately 3.8 percent from 2015 levels. This reduction was attributable mostly to the lower CO emission factors of the motor vehicle fleet.
- Stationary sources showed a decrease in CO emissions in 2016 by approximately 14.7 percent from 2015, largely due to decreased usage of the boilers and snow melters compared to usage during record high snow levels reported in 2015.

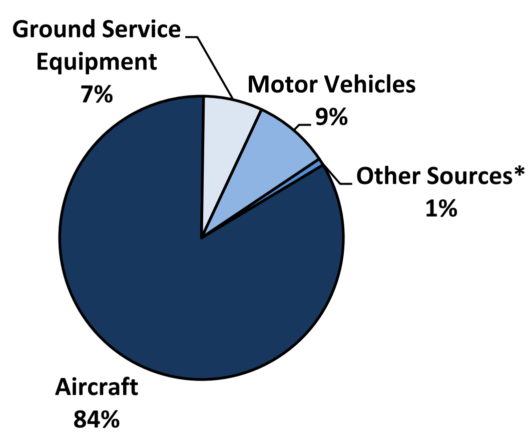
As shown in **Figure 7-6**, for 2016, aircraft emissions continued to represent the largest source (83.9 percent) of CO at Logan Airport, followed by motor vehicles (8.6 percent), GSE (6.7 percent), and stationary sources (less than 1 percent).

Figure 7-5 Modeled Emissions of CO at Logan Airport, 1990, 2000, and 2010-2016



Source: Massport and KBE 2017.
Notes: Other stationary sources not shown (this source made up less than 1 percent of the total). In 2016, aircraft-related emissions were calculated using AEDT.

Figure 7-6 Sources of CO Emissions, 2016



Source: Massport and KBE 2017.
Notes: * Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.) In 2016, aircraft-related emissions were calculated using AEDT.

Table 7-8 Estimated CO Emissions (in kg/day) at Logan Airport, 1990, 2000, and 2010-2016[1]

Aircraft/GSE Model:	Logan Dispersion Modeling System (LDMS)	EDMS v4.03	EDMS v5.1.2	EDMS v5.1.3				EDMS v5.1.4.1				AEDT Version 2c SP2	
Motor Vehicle Model:	**MOBILE 5a**	**MOBILE 6.0**	**MOBILE 6.2.03**					**MOVES 2010b**		**MOVES 2014**	**MOVES 2014a**		
Year:	**1990**	**2000**	**2010**		**2011**	**2012**	**2013**		**2014**		**2015**	**2016**	
Aircraft Sources													
Air carriers	6,613	2,994	2,531	2,531	2,592	2,816	3,320	3,323	3,486	3,486	3,729	3,879	3,653
Commuter aircraft	977	1,188	2,629	2,086	2,042	1,928	1,978	1,907	1,795	1,795	1,826	1,737	1,998
Cargo aircraft	576	400	248	259	246	183	155	155	164	164	167	192	201
General aviation	352	295	177	173	370	304	345	334	319	319	353	336	314
Total aircraft sources	8,518	4,876	5,585	5,049	5,250	5,232	5,798	5,719	5,764	5,764	6,075	6,144	6,166
Ground Service Equipment[2]	6,001	5,335	1,222	1,222	694	618	533	533	484	484	442	493	493
Motor Vehicles													
Ted Williams Tunnel through-traffic	N/A	133	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]
Parking/curbside[4]	1,218	495	106	106	110	104	104	94	57	51	28	37	37
On-airport vehicles	1,689	2,245	726	726	806	737	742	935	591	630	630	596	596

Table 7-8 Estimated CO Emissions (in kg/day) at Logan Airport, 1990, 2000, and 2010-2016[1] (Continued)

Aircraft/GSE Model:	**Logan Dispersion Modeling System (LDMS)**	**EDMS v4.03**	**EDMS v5.1.2**	**EDMS v5.1.3**				**EDMS v5.1.4.1**				**AEDT Version 2c SP2**	
Motor Vehicle Model:	**MOBILE 5a**	**MOBILE 6.0**	**MOBILE 6.2.03**					**MOVES 2010b**		**MOVES 2014**	**MOVES 2014a**		
Year:	**1990**	**2000**	**2010**		**2011**	**2012**	**2013**		**2014**		**2015**	**2016**	
Other Sources													
Fuel storage/handling[5]	0	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous sources[6]	31	27	53	53	59	48	59	59	58	58	68	58	58
Total other sources	31	27	53	53	59	48	59	59	58	58	68	58	58
Total Airport Sources	17,457	13,111	7,962	7,156	6,919	6,738	7,236	7,340	6,954	6,987	7,243	7,328	7,350

Source: Massport

Notes: Years 2010 and 2013 were computed with previous years EDMS version to provide for a common basis of comparison. Years 2013 and 2014 were also computed with the previous year motor vehicle emission factors model.

N/A Not Available.

1 See Appendix I, *Air Quality/Emissions Reduction* for 1993 to 2009 emission inventory results.

2 GSE emissions include aircraft APUs as well as vehicles and equipment converted to alternative fuels.

3 Due to the new roadway configuration and opening of the Ted Williams Tunnel, there was no Ted Williams Tunnel through-traffic at Logan Airport beginning in 2003.

4 Parking/curbside is based on VMT analysis.

5 Fuel storage/handling facilities are not a source of NOx emissions.

6 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

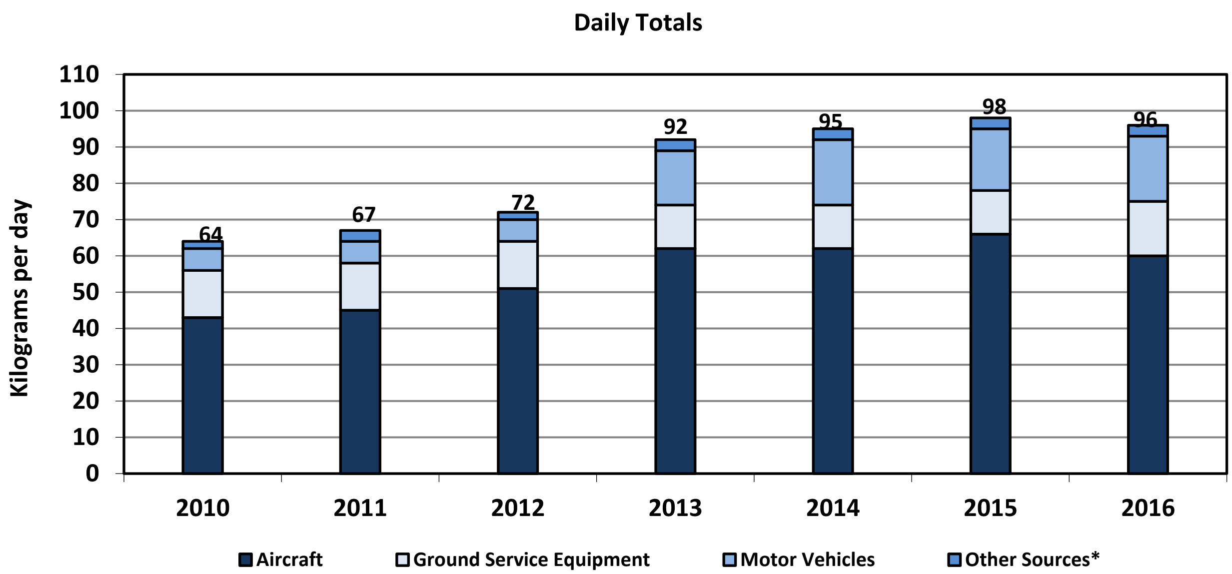
Particulate Matter

Estimated $PM_{10}/PM_{2.5}$ emissions at Logan Airport in 2016 are presented in **Table 7-9**. These results show total emissions of 39 tpy (96 kg/day), or 2.0 percent lower than 2015 levels. Explanations of these results and other key findings include the following:

- Estimated aircraft-related $PM_{10}/PM_{2.5}$ emissions decreased by approximately 9.1 percent in 2016 compared to 2015 levels, due mostly to differences in modeling. Comparing the 2016 results between EDMS and AEDT models, aircraft-related $PM_{10}/PM_{2.5}$ emissions decreased by 14.3 percent in AEDT.
- $PM_{10}/PM_{2.5}$ associated with GSE/APU emissions increased by 25 percent in 2016 when compared to 2015, largely due to the increase in aircraft LTOs and increased APU operating times for narrow body air carriers and commuter aircraft based on the updated GSE time-in-mode survey.
- $PM_{10}/PM_{2.5}$ emissions from motor vehicles increased by 5.9 percent in 2016 when compared to 2015 levels, primarily attributable to lower motor vehicle emission factors being offset by an increase in motor vehicle volumes.
- Stationary source emissions of $PM_{10}/PM_{2.5}$ remained about the same in 2016 compared to 2015.

As shown in **Figures 7-7** and **7-8**, aircraft emissions represent the largest source (62.5 percent) of $PM_{10}/PM_{2.5}$ at Logan Airport, followed by motor vehicles (18.8 percent), GSE (15.6 percent), and stationary sources, such as the Central Heating and Cooling Plant, snow melter usage, and fire training (3.1 percent).

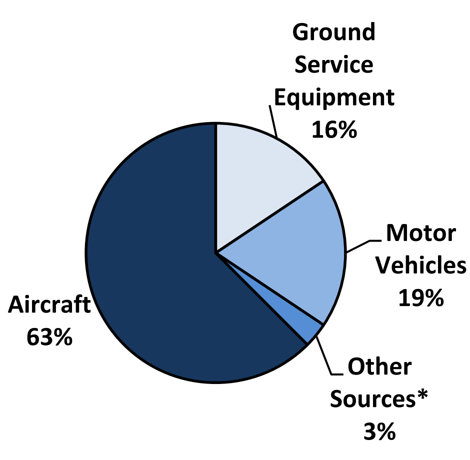
Figure 7-7 Modeled Emissions of $PM_{10}/PM_{2.5}$ at Logan Airport, 2010-2016



Source: Massport and KBE 2017.

Notes: 2005 (not shown) was the first year PM was included in the EDR/ESPR emission inventories.
The increase in emissions from 2012 to 2013 were primarily due to changes in the current EDMS and MOVES computer models.
In 2016, aircraft-related emissions were calculated using AEDT.
* Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.).

Figure 7-8 Sources of $PM_{10}/PM_{2.5}$ Emissions, 2016



Source: Massport and KBE 2017.

Note: * Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.

Table 7-9 Estimated PM_{10}/$PM_{2.5}$ Emissions (in kg/day) at Logan Airport, 2010-2016[1]

Aircraft/GSE Model:	**EDMS v5.1.2**	**EDMS v5.1.3**				**EDMS v5.1.4.1**					**AEDT Version 2c SP2**
Motor Vehicle Model:	**MOBILE 6.2.03**					**MOVES 2010b**		**MOVES 2014**	**MOVES 2014a**		
Year:	**2010**		**2011**	**2012**	**2013**		**2014**		**2015**	**2016**	
Aircraft Sources											
Air carriers	34	34	35	43	41	48	48	48	53	57	52
Commuter aircraft	4	4	3	2	2	7	7	7	7	6	4
Cargo aircraft	3	3	3	3	2	3	3	3	3	3	2
General aviation	2	2	4	3	3	4	4	4	4	4	2
Total aircraft sources	43	43	45	51	48	62	62	62	66	70	60
Ground Service Equipment[2]	13	13	13	13	12	12	12	12	12	15	15
Motor Vehicles											
Parking/curbside[3]	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
On-airport vehicles	6	6	6	6	6	14	14	18	16	17	17
Total motor vehicle sources	6	6	6	6	6	15	14	18	17	18	18
Other Sources											
Fuel storage/handling[4]	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous sources[5]	2	2	3	2	3	3	3	3	3	3	3
Total other sources	2	2	3	2	3	3	3	3	3	3	3
Total Airport Sources	64	64	67	72	69	92	91	95	98	106	96

Source: Massport

Notes: Years 2010 and 2013 were computed with previous years EDMS version to provide for a common basis of comparison. Years 2013 and 2014 were also computed with the previous year motor vehicle emission factors model.

kg/day kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy); PM - particulate matter

1 It is assumed that all PM are less than 2.5 microns in diameter (PM2.5). See Appendix I, *Air Quality/Emissions Reduction* for 2005 to 2009 emission inventory results.

2 GSE emissions include APUs as well as vehicles and equipment converted to alternative fuels.

3 Parking/curbside is based on VMT analysis.

4 Fuel storage and handling facilities are not sources of PM emissions.

5 Includes the Central Heating and Cooling Plant, emergency electricity generation, fire training, snow melters, and other stationary sources.

Greenhouse Gas (GHG) Assessment

GHGs are known to contribute to climate change, although there is still some uncertainty regarding the global magnitude of this impact and the associated short- and long-term remedies. In April 2009, EPA issued a proposed finding that GHGs also contribute to air pollution that may endanger public health or welfare. This action has laid the initial legal groundwork for the regulation of GHG emissions nation-wide under CAA, although currently there are no specific U.S. laws or regulations that call for the regulation of GHGs for airports directly.[11] Current estimates of aviation-related GHG emission contributions to man-made totals range from 2 to 4 percent world-wide, and approximately 3 percent in the United States.[12,13]

In May 2010, the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) revised the *Massachusetts Environmental Policy Act (MEPA) Greenhouse Gas Emissions Policy and Protocol*.[14] Under the revised policy, certain projects subject to review under MEPA (though not these annual EDR/ESPR filings) are required to:

- Quantify GHG emissions generated by a proposed project; and
- Identify measures to avoid, minimize, or mitigate such emissions.[15]

With respect to this *2016 EDR* GHG emissions inventory[16] the following information is noteworthy:

- Even though the *2016 EDR* is not subject to the MEPA GHG policy, since it does not propose any discrete projects, Massport continues to voluntarily prepare an inventory of GHG emissions both directly and indirectly associated with the Airport starting with the *2007 EDR*.
- The emission source categories in the *2016 EDR* satisfy MEPA's requirement to analyze the environmental impacts of direct and indirect mobile and stationary source emissions.
- Consistent with previous years, the 2016 GHG emissions inventory was prepared following methodological guidance by the Transportation Research Board's (TRB) Airport Cooperative Research

11 GHG emission reduction measures have been adopted by the EPA for new aircraft engines, but these regulations do not apply directly to airports.

12 Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, New York City, NY. November 2014.

13 U.S. Governmental Accountability Office (GAO), Aviation and the Environment, NextGen and Research and Development Are Keys to Reducing Emissions and Their Impact on Health and Climate, May 6, 2008.

14 Revised MEPA Greenhouse Gas Emissions Policy and Protocol, Massachusetts Executive Office of Energy and Environmental Affairs, effective May 5, 2010.

15 These GHG are comprised primarily of carbon dioxide (CO_2), methane (CH_4), nitrous oxides (N_2O), and three groups of fluorinated gases (i.e., sulfur hexafluoride [SF_6], hydrofluorocarbons [HFCs], and perfluorocarbons [PFCs]). GHG emission sources associated with airports are generally limited to CO_2, CH_4, and N_2O.

16 This EDR GHG inventory is one of the three that Massport prepares annually; however, the other two comprise only stationary sources of GHGs and are filed with MassDEP and the EPA respectively. These reports are for Massport-owned and -operated equipment only, and do not cover any tenant owned/operated-equipment or facilities.

Program (ACRP).[17] The inventory assigns GHG emissions based on ownership or control (whether it is controlled by Massport, the airlines or other airport tenants, or the general public).

- The 2016 GHG emissions inventory includes aircraft operations within the ground-based taxi-idle/delay mode and up to the top of the 3,000–foot LTO cycle. For estimating GHGs, the LTO cycle (up to 3,000 feet) uses the default mixing height in EDMS and AEDT. GHG emissions associated with GSE/APU, motor vehicles, a variety of stationary sources, and electricity usage were also included.
- Massport has direct ownership or control over a small percentage of the GHG emission sources (which include Massport fleet vehicles, stationary sources, and electrical consumption within Massport buildings). The vast majority of the emission sources are owned or controlled by the airlines, other airport tenants (such as rental car companies), and the general public (such as passenger motor vehicles).
- Massport also prepares two other GHG emissions inventories for stationary sources at Logan Airport:
  - A GHG emissions inventory for the MassDEP GHG Emissions Reporting Program for those sources meeting the criteria for Category 1 and Scope 1 (only those sources under the direct ownership and control of Massport);[18] and
  - EPA Greenhouse Gas Summary Report.[19]

This EDR analysis followed EEA guidelines and uses widely-accepted emission factors that are considered appropriate for airports, including International Organization for Standardization (ISO) New England electricity-based values. The analysis is also consistent with ACRP guidance.

For consistency and comparative purposes, GHG emissions are segregated by ownership and control into categories. These three categories (listed in **Table 7-10**) are further characterized by the degree of control that Massport has over the GHG emission sources.

- **Category 1: Massport Owned** – By definition, these GHG emissions arise from sources that are owned and controlled by the reporting entity (in this case, Massport). More precisely, Category 1 typically represents sources which are owned by the entity - or sources which are not owned by the entity, but over which the entity can exert control. At Logan Airport, these sources include Massport-owned and controlled stationary sources (boilers, generators, etc.), fleet vehicles, and purchased electricity. On-airport ground transportation and off-airport employee vehicle trips are also included as Category 1 emissions as they are partly controlled by the airport.
- **Category 2: Tenant Owned** – This category comprises sources owned and controlled by airlines and airport tenants, and include aircraft (on-ground taxi/idle and within the LTO up to 3,000 feet), GSE/APU, electrical consumption, and tenant employee vehicles.
- **Category 3: Public/Private Owned** – This category comprises GHG emissions associated with passenger ground access vehicles. These include private automobiles, taxis, limousines, buses, and shuttle vans operating on the off-airport roadway network.

17 Transportation Research Board, Airport Cooperative Research Program, ACRP Report 11, Project 02-06, *Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories*. http://onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_011.pdf.

18 Boston-Logan International Airport, Massachusetts Department of Environmental Protection GHG Emissions Reporting Program, 2017.

19 U.S. EPA Greenhouse Gas Summary Report for Boston-Logan International Airport for calendar year 2016.

Consistent with ACRP guidelines, the operational boundaries of the GHG emissions are also delineated, reflecting the scope of the emission source (**Table 7-10**) and include:

- **Scope 1/Direct** – GHG emissions from sources that are owned and controlled by the reporting entity (in this case, Massport) such as stationary sources and airport-owned fleet motor vehicles.
- **Scope 2/Indirect** – GHG emissions associated with the generation of electricity consumed, but generated off-site at public utilities.
- **Scope 3/Indirect and Optional** – GHG emissions that are associated with the activities of the reporting entity (in this case, Massport), but are associated with sources that are owned and controlled by others. These include aircraft-related emissions, emissions from airport tenant's activities, as well as ground transportation to and from the airport.

It is also important to note that the GHG emissions inventory computed for this *2016 EDR* is consistent with the data provided by Massport for the MassDEP and EPA GHG inventories for Logan Airport. However, the *2016 EDR* emissions inventory presented to MEPA is more comprehensive, as it covers all three scopes of GHG emissions including those from tenants and the public.[20] By comparison, the EPA GHG Reporting Program covers only stationary sources (Category 1 and Scope 1).

Table 7-11 presents the 2016 GHG emissions inventory, reported in CO_2 equivalent values.[21] As shown, Massport-controlled emissions represent only 12.4 percent of total GHG emissions at the Airport. By comparison, aircraft, GSE, and other tenant-based emissions represent 70.0 percent, purchased electricity represents 8.3 percent, and passenger ground access vehicle emissions represents 9.3 percent of total GHG emissions. Aircraft represent the largest source of emissions followed by motor vehicles and electricity generation as shown in **Figure 7-9**.

When segregated by scopes, aircraft, GSE, and passenger vehicles (Scope 3) represent the largest source of GHG emissions at 79.3 percent, with electrical consumption (Scope 2) at 8.3 percent, and Massport-controlled sources (Scope 1) at 12.4 percent (refer to **Figure 7-9**).

Overall, total GHG emissions in 2016 increased by 2.8 percent from 2015 levels. Comparing the 2016 EDMS results and the 2016 AEDT results, aircraft-related GHG emissions increased by 2.8 percent. The increase from 2015 to 2016 is largely due to differences in the operational mode calculations between EDMS and AEDT. Total Logan Airport GHG emissions remained less than 1 percent of state-wide emissions as shown in **Figure 7-10**. Massport plans to continue to annually update this GHG Emissions Inventory for Logan Airport.

20 However, aircraft cruise mode emissions above the 3,000-foot LTO cycle were not included.

21 CO_2 equivalent values are based upon the Global Warming Potential values of 1 for CO_2, 28 for CH_4, and 265 for N_2O (based on a 100-year period) as presented in the IPCC Fifth Assessment Report (2014).

Table 7-10 Ownership Categorization and Emissions Category/Scope

Owning/Controlling Entity Categories	Source	Category/Scope
Massport Owned and/or Controlled	Massport Fleet Vehicle	Category 1/Scope 1
	On-airport Ground Transportation	Category 1/Scope 1
	Off-airport Employee Vehicle Trips	Category 1/Scope 3
	On-airport Parking Lots	Category 1/Scope 1
	Stationary Sources (includes generators, boilers, etc.)	Category 1/Scope 1
	Fire Training	Category 1/Scope 1
	Electrical Consumption	Category 1/Scope 2
Tenant Owned and/or Controlled (includes airlines, government, concessionaires, aircraft operators, fixed-based operators, etc.)	Aircraft (on-ground, within the LTO up to 3,000 feet)	Category 2/Scope 3
	Auxiliary Power Units	Category 2/Scope 3
	Ground Support Equipment	Category 2/Scope 3
	Off-airport Employee Vehicle Trips	Category 2/Scope 3
	Electrical Consumption	Category 2/Scope 2
Public Owned and Controlled	Off-airport Vehicle Trips (Includes private automobiles, taxis, limousines, buses, shuttle vans, etc., operating on the off-airport roadway network)	Category 3/Scope 3

Notes: Follows ACRP guidance.
LTO Landing and Takeoff.

Table 7-11 Estimated Greenhouse Gas Emissions Inventory (in MMT of CO_2eq) at Logan Airport, 2016[1]

Source	Category	Scope	CO_2	N_2O	CH_4	Totals
Massport-Controlled Emissions						
Ground Support Equipment[2]	1	1	0.01	<0.01	<0.01	0.01
Massport Shuttle Bus	1	1	<0.01	<0.01	<0.01	<0.01
Massport Express Bus	1	1	<0.01	<0.01	<0.01	<0.01
On-Airport Roadways[3]	1	1	0.03	<0.01	<0.01	0.03
Off-Airport Roadways (Employees)[4]	1	3	<0.01	<0.01	<0.01	<0.01
Parking Lots	1	1	0.01	<0.01	<0.01	0.01
Stationary Sources[5]	1	1	0.03	<0.01	<0.01	0.03
Total Massport Emissions (12.4%)			**0.08**	**<0.01**	**<0.01**	**0.08**
Tenant Emissions						
Aircraft – Ground[6]	2	3	0.19	<0.01	<-[11]	0.19
Aircraft – Ground to 3000 feet[7]	2	3	0.21	<0.01	<0.01	0.22
Aircraft Engine Startup	2	3	<0.01	<0.01	<0.01	<0.01
Ground Support Equipment	2	3	0.01	<0.01	<0.01	0.01
Auxiliary Power Units	2	3	0.01	<0.01	-[11]	0.01
Off-Airport Roadways (Employees)[4]	2	3	0.03	<0.01	<0.01	0.03
Total Tenant Emissions (70.0%)			**0.45**	**<0.01**	**<0.01**	**0.46**
Purchased Electricity Emissions[8]						
Massport	1	2	<0.01	<0.01	<0.01	0.01
Tenant and Common Area	2 and 3	2	0.05	<0.01	<0.01	0.05
Total Purchased Electricity Emissions (8.3%)			**0.05**	**<0.01**	**<0.01**	**0.05**
Passenger Vehicle Emissions						
Off-Airport Roadways[4]	3	3	0.06	<0.01	<0.01	0.06
Total Passenger Vehicle Emissions (9.3%)			**0.06**	**<0.01**	**<0.01**	**0.06**
Total Logan Airport Emissions[9]			**0.65**	**<0.01**	**<0.01**	**0.65**
Percent of Statewide Totals[10]			<1.0%	<1.0%	<1.0%	<1.0%

Source: Massport

Notes:

1 MMT - million metric tons of CO_2 equivalents (1 MMT = 1.1M Short Tons). CO_2 equivalents (CO_2eq) are bases for reporting the three primary GHGs (e.g., CO_2, N_2O, and CH_4) in common units. Quantities are reported as "rounded" and truncated values for ease of addition.

2 Ground Support Equipment include the Logan Airport fleet. Emissions were calculated based on fuel usage.

3 On-airport roadways based on on-site vehicle miles traveled (VMT) and includes all vehicles.

4 Off-site roadways based on off-site Airport-related VMT and an average round trip distance of 60.5 miles (2010 Passenger Ground Access Survey).

5 Other sources include Central Heating and Cooling Plant, emergency generators, snow melters, and live fire training facility.

6 Aircraft – Ground emissions include taxi-in, taxi-out and ground-based delay emissions based on AEDT fuel usages.

7 Aircraft – Ground to 3,000 feet include takeoff, climb out, and approach emissions up to a height of 3,000 feet based on AEDT fuel usages.

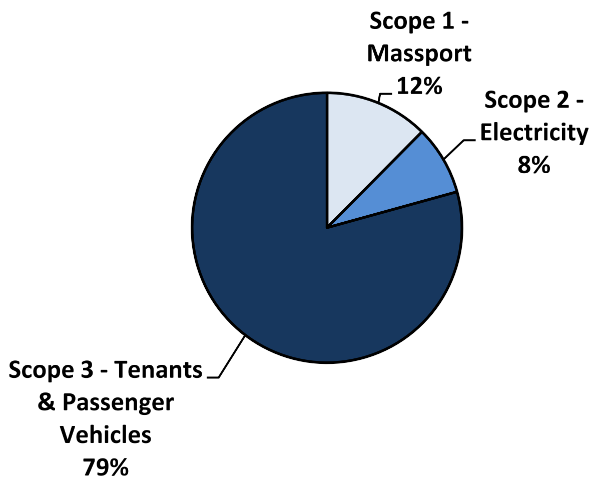
8 Emissions from electrical consumption occurs off-airport at power generating plants.

9 Total Emissions = Airport + Tenant + Public.

10 Percentage based on relative amount of total emissions to statewide total from World Resources Institute (cait.wri.org).

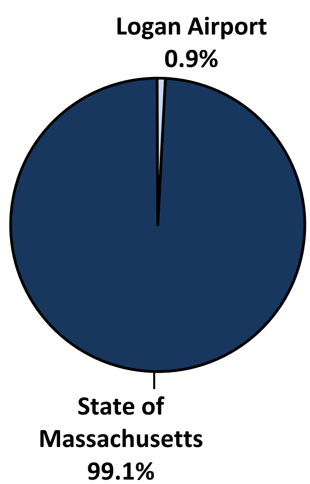
11 Contributions of CH_4 emissions from commercial aircraft are reported as zero. Years of scientific measurement campaigns conducted at the exhaust exit plane of commercial aircraft gas turbine engines have repeatedly indicated that CH_4 emissions are consumed over the full emission flight envelope [Reference: Aircraft Emissions of Methane and Nitrous Oxide during the Alternative Aviation Fuel Experiment, Santoni et al., Environ. Sci. Technol., July 2011, Volume 45, pp. 7075-7082]. As a result, the EPA published that: "...methane is no longer considered to be an emission from aircraft gas turbine engines burning Jet A at higher power settings and is, in fact, consumed in net at these higher powers." [Reference: EPA, Recommended Best Practice for Quantifying Speciated Organic Gas Emissions from Aircraft Equipped with Turbofan, Turbojet, and Turboprop Engines, May 27, 2009 [EPA-420-R-09-901], http://www.epa.gov/otaq/aviation.htm]. In accordance with the following statements in the 2006 IPCC Guidelines (IPCC 2006), FAA does not calculate CH_4 emissions for either the domestic or international bunker commercial aircraft jet fuel emissions inventories. "Methane (CH_4) may be emitted by gas turbines during idle and by older technology engines, but recent data suggest that little or no CH_4 is emitted by modern engines." "Current scientific understanding does not allow other gases (e.g., N_2O and CH_4) to be included in calculation of cruise emissions." (IPCC 1999).

Figure 7-9 Sources of GHG Emissions, 2016



Source: Massport and KBE 2017.
Notes: Scope 1 emissions are from sources that are owned or controlled by Massport, Scope 2 emissions are from electrical consumption, which are generated off-Airport at power generating plants, and Scope 3 emissions are from aircraft, GSE, and ground transportation to and from the Airport.

Figure 7-10 Logan Airport GHG Emissions Compared to State-Wide Emissions



Source: World Resources Institute, Massport, and KBE 2017.

Table 7-12 provides GHG data for Logan Airport from 2007 through 2016, by source and by comparison to statewide totals.

Table 7-12 Comparison of Estimated Total Greenhouse Gas (GHG) Emissions (MMT of CO2eq) at Logan Airport – 2007 through 2016

Source	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Direct Emissions[2]										
Aircraft[3]	0.22	0.21	0.19	0.18	0.19	0.19	0.19	0.20	0.21	0.19
GSE/APUs	0.08	0.08	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01
Motor vehicles[4]	0.03	0.03	0.03	0.03	0.04	0.03	0.05	0.05	0.05	0.05
Other sources[5]	0.04	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
Total Direct Emissions	0.37	0.35	0.27	0.27	0.28	0.26	0.29	0.29	0.32	0.29
Indirect Emissions[6]										
Aircraft[7]	0.18	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.22
Motor vehicles[8]	0.05	0.05	0.05	0.05	0.06	0.05	0.08	0.07	0.08	0.09
Electrical consumption[9]	0.09	0.08	0.07	0.07	0.08	0.08	0.06	0.06	0.06	0.05
Total Indirect Emissions	0.32	0.30	0.29	0.29	0.30	0.30	0.31	0.30	0.32	0.36
Total Emissions[10]	0.69	0.65	0.56	0.56	0.58	0.57	0.60	0.60	0.63	0.65
Percent of State Totals[11]	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Sources: Massport and KBE.

Notes:

1 MMT – million metric tons of CO_2 equivalents (1 MMT = 1.1M Short Tons). CO_2 equivalents (CO_2eq) are bases for reporting the three primary GHGs (e.g., CO_2, N_2O and CH_4) in common units. Quantities are reported as "rounded" and truncated values for ease of addition.

2 Direct emissions are those that occur in areas located within the Airport's geographic boundaries.

3 Direct aircraft emissions based engine start-up, taxi-in, taxi-out and ground-based delay emissions.

4 Direct motor vehicle emissions based on on-site vehicle miles traveled (VMT).

5 Other sources include Central Heating and Cooling Plant, emergency generators, snow melters and live fire training facility.

6 Indirect emissions are those that occur off the Airport site.

7 Indirect aircraft emissions are based on take-off, climb-out and landing emissions which occur up to an altitude of 3,000 ft., the limits of the LTO cycle.

8 Indirect motor vehicle emissions based on off-site Airport-related VMT and an average round trip distance of approximately 60 miles.

9 Electrical consumption emissions occur off-airport at power generating plants.

10 Total Emissions = Direct +Indirect.

11 Percentage based on relative amount of Airport total of direct emissions to statewide total from World Resources Institute (cait.wri.org).

GHG Emissions Normalized by Passengers and Building Area

In response to the March 9, 2018 Certificate from the Secretary of the Executive Office of Energy and Environmental Affairs on the *2016 EDR Notice of Project Change*, Massport has augmented its GHG reporting to include the following metrics:

- GHG emissions (Scopes 1 and 2) per passenger (lbs CO_2e);
- Building energy use intensity (kBTU per square foot); and
- Building GHG emissions per square foot (lbs CO_2e per square foot).

As shown in **Table 7-12**, total GHG emissions at Logan Airport have remained relatively constant over the past 10 years while the number of passengers passing through the Airport have increased by over 29 percent. The total square footage of Logan Airport buildings has also increased over this time-period to more efficiently accommodate growing passenger levels. Normalizing the data by number of passengers and square feet shows that Logan Airport's energy efficiency has increased over time.

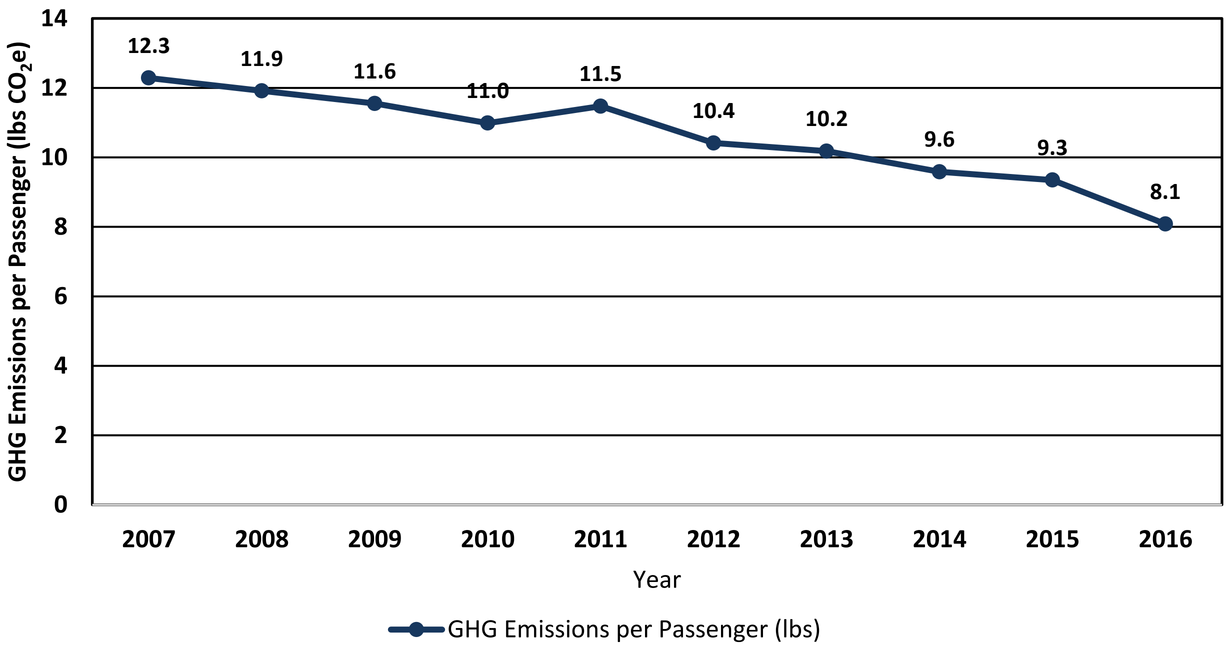
GHG emissions per passenger have decreased by over 34 percent from 2007 to 2016. **Figure 7-11** includes Scopes 1 and 2 emissions only; these emissions are from sources that are owned or controlled by Massport or are from on-Airport electrical consumption.

Figure 7-12 shows Logan Airport's building energy use intensity, which is a measure of energy consumption per square foot. Logan Airport's energy use intensity has decreased by over 23 percent from 2007 to 2016. **Figure 7-13** shows Logan Airport's building GHG emissions per square foot, which has decreased by over 43 percent from 2007 to 2016.

These figures demonstrate that Logan Airport is operating more efficiently over time, shifting to cleaner fuel sources, and serving more passengers in a larger building footprint with less energy. The following Massport initiatives have contributed to this success:

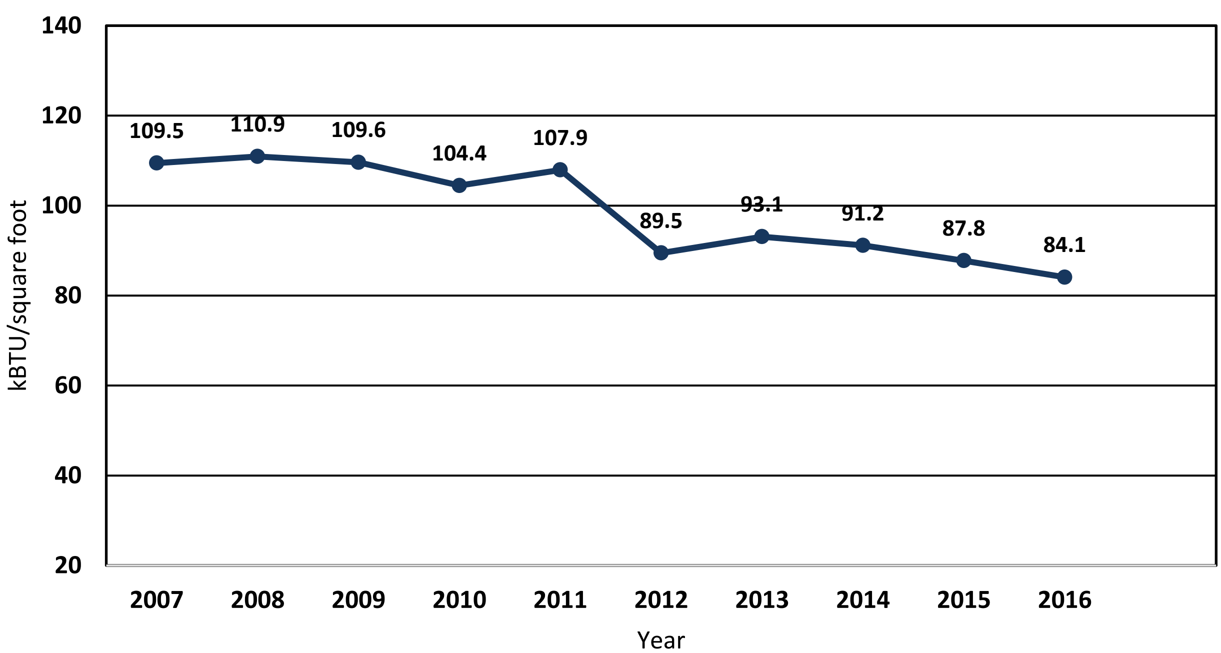
- Commitment to Sustainable Design Standards and Guidelines;
- Constructing and operating facilities to LEED standards;
- Ongoing energy efficiency projects, such as converting to light-emitting diode (LED) lighting and upgrading to energy-efficient heating, ventilation, and air conditioning (HVAC) equipment; and
- Installation of on-site renewable energy sources, including solar and wind.

Figure 7-11 Greenhouse Gas Emissions (Scopes 1 and 2) per Passenger (lbs CO_2e), 2007-2016



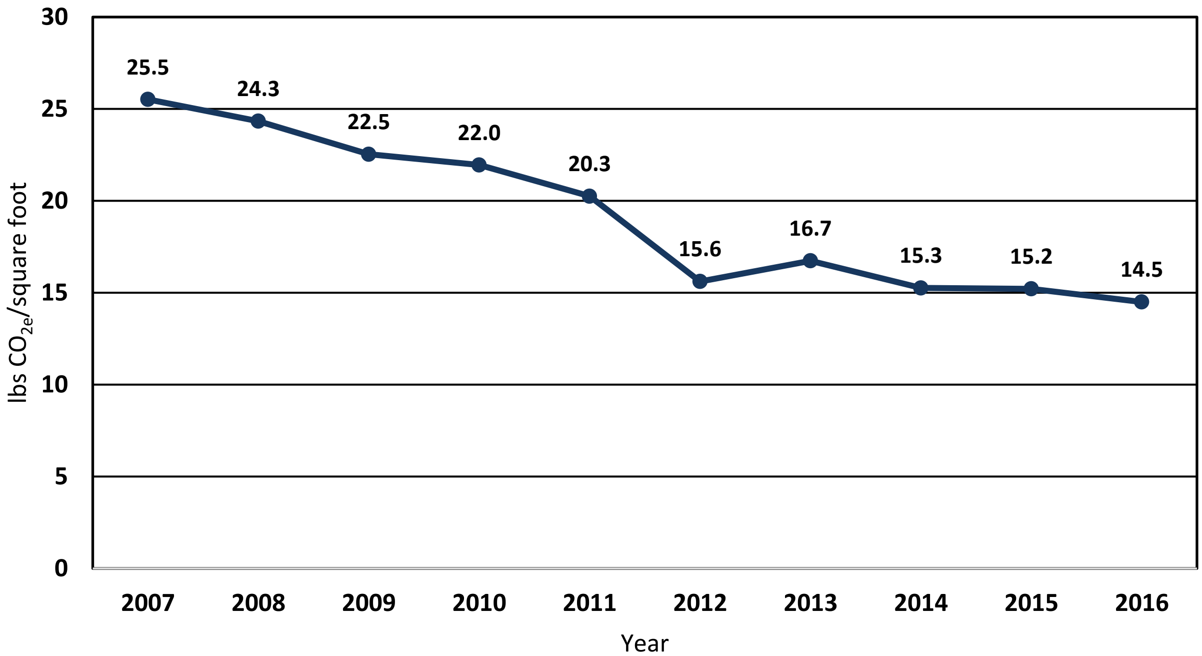
Source: Massport.
Note: Includes Scopes 1 and 2 data as shown in Table 7-12.

Figure 7-12 Building Energy Use Intensity (kBTU/Square Foot), 2007-2016



Source: Massport.
Note: kBTU = thousand British thermal units.

Figure 7-13 Building Greenhouse Gas Emissions (lbs CO_2e) per Square Foot, 2007-2016



Source: Massport.

Air Quality Emissions Reduction

As part of implementing and advancing its ongoing air quality management strategy for Logan Airport, Massport has established a number of goals and objectives to address air emissions from Airport operations, including the minimization of Airport-related emissions through the reduction of ground service equipment (GSE) and Massport vehicle fleet emissions. This section presents an update on these initiatives at Logan Airport.

Alternative Fuel Vehicles Program

A component of Massport's Air Quality Management Program is the AFV Program. The AFV Program is designed to replace Massport's conventionally-fueled fleet with alternatively fueled or powered vehicles, when feasible, to help reduce emissions associated with Logan Airport operations. Massport now operates 99 vehicles powered by CNG, propane, E85 flex fuel, or operates hybrids powered by gasoline or diesel. Massport also established a vehicle procurement policy in 2006 that requires consideration of AFVs when purchases are made. For example, beginning in 2013, as part of the Southwest Service Area (SWSA) redevelopment, the existing fleet of diesel rental car shuttle buses was replaced by CNG or clean diesel-electric hybrid buses. For 2016, one additional CNG NABI bus was put into service, and two CNG pick-up trucks, one propane forklift, and three E85 flex fuel pick-up trucks were retired. **Table 7-13** shows the number of Massport AFVs by vehicle type in 2016. As discussed in Chapter 1, *Introduction/Executive Summary,* several projects and programs support AFVs at Logan Airport including:

- The replacement of 94 diesel rental car buses and older CNG buses with a fleet of 54 alternative fuel (diesel-electric hybrids and CNG) buses, serve the new Rental Car Center (RCC), Massport terminals, and other airport shuttle routes. Partially funded by FAA's Voluntary Airport Low Emissions (VALE) Program grant, one additional CNG bus was also put into service in 2016.
- Operation for almost two decades of one of the largest privately operated, publicly accessible, CNG stations in New England. In 2016, the station dispensed approximately 22,650 gasoline-equivalent gallons per month for Massport vehicles.
- The use of battery powered tugs and belt loaders for the Delta Air Lines ground service fleet at Terminal A.
- A total of 125 electric GSE (or eGSE) in service at Logan Airport. As part of its long-range emission reduction strategy, Massport is working with the airlines to replace 25 percent of all GSE with electric alternatives by 2022, and 100 percent by 2027.
- Installation of 13 electric vehicle-charging stations to accommodate a total of 26 vehicles in the Central Garage and Terminal B parking areas. There are also two charging stations at the new Framingham Logan Express Garage.
- Continued operation of Massport's "Clean-Air-Cab" incentive program for AFVs, which allows hybrid or alternative fuel taxis to go to the head of the taxi line to serve passengers.

In addition, Logan Airport's Green Bus Depot is designed to maintain the expanded CNG-fueled and clean diesel-electric hybrid shuttle bus fleet. Since 2007, Massport also offers preferred parking for customers driving hybrid and AFVs.

Table 7-13 Massport's Alternative Fuel Vehicle Fleet Inventory at Logan Airport

Fuel Type	Vehicle	2016
Diesel/Electric Hybrid	Shuttle Bus[1]	32
Compressed Natural Gas (CNG)	Van	3
	Pick-Up Truck	3
	Honda Civic	9
	CNG NABI Bus[2]	22
Gasoline/Electric Hybrid	Ford Escape	2
Propane	Non-Road Vehicles (Forklifts)	1
E85 Flex Fuel	Pick-Up Truck	18
	Van	2
	Ford Escape	2
	Total	**94**

Source: Massport.
Notes:
1 The 32 diesel/electric hybrid shuttle buses, added to the fleet in 2013, replaced the diesel rental car buses.
2 The CNG NABI buses replaced the 26 aging CNG shuttle buses.

Air Quality Management Goals

Massport's air quality management strategy for Logan Airport focuses on decreasing emissions, when feasible, from all Airport-related sources, in addition to furthering innovative means to achieve emissions reductions Airport-wide. Massport's air quality improvement goals, the measures proposed to accomplish them, and some of the 2016 milestones are listed in **Table 7-14**.

Massport continues to comply with the Logan Airport Parking Freeze,[22] in accordance with 10 CMR 7.30 and 40 CFR 52.1135. Chapter 5, *Ground Access to and from Logan Airport* provides detailed discussion of Massport's compliance with the Parking Freeze regulation, and the counterproductive effect of constrained parking at Logan Airport on VMT and associated emissions.

Table 7-14 Air Quality Management Strategy Status

Air Quality Emissions Reduction Goals	Plan Elements	2016 Status
Reduce emissions from Massport fleet vehicles	Convert Massport fleet vehicles to electricity or compressed natural gas (CNG) by retrofitting or procurement.	Massport uses the Energy Policy Act (EPAct) of 1992 to expedite its Alternative Fuel Vehicle (AFV)/Alternative Power Vehicle (APV) program. In 2016, one additional CNG NABI bus was acquired.
Encourage use of alternative fuel and alternative power vehicles by private fleet and airside service vehicle owners	Provide infrastructure to support alternative fuels including CNG and electricity.	Massport continues to operate one of New England's largest retail CNG stations, which is open to the public. In calendar year 2016, the CNG station pumped approximately 22,650-gallon equivalents per month for all Massport fleet vehicles (non-Massport vehicles were also using CNG). Massport plans to support the current and future standard systems for plug-in electric vehicles (EVs). For example, the Rental Car Center (RCC) in the Southwest Service Area (SWSA) includes the infrastructure necessary to accommodate future plug-in stations for electric vehicles. In 2012, Massport installed 13 electric vehicle charging stations to accommodate a total of 26 vehicles in the Central Garage and Terminal B parking areas. There are also two charging stations at the new Framingham Logan Express Garage.
	Work with ground access fleet and airside service-vehicle owners to encourage conversion.	Massport encourages conversion to AFVs/APVs by others through such policies as 50 percent discounts in AFV/APV ground access fees to limousines, vans, and buses; limited "front-of-line" taxi pool privileges to hybrid and AFVs/APVs; and preferred parking for hybrid and AFVs/APVs at Logan Airport parking facilities.

22 310 Code of Massachusetts Regulations 7.30 and 40 Code of Federal Regulations 52.1120.

Table 7-14 Air Quality Management Strategy Status (Continued)

Air Quality Emissions Reduction Goals	Plan Elements	2016 Status
Minimize emissions from motor vehicles	Implement a program to increase high occupancy vehicle (HOV) ridership by air passengers.	As described in detail in Chapter 5, *Ground Access to and from Logan Airport,* there are a number of HOV services serving Logan Airport that are aimed at air passengers, including the Massachusetts Bay Transportation Authority (MBTA) Blue Line and Sliver Line, Logan Express, and water transportation. Massport promotes the use of these services by employees, primarily through the Logan Airport Employee Transportation Management Association (Logan TMA) and various pricing incentives.
	Expand the Logan TMA for Airport employees.	Massport continues to provide commuting information to all Airport employees including Sunrise and Logan Express Shuttles with reductions in employee parking. Logan Express extended service now provides nearly 24-hour service at several Logan Express locations, with discounts provided to employees.
	Encourage employees to use bicycling as a mode of commuting.	Massport includes bike racks at all new facilities and at appropriate existing facilities to promote employees biking to work. Bicycle racks are currently provided at Terminal A, Terminal E, Logan Office Center, MBTA's Airport Station, Economy Parking Garage, Signature general aviation facility, and the Green Bus Depot (Bus Maintenance Facility). Additional racks were installed at the RCC facility in 2014.
Minimize emissions from Construction Equipment	Incorporate Clean Air Construction Initiative (CACI) into major earthwork construction projects.	For all large construction projects, heavy construction equipment is required to be equipped with diesel particulate filters or diesel oxidation catalysts in accordance with CACI.
Reduce emissions from fuel vapor loss	Provide state-of-the-art fuel storage and distribution equipment.	The Fuel Storage and Distribution System is in operation.
	Implement Tank Management Program.	Refer to Chapter 8, *Water Quality/Environmental Compliance and Management* provides details regarding tank management focuses on proper maintenance.

Table 7-14 Air Quality Management Strategy Status (Continued)

Air Quality Emissions Reduction Goals	Plan Elements	2016 Status
Reduce emissions from stationary sources	Employ Reasonable Available Control Technologies (RACT) for NO_x at Central Heating and Cooling Plant.	RACT policies have been implemented.
	Use alternative fuels in snow melters.	Massport is required to use Ultra Low Sulfur Diesel fuel in all Massport snow melting equipment. Massport installed two new stationary snow melters using natural gas in 2016 and will install two additional snow melters in 2018. These installations will reduce the need for Ultra Low Sulfur Diesel fuel fired portable snow melters.
	Incorporate green building technologies and energy use reduction strategies.	Logan Airport has five U.S. Green Building Council (USGBC)'s Leadership in Energy and Environmental Design (LEED®) certified facilities. Terminal A (the first LEED® certified terminal in the world), the Signature Flight Support GA Facility, the Green Bus Deport (LEED® Silver certified), and the RCC (LEED® Gold), and a recently renovated portion of Terminal E (LEED® Gold). An overview of sustainability initiatives is presented in Chapter 1, *Introduction/Executive Summary*.
	Install diesel particulate filters on large emergency generators	Massport has voluntarily installed diesel particulate filters on all large (>500 kilowatts) stationary emergency generators beginning in 2011.
Reduce aircraft emissions	Work with FAA to study and implement airfield-improvement concepts and operational changes that may have air quality benefits.	Massport promoted such concepts through the *Logan Airside Improvements Planning Project Environmental Impact Statement*, which recommended physical and operational improvements to Logan Airport including construction of the new Runway 14-32 and Centerfield Taxiway, and taxiway improvements. Runway 14-32 became operational in November 2006 and the Centerfield Taxiway was fully opened in summer of 2009. In addition, in coordination with Massport, the Massachusetts Institute of Technology (MIT) completed a detailed survey of pilots at Logan Airport to better understand the use of single engine taxiing and issued a paper in March 2010, and in January 2011, MIT issued a paper on aircraft pushback control strategy to reduce congestion and taxi delay.
Reduce aircraft emissions (Continued)	Use of pre-conditioned air at new and renovated terminals and terminal gates.	The majority of contact gates have pre-conditioned air and/or 400-Hz power. This reduces the need for auxiliary power unit (APUs) and, consequently, reduces associated emissions. The recent improvements of Terminal B included the installation of pre-conditioned air at all renovated gates.

Table 7-14 Air Quality Management Strategy Status (Continued)

Air Quality Emissions Reduction Goals	Plan Elements	2016 Status
Reduce energy intensity and greenhouse gas emissions while increasing portion of Logan Airport's energy generated from renewable sources	Reduce energy consumption Increase the portion of Massport's energy being generated from renewable sources Reduce overall GHG emissions associated with energy consumed in Massport operated facilities at Logan Airport Reduce GHG emissions from Massport-operated mobile sources	This goal was identified as part of the Logan Airport Sustainability Management Plan (SMP)[1], which was released in April 2015. Progress on this goal will be reported in future sustainability reports.

Notes:

1 Progress towards goals identified as part of the Logan Airport Sustainability Management Plan (SMP) will be reported separately, as part of Massport's annual sustainability reporting.

Updates on Other Air Quality Efforts

This section further highlights other Logan Airport-related air quality efforts in 2016.

Massachusetts Department of Public Health Study

In 2004, the Massachusetts Legislature appropriated funds for the Department of Public Health (DPH) to undertake an assessment of potential health impacts of Logan Airport in the East Boston section of the city and any other communities located within a five-mile radius of the Airport, with a focus on noise and air quality. This study was completed in May 2014 and consisted of an epidemiological survey combined with computer modeling of noise levels and air pollution concentrations. Massport has cooperated in this effort by providing funding to complete the study and Airport operational data in support of the study. In the spring of 2011, Massport also gave technical assistance in support of the DPH study by providing geographic information systems (GIS) analysis of the roadway network in and around Logan Airport in a format compatible with FAA's EDMS. Massport is working with DPH and East Boston Health Center on implementing DPH recommendations related to Massport.

In response to the DPH study recommendations, Massport has:

- Entered into an agreement to provide funding to The East Boston Neighborhood Health Center to help expand the efforts of their Asthma and Chronic Obstructive Pulmonary Disease (COPD) Prevention and

Treatment Program in East Boston and launch a program in Winthrop including screening children, providing asthma kits, and home visits, among others.

- Entered into an agreement with the Massachusetts League of Community Health Centers for the evaluation and assessment of the Asthma and COPD Prevention and Treatment Program, and engagement of community health centers in the North End, Charlestown, Chelsea, and South Boston. The East Boston Neighborhood Health Center will conduct the same evaluations for the East Boston and Winthrop community programs.
- Entered into an agreement with DPH to expand or establish the Asthma and COPD Prevention and Treatment Program in South Boston, the North End, Chelsea, and Charlestown in collaboration with the Massachusetts General Hospital, South Boston Neighborhood Health Center, and conduct training on the Community Health Worker assessments.

The findings from this study can be viewed from DPH website at: http://www.mass.gov/eohhs/docs/dph/environmental/investigations/logan/logan-airport-health-study-final.pdf.

Massport Air Quality Monitoring Study

Massport has also completed a $1.6 million air quality monitoring study in and around Logan Airport in compliance with its MEPA Section 61 findings for the Centerfield Taxiway component of the Logan Airside Improvements Project. The study gathered air quality data in the communities around Logan Airport before and after the new Centerfield Taxiway became operational, with an emphasis on ambient (or "outdoor") levels of particulate matter and hazardous air pollutants (HAPs). The intent of the study was to assess potential air quality changes related to the operation of the new taxiway. Massport worked cooperatively with MassDEP and DPH to develop the scope of the monitoring study.

Air monitoring commenced in 2007 at ten different stations located on and off the Airport. The monitoring comprised both real-time and time-integrated monitoring methods, and includes measurement of fine particulates, VOCs, carbonyls, black carbon, and polynuclear aromatic hydrocarbons (PAHs). Massport also met periodically with MassDEP and DPH regarding the progress and results of the air monitoring.

The first year of the two-year study was completed September 2008 and the second phase concluded in September 2011 following the completion of the Centerfield Taxiway, which is now fully operational. The report is posted on Massport's website. For details on the study see Massport's website at: http://www.massport.com/massport/business/capital-improvements/sustainability/air-quality/.

Single Engine Taxiing

Single engine taxiing is one measure that is being used by air carriers to help reduce fuel use and emissions. As a result, Massport supports the use of single engine taxiing when it can be done safely, voluntarily and at the discretion of the pilot. Massport has conducted three surveys of Logan Airport air carriers (2006, 2009, and 2010) to understand the extent single engine taxiing is used at Logan Airport. In addition, Massport is an active member of the FAA Partnership for Air Transportation Noise and Emissions Reduction (PARTNER) program on reducing noise and emissions. In 2009, Massport offered to facilitate a more detailed survey of pilots at

Logan Airport by the Massachusetts Institute of Technology (MIT) to better understand the use of single engine taxiing. MIT completed its survey and issued a paper in March 2010, which was provided in the *2009 EDR*. The MIT survey confirms earlier Massport survey findings that single engine taxiing is an important operational measure used by airlines to conserve fuel and is extensively used at Logan Airport. MIT issued a paper in January 2011 reporting on a control strategy to minimize airport surface congestion, and thus taxiing time, by regulating the rate at which aircraft are pushed back from their gates. Also in January 2011, Massport sent a memorandum to air carriers in support of single engine taxiing when consistent with safety procedures. The memorandum highlighted best practices for single engine taxiing use based on the MIT survey findings. In May 2015, Massport sent an additional memorandum to air carriers in support of single/reduced-engine taxiing and the use of idle reverse thrust as strategies. Copies of these memoranda are provided in Appendix L, *Reduced/Single Engine Taxiing at Logan Airport Memorandum*.

MIT and the Center for Air Transportation Systems Research developed a methodology to account for single engine taxi procedures during the taxi-in or -out modes.[23,24,25] Some of the single engine taxi challenges noted in these studies include: (1) excessive thrust and associated issues (2) maneuverability problems particularly related to tight taxiways turns and weather; (3) problems starting the second engine; and (4) distractions and workload issues. Thus, pilots do not use single engine taxiing during each aircraft operation in practice, and when they do use it, it is not for the entire operation. Pilots use single engine taxiing even less often during taxi out.

When using the MIT methodology and available data (such as aircraft pilot surveys) applied to the most recent set of aircraft operational data for Logan Airport (i.e., 2016), the results show a savings of approximately 1,645,000 gallons of jet fuel and the reduction of approximately 16,200 metric tons of GHG emissions associated with this initiative.

As the design for the Terminal E Modernization Project advances, energy efficiency measures will be summarized in future EDR/ESPR filings.

Engagement in Aviation-Related Environmental Issues

Massport maintains memberships and active participation in a number of organizations involved in addressing aviation related environmental issues, including air quality. These include serving on environmental committees for TRB, the American Association of Airport Executives (AAAE), and the Airports Council International-North America (ACI-NA).

Ultrafine Particles

Within the field of air quality, airborne particles are collectively categorized as PMs and subdivided into size categories based on their diameters. These divisions are total suspended particles (TSP) with diameters ranging from 2.5 to 40 micrometers (μm), course particles (PM_{10}) with diameters ranging from 2.5 to 10 μm, fine

23 A Survey of Airline Pilots Regarding Fuel Conservation Procedures for Taxi Operations, Massachusetts Institute of Technology.
24 Opportunities for Reducing Surface Emissions through Airport Surface Movement Optimization, Massachusetts Institute of Technology, 2008.
25 Analysis of Emissions Inventory for Single Engine Taxi-out Operations, Center for Air Transportation Systems Research.

particles ($PM_{2.5}$) with diameters less than 2.5 μm, and UFPs with diameters less than 0.1 μm. The majority of these particles originate from the exhaust gases generated by fossil fuel-powered engines and other high-temperature combustion sources including aircraft.

Under CAA, EPA has established NAAQS for six criteria air pollutants including PM_{10} and $PM_{2.5}$. Outdoor concentrations within EPA standards are considered safe for the public. Presently, UFPs (by themselves) are not regulated ambient pollutants. UFPs cannot be considered a part of $PM_{2.5}$ because $PM_{2.5}$ regulates on a mass basis, and UFPs are so small by comparison, they make up a negligible mass. Any eventual UFP regulation would be a number concentration.

EPA has begun to reconsider a NAAQS for UFPs on the basis of the unique physical attributes and potential human health hazards. Under CAA, reassessments of the NAAQS for $PM_{10/2.5}$ are underway and should be finalized by 2022.[26] This would be the next opportunity to consider including UFPs among the criteria pollutants. However, the link between UFP exposure and adverse health effects, although suggestive, may not rise to the level of promulgating a new NAAQS at this time.

With respect to airport-related UFP studies, the collection of materials is limited. However, recent studies have focused on understanding UFP measurements in the vicinity of airports. Studies conducted at Zurich Airport in Switzerland and Heathrow Airport in London have demonstrated that UFP dispersion is highly dependent on wind speed and direction at the airport with UFP particle numbers being on the order of 10 times more when measured downwind of the airport.[27, 28] A study conducted at Brussels Airport demonstrated the UFP emissions from the airport can significantly impact concentrations up to 7 kilometers (4.3 miles) away from the source.[29] These studies have begun to understand the dispersion characteristics of UFPs from airports, however specific health studies to assess impacts of UFPs from airport sources have yet to be conducted. FAA conducts research through the Center for Excellence Aviation Sustainability Center (ASCENT) Program on UFPs.

Black Carbon

Particulate matter at all sizes is comprised of multiple components, one of the more significant being Black Carbon (BC). BC particles, also referred to as soot, form as a result of incomplete combustion, particularly at the higher temperatures at which aircraft burn fuel, making BC emissions common from aircraft. BC from aviation activities largely contributes to smaller PM particles (i.e., $PM_{2.5}$ and UFPs). $PM_{2.5}$ is classified as a criteria air pollutant by EPA and regulated under NAAQS.

BC is known to have negative impacts on both human health and the environment. According to EPA, BC is associated with respiratory distress, cardiovascular disease, cancer, and birth defects. A recent study using air

26 U.S. EPA Final Integrated Review Plan for the Ambient Air Quality Standards for Particulate Matter, December 2016 (https://www3.epa.gov/ttn/naaqs/standards/pm/data/201612-final-integrated-review-plan.pdf).
27 Fleuti, E., Maraini, S., Bieri, L., 2017. *Ultrafine Particle Measurements at Zurich Airport.* Flughafen Zurich AG.
28 Masiol, M., Harrison, R. M., Vu, T. V., and Beddows, D. C. S. *Sources of Submicrometre Particles Near a Major International Airport,* Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2017-150, in review, 2017.
29 Peters, J., Berghmans, P., and Frijns, E. 2016. *Ultrafine Particles and Black Carbon monitoring in the surroundings of Brussels Airport.* Brussels Environmental Agency.

quality monitors near an airport, has shown that airports can contribute to 24 to 28 percent of total BC within 4 km.[30] However, modeling studies, commonly used to ascertain the extent of impacts on human health and the environment, have shown the level of contribution by an airport to be less, only on the order of 2 to 5 percent. Researchers are working on understanding the reasons for this discrepancy. It may be an indication that emissions estimates from airports need improvement.[31]

To fully understand the extent of impacts from airport related BC emission much more research is needed. It is important for research to focus on improving emissions estimates of BC from airports and improved modeling studies. FAA conducts research through the ASCENT program on black carbon.

Statewide, National, and International Initiatives

Advancements on the national and international levels to decrease Airport-related air emissions have continued to focus primarily on three initiatives through the 2012 and 2013 time-periods: the advanced quantification of PM and HAPs emissions from aircraft engines; the continued phasing-in of AFV; and the implementation of GHG emissions reduction strategies. These initiatives are briefly described below.

- **Particulate Matter and Hazardous Air Pollutant Research -** Conducted by the International Civil Aviation Organization (ICAO), FAA, EPA, and others, research continues to better characterize PM and HAPs emissions (including lead) from aircraft engines. Similarly, air quality monitoring efforts at other airports were also conducted at various locations to advance what is known about ambient levels of these air pollutants in the vicinities of the nation's airports. Massport continues to closely track these issues through its involvement in aviation industry organizations such as ACI-NA and AAAE.
- **Alternative Fuel Vehicle Conversions—**Airlines and other GSE users are continually replacing their older fossil-fueled vehicles and equipment with more fuel-efficient, low- and non-emitting (e.g., electric) technologies. Airport-fleet vehicles are also being converted to alternative fuels (e.g., electric, propane). In response, GSE and automobile manufacturers are offering a wider selection of AFVs, many of which are designed specifically for airport use. Massport continues to support the conversion of fossil-fueled vehicles and equipment to alternative, electric, or lower-emitting fuels.
- **Participation in Massachusetts Climate Protection Plan—**Massport was one of 15 state agencies and authorities that participated in the development of the state's Climate Protection Plan, the Commonwealth's initial step towards reducing GHG emissions. Massport is participating on two of the Plan's teams: Transportation System Planning and Transportation Technologies and Operations, with a focus in GHG emission reductions associated with Airport operations. Current reduction strategies include:
  - Incorporating energy use and GHG emissions as criteria in transportation decisions;
  - Maintaining and update public transit systems;
  - Expanding programs to promote efficient travel;

30 Dodson R. E.; Houseman E. A.; Morin B.; Levy J. I. *An analysis of continuous black carbon concentrations in proximity to an airport and major roadways.* Atmos. Environ. 2009, 43243764–3773.

31 Arunachalam S.; Valencia A.; Yang D.; Davis N, Baek B.H.; Dodson R.E.; Houseman A.E.; Levy J.I.; *Comparing Monitoring-Based and Modeling-Based Approaches for Evaluating Black Carbon Contributions from a US Airport.* Air Pol. Mod. 2011, 619-623

- Seeking opportunities to reduce emissions at Logan Airport;
- Improving aircraft movement efficiency;
- Promoting the use of cleaner vehicles and fuels in public transit fleets;
- Continuing to promote the use of clean diesel equipment on publicly-funded construction projects;
- Eliminating unnecessary idling of buses; and
- Advocating for aircraft efficiency at regional and national levels.

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8

Water Quality/Environmental Compliance and Management

Introduction

The Massachusetts Port Authority's (Massport) approach to environmental management and compliance is a key component of its commitment to sustainability and responsible stewardship at Boston-Logan International Airport (Logan Airport or the Airport) (refer to Chapter 1, *Introduction/Executive Summary* for details). Through monitoring and documentation, environmental performance is assessed, allowing policies and programs to be developed, implemented, evaluated, and continuously improved. In October 2000, the Massport Board approved a Massport-wide Environmental Management Policy, which articulates the agency's commitment to protect the environment and to implement sustainable design principles:

> *"Massport is committed to operate all of its facilities in an environmentally sound and responsible manner. Massport will strive to minimize the impact of its operations on the environment through the continuous improvement of its environmental performance and the implementation of pollution prevention measures, both to the extent feasible and practicable in a manner that is consistent with Massport's overall mission and goals."*

Massport's overall environmental compliance and management efforts address the following goals:

- Protect water quality Airport-wide;
- Protect groundwater resources;
- Protect surface waters (Boston Harbor) and preserve coastal resources adjacent to the Airport;
- Minimize air quality impacts;[1]
- Protect resources during construction;
- Mitigate construction impacts; and
- Reduce occurrences of fuel leaks and spills.

Massport is responsible for ensuring compliance with applicable state and federal environmental laws and regulations. Massport promotes appropriate environmental practices through pollution prevention and remediation measures. Massport also works closely with Airport tenants and Airport operations staff in an effort to continuously improve compliance.

1 Air quality impacts are reported in Chapter 7, *Air Quality/Emissions Reduction.*

This chapter reports on Massport's environmental programs pertaining to water quality and environmental compliance and management, which include:

- Environmental Management System (EMS) implementation;
- Sustainability Management Plan (SMP);
- Water quality and stormwater management;
- Fuel use and spills;
- Storage tank management and compliance; and
- Site Assessment and Remediation (in accordance with the Massachusetts Contingency Plan [MCP]).

Table 8-1 provides a progress report of environmental compliance and management efforts in 2016. The progress report summarizes Massport's mechanisms for implementing its environmental management goals and details where changes to these efforts occurred in 2016.

Table 8-1 Progress Report for Environmental Compliance and Management

Plan Elements	Progress Report for 2016
Environmental Compliance Inspections	In 2016, Massport performed tenant inspections at a number of its National Pollutant Discharge Elimination System (NPDES) co-permittees' (Logan Airport tenants) leaseholds and made recommendations on how to rectify issues identified during the inspections.
Environmental Management System (EMS) and International Organization for Standardization (ISO) 14001	ISO 14001 certification began for Facilities II (Vehicle maintenance, Landscaping, and Snow Removal) in December 2006. In 2010, Massport expanded the Logan Airport EMS to include Facilities I (Central Heating and Cooling Plant, and heating, ventilation, and air conditioning [HVAC]), and Facilities III (Electrical, Structural, Central Stockroom and sign shop). The most recent certification audit took place in June 2014, and a certificate was issued in July 2014; this certificate is valid through July 2017.
Tenant Technical Assistance	Massport continued publication of *EnviroNews,* which was rebranded in late 2016 as "*Sustainable Massport.*" This quarterly newsletter informs tenants of regulatory calendar milestones, permitting requirements, pollution prevention, and best management practices. It recommends use of sustainable materials and provides information on Massport and other environmental requirements (2016 newsletters are provided in Appendix J, *Water Quality/Environmental Compliance and Management)*.
Stormwater Pollution Prevention Plan (SWPPP)	In accordance with the requirements of the current NPDES stormwater permit for Logan Airport that was issued on July 31, 2007, Massport and the 22 co-permittees were required to develop SWPPPs. Massport completed its SWPPP in December of 2007 with regular updates since that time. The most recent update to the SWPPP was completed in December 2016 and distributed to Massport and its stormwater co-permittees. Massport's SWPPP addresses stormwater pollutants in general, deicing and anti-icing chemicals, potential bacteria, fuel and oil, and other sources of stormwater pollutants. Best management practices (BMPs) are included in the SWPPP. In accordance with the other requirements of the NPDES permit, Massport conducts training for personnel responsible for implementing activities identified in the SWPPP. The 2016 Annual Certificates of Compliance were submitted jointly to the U.S. Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (MassDEP) in December 2016 for Massport and co-permittees.

Table 8-1 Progress Report for Environmental Compliance and Management (Continued)

Plan Elements	Progress Report for 2016
Design and Construction	Massport developed Sustainable Design Standards and Guidelines (SDSG) for use by architects, engineers, and planners for Massport capital improvement projects.[1] The SDSGs, first issued in 2009 and revised in 2011, are designed to foster innovation yet include clear targets to achieve more sustainable project design and practices. The SDSGs are intended to evolve over time, based on changes in technologies and industries. In addition to the SDSGs, Massport aims to construct buildings at Logan Airport to achieve U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED®) Silver certification or higher. Massport requires contractors to comply with the EPA Construction General Permit for all construction projects impacting an acre or more. For smaller projects, Massport requires compliance with the Logan Airport SWPPP's Best Management Practices. For all construction projects, Massport requires the use of ultra-low-sulfur diesel fuel in construction equipment, recycling of all construction waste to the maximum extent possible, and construction equipment retrofits with pollution control devices such as diesel oxidation catalysts and/or particulate filters.
Spill Prevention Control and Countermeasure (SPCC) Plans [2]	Tenants meeting certain thresholds are required to prepare their own SPCC plans for their facilities. Massport checks for SPCC plans during environmental compliance inspections. Additionally, tenants receive information on Massport BMPs which focus on spill management and prevention.

Source: Massport
Notes:
1 More information on SDSGs is provided in Chapter 1, *Introduction/Executive Summary*.
2 In accordance with the Clean Water Act, 40 CFR 112, Oil Pollution Prevention.

International Organization for Standardization (ISO) 14001 Certified Environmental Management System (EMS)

Since 2006, Massport has had an ISO 14001 certified EMS in place, a systematic approach which Massport uses to promote continual improvement of environmental management at Logan Airport. The goals of Massport's EMS are to meet regulatory requirements and to improve Massport's environmental performance beyond compliance on an ongoing basis.

The EMS consists of policies, procedures, and records that are collectively used by Massport employees to prevent pollution and address potential environmental impacts associated with Airport operations. Responding to environmental regulations and international standards, Logan Airport's EMS provides a structure for regulatory compliance and monitoring of a wide range of activities at the Airport that affect the environment, such as air quality, recycling, stormwater pollution prevention, and energy use.

Logan Airport's EMS is independently certified to the ISO 14001:2004 international standard. Certification for Facilities II (Vehicle Maintenance, Landscaping, and Snow Removal) began in December 2006. In 2010, Massport expanded the Logan Airport EMS to include Facilities I (Central Heating and Cooling Plant), Facilities II (Vehicle Maintenance, Landscaping, and Snow Removal), and Facilities III (Electrical and Structural). The most recent certification audit took place in June 2014, and a certificate was issued in July 2014; this current certificate is in effect through July 2017.

Logan Airport Sustainability Management Plan

In 2013, Massport was awarded a grant by the Federal Aviation Administration (FAA) to prepare a SMP for Logan Airport. The Logan Airport SMP planning effort began in May 2013 and was completed in April 2015. The SMP integrates with the existing EMS framework to promote continuous environmental, social, and economic improvement. The completion of the SMP demonstrates Massport's leadership and commitment to a sustainable future for Logan Airport and its surrounding communities. The plan builds on Massport's rich history of advancing sustainability and serves as a roadmap for prioritizing initiatives and moving goals forward. The SMP is intended to guide Massport's sustainability practices over the next decade and supports Massport's ongoing commitment to environmental stewardship.

The SMP represents the combined efforts of over 125 employees and tenants who came together to establish Massport's baseline sustainability performance, shape goals, and identify new sustainability initiatives. Massport is focused on a holistic approach with an emphasis on economic viability, operational efficiency, natural resource conservation, and social responsibility. As part of the SMP process, Massport developed a Sustainability Mission Statement:

> *"Massport will maintain its role as an innovative industry leader through continuous improvement in operational efficiency, facility design and construction, and environmental stewardship while engaging passengers, employees, and the community in a sustainable manner."*

Most recently, Massport published second *Logan Airport Annual Sustainability Report* in April of 2018. The report highlights progress towards Massport's sustainability goals and targets since the release of the SMP in 2015. Massport has also published four *Sustainable Massport* calendars (2015, through 2018), which highlight Massport's sustainability successes. The 2015 *SMP Highlights Report*, *Logan Airport Annual Sustainability Reports,* and latest *Sustainable Massport* calendars can be viewed on Massport's website at the following address: http://www.massport.com/massport/business/capital-improvements/sustainability/sustainability-management/.

Water Quality and Stormwater Management in 2016

Massport's primary water quality goal is to prevent or minimize pollutant discharges in stormwater, thus limiting adverse water quality impacts associated with Airport activities to Boston Harbor. Massport employs several programs to promote awareness of Massport and tenant activities to support improved surface and groundwater quality. Programs include: implementing best management practices (BMPs) for pollution prevention by Massport, its tenants, and its construction contractors; staff and tenant training; a comprehensive Stormwater Pollution Prevention Plan (SWPPP); and project-specific construction SWPPPs.

The Clean Water Act of 1972 requires permits for pollutant discharges into U.S. waters from point sources and for stormwater discharges associated with industrial activities. Massport holds permits under the U.S. Environmental Protection Agency's (EPA) and MassDEP's National Pollutant Discharge Elimination System (NPDES) Program. The individual NPDES permit covers Massport and its co-permittees at Logan Airport. It establishes effluent limitations and monitoring requirements for discharges from specified stormwater outfalls.

On July 31, 2007, EPA and MassDEP issued an individual NPDES Stormwater permit for Logan Airport (NPDES Permit MA0000787). The permit became effective on September 29, 2007, replacing the previous NPDES Permit dated March 1, 1978. The NPDES permit is on EPA's website at https://www3.epa.gov/region1/npdes/logan/pdfs/finalma0000787rtc.pdf. The permit remains in effect until a new permit is issued by the EPA. Massport holds a separate NPDES permit for the Fire Training Facility (NPDES Permit MA0032751). The following sections describe the requirements of the two permits and Massport's compliance with these requirements.

Stormwater Outfall NPDES Permit Requirements and Compliance

The following sections describe stormwater outfalls that are subject to the NPDES Permit No. MA0000787, the monitoring requirements, and the monitoring results for 2016.

NPDES Permitted Outfalls

The NPDES permit regulates stormwater discharges from all Logan Airport outfalls including the North, West, Northwest, Porter Street, and Maverick Street Outfalls, and airfield outfalls. The acreage associated with each outfall are as follows: North Outfall Drainage Area (152 acres); West Outfall Drainage Area (449 acres); Northwest Outfall Drainage Area (23 acres); Porter Street Outfall Drainage Area (182 acres); Maverick Street Outfall Drainage Area (34 acres); and Airfield Outfall Drainage Areas (A1 through A44), which drain the remainder of the airfield including runways, taxiways, and the perimeter roadway (910 acres). The North and West Outfall Drainage Areas also drain a portion of the airfield. These drainage areas are shown in **Figure 8-1** and further described in **Table 8-2**. The North and West Outfalls have end-of-pipe pollution control facilities to remove debris and floating oil and grease from stormwater prior to discharge into Boston Harbor.

Table 8-2 Stormwater Outfalls Subject to NPDES Permit Requirements

Outfall Name and Number	Drainage Area (Acres)	Boston Harbor Discharge Location	Major Land Uses
North (001)	152	Wood Island Bay	Terminal E, apron, taxiway, cargo areas, fuel farms, and runways
West (002)	449	Bird Island Flats	Taxiways, terminal areas, aprons, cargo areas, runways, and roadways
Porter Street (003)	182	Bird Island Flats	Hangars, vehicle maintenance facilities, cargo areas, and car rental facilities
Maverick Street (004)	34	Jeffries Cove	Car rental facilities, bus/limousine pools, and parking areas
Northwest (005)	23	Wood Island Bay	Flight kitchens and bus maintenance facility
Airfield (A1 through A44)[1]	910	Perimeter of Airfield	Runways, taxiways, perimeter roadways, fire training facility, and Massport Fire/Rescue Station 2

Source: Massport
Notes:
1 In accordance with the requirements of the NPDES permit, Massport developed an *Airfield Stormwater Outfall Sampling Plan* (March 27, 2008). The plan requires quarterly wet weather sampling at a minimum of seven of the airfield outfalls (A1 through A44) to obtain representative samples of the quality of stormwater runoff from the airfield.

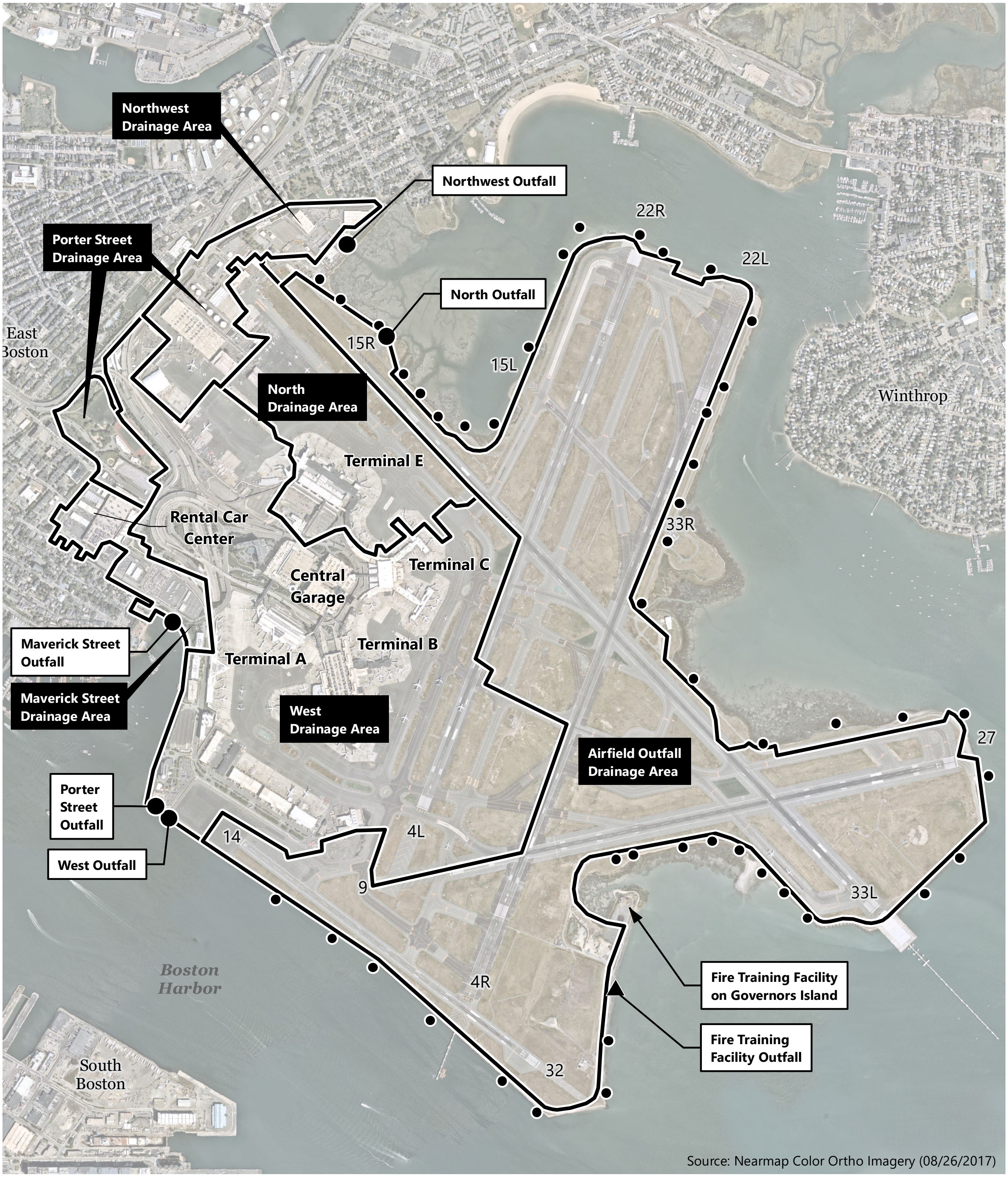


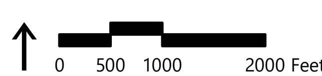
FIGURE 8-1 **Logan Airport Outfalls**

2016 Environmental Data Report

▲ Fire Training Facility Outfall

● Airfield Stormwater Outfalls

▭ Drainage Area



Monitoring Requirements

The NPDES permit (No. MA0000787) requires grab samples (single samples collected at a particular time and place) to be taken monthly from the North, West, Porter Street, and Maverick Street Outfalls. Samples are tested for pH, oil and grease, total suspended solids (TSS), benzene, surfactants, fecal coliform bacteria, and *Enterococcus* bacteria during both wet and dry weather. Grab samples are also taken quarterly from these four outfalls during wet weather to test for eight different polycyclic aromatic hydrocarbons (PAHs).

Additional NPDES permit sampling requirements include sampling for deicing compounds twice per deicing season (October through April) at the North, West, and Porter Street Outfalls. The NPDES permit sets discharge limitations for pH, oil and grease, and TSS from the North, West, and Maverick Street Outfalls and for pH from the Porter Street Outfall. The NPDES permit does not include any discharge limitations for the Northwest Outfall, airfield outfalls, or the deicing monitoring, and requires only that the sampling results be reported. Appendix J, *Water Quality/ Environmental Compliance and Management,* contains additional information on the sampling requirements of the NPDES permits.

2016 Monitoring Results

In 2016, approximately 98.6 percent of stormwater samples were in compliance with standards (Refer to **Table J-15** in Appendix J, *Water Quality/Environmental Compliance and Management* for more details). Due to the large size of the drainage areas and relatively low concentration of pollutants, it is not always possible to trace exceedances to specific events. Where a known event such as a spill is reported, Massport checks the drainage system for impacts from the event and takes any necessary corrective actions.

During 2016, one out of 11 wet weather event stormwater samples collected from the Maverick Street Outfall exceeded the TSS limit with a concentration of 260 mg/L on November 15, 2016. The TSS permit limit is 100 mg/L. There was no discernable source of the TSS exceedance.

One out of 11 wet weather event stormwater samples collected from the Maverick Street Outfall was measured outside of the limits for pH established in the NPDES permit with a reading of 5.59 on March 2, 2016. One out of 11 wet weather event stormwater samples collected from the North Outfall was measured outside of the limits for pH established in the NPDES permit with a reading of 5.50 on April 12, 2016. The boundary limits established for pH in the NPDES Permit are 6.0 to 8.5.

Sampling results at Porter Street are averaged among the three Porter Street Outfalls. The averages for the three Porter Street Outfalls were all within range during 2016.

The NPDES permit requires reporting of sampling results for the Porter Street, Northwest Outfall, and all airfield outfalls. These specific outfalls do not have specific discharge limits with the exception of pH. In 2016, the highest average concentrations observed at the Porter Street Outfalls were 206 mg/L of TSS (December 21, 2016) and 9.7 mg/L of oil and grease (November 9, 2016). In 2016, the highest concentration of TSS observed at the Northwest Outfall was 220 mg/L (September 19, 2016). The highest concentration of oil and grease measured at the Northwest Outfall was 4.6 mg/L (September 19, 2016).

The highest average concentrations observed at the airfield outfalls were 14.2 mg/L of TSS (September 19, 2016) and 1.9 mg/L of oil and grease (September 19, 2016).[2]

The NPDES water quality monitoring results are posted on Massport's website (http://www.massport.com/massport/business/capital-improvements/sustainability/water-quality/). Massport provides copies of the monitoring results to EPA and MassDEP. The 2016 water quality monitoring results for discharge from the outfalls is provided in Appendix J, *Water Quality/ Environmental Compliance and Management,* along with the history of water quality monitoring results dating back to 1993.

Deicing Monitoring

Deicing is typically conducted at Logan Airport from October or November through March or April. Deicing operations at Logan Airport have been subject to comprehensive discharge regulations since 1990. Deicer use is subject to the 2007 NPDES permit, which requires Massport and each airline and/or fixed base operator conducting deicing at Logan Airport to develop tailored plans to reduce deicer usage. Massport and its co-permittees were actively engaged in a *Deicing Management Feasibility Study* to evaluate various technologies to reduce aircraft deicing fluid discharges to Boston Harbor. Massport submitted the results of the *Deicing Management Feasibility Study* to EPA in May 2017.

Deicing sampling at the North, West, Porter Street, and airfield outfalls occurred during wet weather on February 8 and March 21, 2016. Sampling results are reported as required by the EPA and MassDEP and listed in Appendix J, *Water Quality/ Environmental Compliance and Management* (see **Tables J-13** through **J-14** for deicing monitoring results).[3]

Stormwater and Sanitary Sewer System Inspections and Repairs

Between 2006 and 2008, Massport conducted inspections of the sanitary sewer and stormwater drainage system serving Logan Airport to document the condition of the systems and identify potential impacts from the sewer to the stormwater drainage system. Such impacts could result from leaks or breaks from the sanitary sewer or from direct, inadvertent, illegal cross-connections to the stormwater drainage system. As a result of these surveys, the Boston Water and Sewer Commission (BWSC) and Massport completed replacement of sections of the sanitary sewer system as detailed in previous EDRs.

Massport's Facilities Department continues its inspection and cleaning of manhole and catch basin structures at locations throughout the Airport. The drainage system maintenance program also includes inspection and cleaning of Stormceptor water quality control structures. In accordance with Part I.B.10. h. of the Logan Airport NPDES Permit, the inspection and cleaning activities focus on manhole and catch basin structures within 100 yards of aircraft, vehicle, and equipment maintenance facilities.

Drainage structures, including catch basins and manholes, were inspected and cleaned as needed. From April 9 to June 3, 2016, a total of 56 Stormceptor units were inspected. The maximum depth of sediment measured in the units was 12 inches. None of the Stormceptor units were found to contain sediment depths that required cleaning; however, each unit was cleaned and any limited accumulated sediment was

2 The 2007 NPDES permit does not set maximum daily discharge limitations for the Runway/Perimeter Stormwater Outfalls.
3 Wet weather deicing monitoring was only required during the first and third year of the NPDES permit.

removed. Less than 5 cubic yards of sediment was removed from the units. From September 23 to October 4, 2016, the Stormceptor units were again inspected. The maximum depth of sediment measured was 12 inches and none of the Stormceptor units contained sediment depths that required cleaning.

2016 Bacteria Source Tracking

Massport continues to monitor bacteria levels at stormwater outfalls by obtaining samples during wet weather and dry weather events for laboratory analysis. Review of the analytical data indicates that bacteria levels continue to be highly variable, with no consistent trends that would indicate an ongoing source such as a cross-connection to a sanitary sewer line. Sampling results are available in Appendix J, *Water Quality/Environmental Compliance and Management.*

Fire Training Facility NPDES Permit Requirements and Compliance

NPDES Permit No. MA0032751 regulates treated wastewater from the Fire Training Facility on Governors Island (**Figure 8-1**).[4] This Permit is effective on the signature date (August 15, 2004) and expires five years from the last day of the month preceding the effective date (August 31, 2019). The treated wastewater from fire training exercises is stored, treated by separation and a carbon filter to remove fuel contaminants, and is typically beneficially reused onsite to recharge the fire training pit for training exercises. If no storage is available, treated wastewater is tested prior to discharge to the storm sewer to ensure compliance with the Fire Training Facility's NPDES Permit. Discharge monitoring reports are submitted monthly to EPA. In 2016, Massport reused all wastewater generated at the Fire Training Facility. There were no discharges into Boston Harbor nor were there any shipments of wastewater off-site.

Fuel Use and Spills in 2016

Management of fueling operations at Logan Airport is designed to minimize impacts on water quality by implementing stormwater pollution prevention plan BMPs, including the use of reliable storage, secondary containment, and effective spill cleanup procedures. Massport's jet fuel storage and distribution infrastructure, installed in 2000 and 2001, includes a zoned leak detection system for underground fuel piping, which identifies volumetric changes of product in the pipe at operating pressure and zero pressure. The system combined the storage facility with a hydrant fuel system that reduced the need for trucks and dispensing. The former individual fuel farms were removed in 2000.

The fuel storage and distribution system was designed to ensure, to the extent technologically feasible, the reliable detection of leaks. The consolidated above ground jet fuel storage facility and distribution system are leased and operated by BOSFuel Corporation, an airline consortium. The management of the facility by one entity was put in place to minimize potential fuel spills and maximize water quality protection for the storage and distribution facilities. Cathodic protection, leak detection, secondary containment, and tank overfill protection methods such as alarms, inventory-gauging sensors in the tanks, and emergency fuel shut-off systems have been installed. The operation and maintenance of these controls have been included in the operation and maintenance manual used by BOSFuel's contractor to operate and maintain the facility. Built-in environmental controls, unified operations, and the ongoing contingency planning provide heightened environmental protection and more efficient fuel handling

4 NPDES Permit No. MA0032751 - *Logan International Airport Fire Training Facility*. Issued November 1, 2006.

operations than the previous system. In 2010, BOSFuel, in coordination with Massport, completed the replacement of the portion of the jet fuel distribution system that had not been part of the fuel storage and distribution system improvements completed in 2001. The fuel line replacement, which began in 2008, involved the installation of approximately 6,500 linear feet of pipe in the vicinity of Terminals B and C.

The Massport Fire Rescue Department keeps logs of all spills at Logan Airport (see **Table 8-3**). State environmental regulations require that oil spills of 10 gallons or more in volume be reported to MassDEP. Spills that enter storm drains of any volume must also be reported to Massport. During 2016, five fuel spills entered the storm drainage system. Massport keeps records of all spills, including those less than the reporting threshold. In 2016, of the oil and hazardous material spills reported to the Massport Fire Rescue Department, 14 spills (6.1 percent) were reportable due to their volume. Of the 14 reportable spills in 2016, commercial airlines were responsible for 58 percent of the spills, 14 percent from fixed base operators' equipment, 7 percent from Massport, 7 percent from aircraft fueling, 7 percent from general aviation, and 7 percent from trucking companies. By volume, jet fuel spills accounted for 48 percent of total fuel spilled; diesel fuel accounted for 26 percent; hydraulic oil accounted for 19 percent; gasoline accounted for 1 percent; and 6 percent was from other fluids such as antifreeze, transmission fluid, and glycol.

A summary of Logan Airport jet fuel usage and spill records from 1990 to 2016, and details pertaining to type and quantity of the spills can be found in Appendix J, *Water Quality/Environmental Compliance and Management*.

Table 8-3 Logan Airport Oil and Hazardous Material Spills and Jet Fuel Handling[1]

Year	Total Number of all Spills	Total Number of all Spills ≥10 gallons	Total Volume of all Spills (Gallons)	Estimated Volume of Jet Fuel Handled (Gallons)	Total Volume of Jet Fuel Spilled (Gallons)
2010	87	15	476	335,693,997	360
2011	108	12	572	340,421,373	337
2012	132	5	593	343,731,127	439
2013	94	6	452	349,397,940	351
2014	129	17	2,785	370,222,342	785
2015	196	16	1,278	374,985,216	885
2016	231	14	1,158	456,003,328	558

Source: Massport Fire Rescue and Massport Environmental Management
Notes: Oil and hazardous material spills and jet fuel handling data from 1990 through 2016 are provided in Appendix J, *Water Quality/Environmental Compliance and Management.*
1 Material Spills include: jet fuel, hydraulic oil, diesel fuel, gasoline, and other materials such as glycol and paint.

Tank Management Program

Since 1993, Massport has maintained a Tank Management Program that is designed to ensure that all Massport-owned tanks are in regulatory compliance with federal and state tank regulations. The program includes tank permitting, monitoring, upgrades, and replacement. From 1993 through 2005, Massport completed six construction phases of storage tank modifications that included removal, replacement, and upgrades to existing tanks and the related piping systems to comply with federal and state tank regulations. In 2009, Massport installed a remote tank monitoring system for heating oil underground storage tanks (USTs) to allow for continuous monitoring of inventory levels, as well as leak detection. As a BMP, Massport continues to monitor tank systems, upgrade facilities, and remove tanks as needed.

In 2016, Massport and its tenant tank owners continued to comply with new state storage tank regulations, these regulations can be found through the MassDEP UST Program.[5] These new regulations transferred jurisdiction of all USTs from the Massachusetts Department of Fire Services (DFS) to MassDEP. Jurisdiction of all aboveground storage tanks (ASTs) with capacity volumes greater than 10,000 gallons remains with the DFS, and those ASTs with less than a 10,000-gallon capacity are now under local Massport Fire Department jurisdiction. There are three ASTs at Logan Airport with volumes greater than 10,000 gallons. Two of these tanks are located in the North Service Area and contain potassium acetate runway deicing fluid. The third tank is located at the Central Heating Plant, and is used for the storage of heating oil. Compliance with the new tank regulations included:

- Re-permitting all ASTs using a newly created Massport Fire Department tank permit;[6] and
- Updating and tracking AST permit status, using the Massport AST database.

Massport is also implementing a tank management program that includes:

- A continuing program of monthly inspections, testing, and minor repairs of all Massport-owned tanks, related piping, tank monitoring systems, and related equipment.
- Annual Stage I Vapor Recovery testing was conducted in May 2016, for Massport's gasoline USTs and piping systems at the Airport, and Massport personnel were trained on the proper operation and inspection of the Stage I systems. Stage I vapor recovery involves the recovery of vapors from the gasoline tank by the tanker truck when deliveries occur. Stage I systems will continue to be operated, maintained, and tested on an annual basis.
- Annual DFS inspections of all three of Massport's ASTs greater than 10,000 gallons in volume, and submittal of the inspection documentation to DFS.

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5 310 Code of Massachusetts Regulations (CMR) 80.00.

6 Although aboveground storage tanks (ASTs) with a capacity of less than 10,000 gallons are no longer under the jurisdiction of the Massachusetts Department of Fire Services, the tanks are still subject to the Massachusetts fire regulations. The ASTs with a capacity of less than 10,000 gallons are now under the jurisdiction of the Massport Fire Department. Each tank requires a permit from the Massport Fire Department, which does not expire unless the tank is moved to a different location. ASTs with capacity of over 10,000 gallons need to obtain both an annual permit from the Massport Fire Department and the required permit from the Massachusetts Department of Fire Services.

- Review of all proposed tenant tank upgrades, installations, and tank removals (under Massport's Tenant Alteration Application process[7]) to ensure compliance with applicable state and federal regulations and with Massport policy.
- Ongoing upgrade and maintenance of a database that contains information on all USTs located on Massport property. For each tank, the database tracks location, permit status, third party inspection status, compliance status with applicable tank regulations, and tank and monitoring system equipment summaries. Information on ASTs is kept in a separate database, which was developed in 2010.
- Information provided to tenants regarding the revised storage tank regulatory requirements and assistance with tenants' tank permitting procedures.

Site Assessment and Remediation

Massport complies with the Massachusetts Contingency Plan (MCP) by monitoring fuel spills and tracking the status of spill response actions. The MCP (310 Code of Massachusetts Regulations 40.0000) lays out a set of regulations that govern the reporting, assessment, and cleanup of spills of oil and hazardous materials in Massachusetts. The MCP, which is administered by MassDEP, prescribes the site cleanup process based on the nature and extent of a release's contamination. The MCP defines the roles for those parties affected by and potentially responsible for the release and establishes the release reporting program and submission deadlines for tracking events from initial release to regulatory closure.

In accordance with the MCP, Massport continues to assess, remediate, and bring to regulatory closure areas of subsurface contamination. There are several phases of investigation for contaminated sites. Phase I involves initial site investigations for the presence of contamination and Phase II assessments are more comprehensive site investigations. Phase III identifies, evaluates, and selects remediation actions and Phase IV involves the implementation of selected remedial actions. Phase V involves the operation, maintenance, and/or monitoring of the remediation program. Massport leads the performance of a variety of response actions, including remediation at sites where Massport is the responsible party, where there are multiple responsible parties, and where no responsible party has been identified. **Table 8-4** describes Massport's progress in 2016 in achieving regulatory closure of the MCP sites identified in **Figure 8-2**.

7 The Tenant Alteration Application is an internal Massport process for tenants who want to make modifications to their leasehold.

FIGURE 8-2 **Massachusetts Contingency Plan Sites**

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Note: Refer to Table 8-4 for the numbered projects.

0 450 900 1800 Feet

Table 8-4 MCP Activities Status of Massport Sites at Logan Airport

Location (Release Tracking Number) and MassDEP Reporting Status	Action/Status
Fuel Distribution System (FDS) (3-1287)	
2011	A Periodic Review of the Temporary Solution for the FDS was submitted in April 2011. Three Post-Class C RAO Status Reports were submitted for the FDS in February, June, and December 2011, summarizing the routine inspection and monitoring activities.
2012	Post-Class C RAO Status Reports were submitted in May and November 2012, summarizing the routine inspection and monitoring activities.
2013	Post-Class C RAO Status Reports were submitted in May and November 2013, summarizing the routine inspection and monitoring activities.
2014	Post-Class C RAO Status Reports were submitted in May and November 2014, summarizing the routine inspection and monitoring activities. In addition, a RAM Plan was submitted in April 2014 to address construction in the area of the FDS followed by a RAM Completion Report submitted in August 2014.
2015	Post-Temporary Solution Status Reports were submitted in May and November 2015, summarizing the routine inspection and monitoring activities.
2016	RAO-C 5-year periodic review submitted in July 2016. Two Post-Temporary Solution Status Reports were submitted in 2016 summarizing the routine inspection, monitoring, and product recovery activities.
Former Robie Park (3-10027) - CLOSED	
2011	Phase IV Project Status Reports 2 and 3 were submitted in March and September 2011, respectively.
2012	Phase V Status Reports 4 and 5 were submitted in March and September 2012, respectively.
2013	Phase V Status Reports 6 and 7 were submitted in March and September 2013, respectively.
2014	Phase V Status Reports 8 and 9 were submitted in March and September 2014, respectively.
2015	Phase V Reports 10 and 11 were submitted in March and September 2015, respectively.
2016	A Permanent Solution Statement was submitted in 2016.

Table 8-4 MCP Activities Status of Massport Sites at Logan Airport (Continued)

Location (Release Tracking Number) and MassDEP Reporting Status	Action/Status
Fire Training Facility (3-28199)	
2011	A RAM Completion Statement was submitted on April 25, 2011. A Phase II Scope of Work was prepared and submitted to MassDEP on January 18, 2011. Phase II and Phase III Reports were submitted on December 8, 2011. A RAM Completion Statement was submitted on April 25, 2011.
2012	Phase 4 Status Report transmitted in June 2012; the Phase IV Remedy Implementation Plan was submitted in December 2012.
2013	Phase 4 Status Report transmitted in June 2013, the Phase IV Completion Report was transmitted in December 2013.
2014	Phase 5 Remedy Operation Status Reports submitted in June and December 2014.
2015	Phase 5 Remedy Operation Status Reports submitted in June and December 2015.
2016	Phase 5 Remedy Operation Status Reports submitted in June and December 2016.
Taxi Pool Site (3-32022)	
2014	MassDEP notified of 72-hour Reportable Condition on March 10, 2014.
2015	Phase I Report and Tier Classification submitted March 9, 2015.
2016	Permanent Solution Statement scheduled to be submitted in 2017.

Source: Massport
Notes: This list includes active Massport MCP sites only. Additional sites are the responsibility of Logan Airport tenants. Refer to Figure 8-2 for location of MCP sites. Complete information dating back to 1997 is included in Appendix J, *Water Quality/Environmental Compliance Management*.

AUL Activity and Use Limitation
MCP Massachusetts Contingency Plan
RAM Release Abatement Measure
RAO Response Action Outcome
FDS Fuel Distribution System
IRA Immediate Response Action
Phase I Initial Site Investigation
Phase II Comprehensive Site Assessment
Phase III Identification, Evaluation, and Selection of Comprehensive Remedial Actions
Phase IV Implementation of Selected Remediation Action
Phase V Operation, Maintenance and/or Monitoring

9

Project Mitigation Tracking

Introduction

This *2016 Environmental Data Report (EDR)* provides an update on Massachusetts Port Authority's (Massport) mitigation commitments under the Massachusetts Environmental Policy Act (MEPA) for projects at Boston-Logan International Airport (Logan Airport or the Airport) for which an Environmental Impact Report (EIR) was filed. Each of the projects completed the state and federal environmental review processes and adopted a mitigation plan that has been formalized with individual Section 61 Findings.[1] Massport tracks both Massport and Logan Airport tenants' progress toward implementing and meeting their environmental mitigation commitments on schedule and in accordance with the requirements set out in the Section 61 Findings for each project. As each project moves forward through its design and construction phases, its mitigation plan is implemented with ongoing tracking to ensure compliance. This chapter provides updates in 2016 for projects with ongoing or upcoming Section 61 mitigation commitments, as documented in **Tables 9-1** through **9-8**. Projects for which mitigation has been completed are not reported on in EDRs and Environmental Status and Planning Reports (ESPRs). For projects with ongoing requirements, once those projects are constructed, mitigation tracking will report only on the continuing requirements.

Projects with Ongoing Mitigation

- **West Garage Project**, Executive Office of Energy and Environmental Affairs (EEA) #9790: Phase I and Phase II construction was completed in 2007. The status of continuing mitigation requirements is documented in this chapter.
- **International Gateway Project**, EEA #9791: Phase I was completed in 2004; Phase II was completed in 2007; and the final phase has been changed to the Terminal E Modernization Project (EEA #15434). The status of continuing mitigation requirements for Phases I and II are documented in this chapter.
- **Replacement Terminal A Project**, EEA #12096: Terminal A opened March 16, 2005. The status of continuing mitigation requirements is documented in this chapter.
- **Logan Airside Improvements Planning Project**, EEA #10458: Runway 14-32 opened on November 23, 2006. The Centerfield Taxiway was completed and became fully operational in 2009. The status of continuing mitigation requirements is documented in this chapter.
- **Southwest Service Area (SWSA) Redevelopment Program**, EEA #14137: Construction of the Rental Car Center (RCC) program began in summer of 2010, and the first phase of the facility opened in the fall

1 Massachusetts General Law, Chapter 30, Section 61 (M.G.L. c. 30, § 61).

of 2013. Other phases of the project were completed in 2014. The status of ongoing mitigation requirements is documented in this chapter.

- **Logan Airport Runway Safety Areas (RSA) Project**, EEA #14442: Construction on the Runway 33L RSA began in June 2011 and was completed in November 2012. The replacement of the Runway 33L approach light pier was completed concurrently with Runway 33L RSA construction. Construction of the Runway 22R Inclined Safety Area (ISA) was completed in the fall of 2014.
- **Terminal E Modernization Project**, EEA #15434: The project will accommodate existing and long range forecasted passenger demand for international service and will include the three gates permitted and approved as part of the International Gateway/West Concourse Project in 1996 (but never constructed), and four additional new aircraft contact gates. An Environmental Notification Form (ENF) was filed in October 2015, the Draft Environmental Assessment (EA)/EIR was filed in May 2016, and the Secretary of the EEA issued a Certificate on the Draft EA/EIR on September 16, 2016 noting that the project adequately and properly complies with MEPA. Massport filed the Final EA/EIR on September 30, 2016. On November 10, 2016, the Federal Aviation Administration (FAA) issued a Finding of No Significant Impact (FONSI) and on November 14, 2016, a Record of Decision (ROD) for the project, indicating that Massport can now update the Airport Layout Plan (ALP) with the proposed Terminal E Modernization Project. Final design is underway in anticipation of a 2018 construction start (see Chapter 3, *Airport Planning* for additional information).

Projects with Section 61 Mitigation

The following section documents the status of projects with Section 61 mitigation commitments, in chronological order, starting with the West Garage Project from 1995 to the Terminal E Modernization Project from 2016. Massport will continue to report on the status of mitigation in EDRs and ESPRs to provide a solid accounting of Massport's commitment to regulatory compliance and to provide information to the community.

West Garage Project – EEA #9790

Permitting History

- Certificate on the Final EIR issued on March 16, 1995.
- Section 61 Findings approved on March 27, 1995.

Project Status

The West Garage Project (**Figure 9-1**) was initially proposed to be constructed in two phases. Phase I of the Project provided 3,150 parking spaces that were consolidated from other areas of Logan Airport. The West Garage is directly connected to the Central Garage, centralizing the two structures' parking into a larger, single functioning, easily accessible garage. The West Garage Project also included construction of elevated walkways connecting the West Garage to Terminals A and E, and improvements to the terminal roadways. The original design of Phase II of the West Garage included the construction of a new structured parking facility adjacent to the West Garage. Instead, Massport concluded it was more cost efficient to proceed with Phase II by adding three additional levels (Levels 5, 6, and 7) to the existing Central Garage. Phase II of the West Garage Project provided approximately 2,800 additional parking spaces.

- **Phase I** – Construction commenced in October 1995 and the garage opened on September 8, 1998. The elevated walkways to the terminals were completed in 2002. Improvements to terminal roadways were completed in 2003.
- **Phase II** – Permitting was completed in 2000 to add three levels to the Central Garage. Construction commenced in 2004 and the entire facility enhancement was completed in 2007.

Table 9-1 lists each of the continuing Section 61 mitigation commitments for the West Garage Project and Massport's progress in achieving these measures. **Table 9-2** details the elements and status of the Alternative Fuels Program, which was a key mitigation effort associated with the West Garage Project. **Tables 9-1** and **9-2** detail the Section 61 mitigation measures from the *West Garage Project Final EIR*, dated January 31, 1995, and those measures referenced in the Massport Board vote on the West Garage Project. Many of the mitigation measures for this project have long since been implemented, but it is noted in the tables when there have been recent updates.

Unrelated to this project, in late 2015, Massport completed the West Garage Parking Consolidation Project, which consolidated 2,050 temporary parking spaces as part of an addition to the West Garage and at the existing surface lot between the Logan Office Center and the Harborside Hyatt. The West Garage addition is located on the site of the existing Hilton Hotel parking lot. Construction of these spaces constituted all of the remaining spaces permitted under the Logan Airport Parking Freeze as of that date. [2] On March 20, 2014, EEA issued an Advisory Opinion confirming that no MEPA review was required for this project. Construction commenced in spring 2015 and was completed in late 2015.

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

FIGURE 9-1 West Garage Project | **2016 Environmental Data Report**

◆ West Garage Project EEA #9790

Phase I West Garage Construction
Phase II Addition to Central Garage

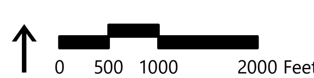

Table 9-1 West Garage Project Status Report (EEA #9790) Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016)

Mitigation Measure	Status
Parking Pricing	
Parking pricing initiatives: keeping first-hour price high enough to provide a disincentive for drop-off/pick-up.	**Implemented.** Massport continues to evaluate and adjust the first-hour price of parking. In light of the security prohibition on curbside parking, in 2002, Massport reduced the cost of the first half-hour from $4 to $2, the first time it had changed since the first-hour free rate was rescinded in 1998. In June 2007, rates increased to $3 for the first half-hour. Parking rates increased in 2012, 2014, and 2016 for on-Airport parking; further details on parking rate increases are provided in **Table 5-6** of Chapter 5, *Ground Access to and from Logan Airport*.
Parking pricing initiatives: keeping the weekly price low enough to encourage vacation travelers to park for a week.	**Implemented.** Massport encourages long-term parking by providing lower cost parking at its Economy Lot. Data on long-term parking use are provided in Chapter 5, *Ground Access to and from Logan Airport*.
Massport will consider means to encourage the use of limited amount of on-Airport commercial parking for long-term parking and promote environmentally positive modes of airport access by air passengers.	**Implemented.** An important element of Massport's strategy to reduce the impact of Airport-related traffic on regional highways and local streets in neighboring communities is the Massport Parking Pricing Policy. Massport's Parking Pricing Policy encourages long-term parking over short-term parking by charging a premium for time spent in the on-Airport parking facilities between one and four hours and substantially reducing the per hour rate for parking durations longer than four hours. This strategy has proved to be a successful incentive for passengers to drive themselves and park long-term at Logan Airport rather than having someone else drop them off or pick them up. Additional information on parking is provided in Chapter 5, *Ground Access to and from Logan Airport*.
Once sufficient data have been collected, Massport will evaluate parking behavior that may be attributable to the modified rates and consider further adjustments in pricing that will assist in achieving Massport's ground transportation goals.	**Implemented.** Massport's parking rate structure is compatible with continued growth in long-term parking, and the continued goal to increase the total high occupancy vehicle (HOV) use by air passengers. Adjustments to hourly parking rates are been made over time to reflect usage patterns. Additional information on parking pricing is provided in Chapter 5, *Ground Access to and from Logan Airport*.
Executive Director shall report to Massport annually regarding the effectiveness of parking pricing policy in achieving Massport's ground access goals initiatives and recommend appropriate policy adjustments.	**Implemented**. Through the annual Environmental Data Report (EDR)/Environmental Status and Planning Report (ESPR) filings, Massport reports on parking pricing strategies. Please refer to Chapter 5, *Ground Access to and from Logan Airport*, for additional details on Massport's parking pricing efforts.

Table 9-1 West Garage Project Status Report (EEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Concurrent Ground Access Improvement Mitigation Measures	
Employee Trip Reduction Measures	
Massport will form a Transportation Management Association (Logan TMA) for Logan Airport employees to provide new opportunities for the development of targeted transportation demand management (TDM) strategies for Massport and airport tenant employees.	**Implemented.** In the 1995 Board Resolution, Massport's Executive Director was authorized to expend an initial amount of up to $50,000 for the purpose of organizing the Logan TMA. The Logan TMA was created in March 1997. Massport continues to support the Logan TDM strategies by funding the Logan Sunrise Shuttle at an annual cost of $65,000.
Massport will seek to develop, coordinate, and implement effective TDM strategies to reduce the number of single-occupant trips made by all Logan Airport employees, including outreach to employees about transportation options.	**Implemented.** Massport supports TDM strategies by providing services and by periodically conducting the Logan Airport Employee Survey. The most recent survey was conducted in the spring of 2016. The results of this study are summarized in Chapter 5, *Ground Access to and from Logan Airport*.
Massport will encourage participation by all employees, but will particularly target the Airport's largest employers.	**Implemented.** Refer to Chapter 5*, Ground Access to and from Logan Airport* for more details on the Logan TMA.
Massport will report on the formation and activities of the Logan TMA in the next Generic Environmental Impact Report (GEIR).	**Implemented.** The current status of the Logan TMA is summarized in Chapter 5, *Ground Access to and from Logan Airport*.
Massport proposes to implement a new Logan Express service or other HOV service depending on the needs of the targeted market before Phase II of the West Garage Project is operational.	**Implemented**. The Peabody Logan Express facility opened in September 2001 (See Chapter 5, *Ground Access to and from Logan Airport* for additional information on Peabody Logan Express.) Despite low ridership, Massport continues to operate this service. In 2014, Massport initiated the Back Bay Logan Express pilot service, which provides travelers with three scheduled trips per hour between the Hynes Convention Center, Copley Square Station, and Logan Airport. This route was established as an interim/pilot service to supplement ground access to Logan Airport while the Massachusetts Bay Transportation Authority (MBTA) Green Line station was temporarily closed for reconstruction. The new Government Center station reopened in March 2016. The Back Bay Logan Express pilot service is still operating at the time of this document filing.

Table 9-1 West Garage Project Status Report (EEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Provide an airport shuttle service from South Station Transportation Center. Massport is preparing a feasibility and business plan for a South Station-Logan Airport shuttle service and will implement this service when the Third Harbor Tunnel is opened for commercial traffic. This service will be modeled on the existing, successful Logan Express services and will include frequent bus service between South Station and the airport terminals.	**Implemented.** In 1997, Massport sponsored the development of a joint public/private partnership with intercity bus operators serving the South Station Transportation Center. The service had limited success largely because of variable operator schedules and the fact that the service operates out of the South Station Transportation Center instead of a location closer to the South Station Red Line stop. Following the interim Logan DART service between Logan Airport and South Station in 2000, in June 2005, Massport and the MBTA jointly commenced full Silver Line Airport Service providing a direct connection between South Station and each Logan Airport terminal. Refer to Chapter 5, *Ground Access to and from Logan Airport* for additional information on the Silver Line.
Massport will regularly evaluate the frequency of, and demand for, such shuttle service and will provide such service at the greatest frequency that is practical and effective.	**Implemented.** Massport continues regular collaboration with the MBTA on the Silver Line Airport Service and makes adjustments as necessary. Since May 2012, Massport has sponsored a pilot program offering free rides on the Silver Line from Logan Airport to downtown Boston to promote HOV usage and heighten awareness of public transit options. The purpose of the program is to promote ridership, operations, and customer service. Free service from Logan Airport continues as of the date of this *2016 EDR*.
Massport will implement a new water shuttle service in Boston Harbor before the opening of Phase I of the West Garage Project. The water shuttle would run between Logan Airport and one, or possibly, more sites in the Harbor.	**Implemented.** Massport identified a number of possible destinations for a new water shuttle service, with the Quincy Shipyard and Long Wharf sites meeting the basic service parameters. Harbor Express was chosen as the water shuttle operator and began operation between the Airport and these two sites in November 1996. Massport continues to support the Rowes Wharf Water Taxi and City Water Taxi operations. Refer to Chapter 5, *Ground Access to and from Logan Airport* for water shuttle ridership information.
The Executive Director shall make recommendations to Massport for budgetary appropriations to establish and implement the new ground access services on a schedule that permits Massport to implement the new ground access services within these time frames.	**Implemented.** Massport's Executive Director/CEO recommends budgetary appropriations for ground access services on an annual basis.
Enhancement of Existing HOV Services: Logan Express	
Expand Logan Express hours of service.	**Implemented.** Service is offered from Braintree as early as 2:30 AM and as late as 11:00 PM; from Framingham as early as 3:15 AM and as late as 11:00 PM; from Woburn as early as 3:00 AM and as late as 11:00 PM; and from Peabody as early as 3:15 AM and as late as 10:15 PM. Buses leave every hour or half hour. Logan Express buses now depart from Logan Airport as late at 1:15 AM. The Logan Express schedule is available at http://www.massport.com/logan-airport/to-from-logan/transportation-options/logan-express/.
Provide a guaranteed ride home for Logan Express users.	**Implemented and subsequently modified.** From January 1995 until November 2001, Massport provided this service for air passengers and Logan TMA members. Due to financial constraints following September 11, 2001, this program was suspended for those passengers arriving after midnight with pre-purchased round-trip Logan Express tickets. Extended service now provides nearly 24-hour service at several Logan Express locations.

Table 9-1 West Garage Project Status Report (EEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Provide Logan Express price incentives.	**Implemented.** Massport continues to monitor price incentives and implements additional incentives to promote Logan Express ridership, particularly during vacation periods and other periods of peak airport activity. In April 2011, Logan Express sites offered a discounted rate for parking. A survey of Logan Express passengers revealed that drop-off activity at Logan Airport was reduced and the demand for parking at Logan Airport was reduced during the period of the discounted Logan Express parking. To encourage greater ridership, Massport restructured parking rates, which lowered parking rates to $7 per day from $11 per day at Logan Express parking lots. These rates have been in effect since March 1, 2012 (and resulted in increased Logan Express passenger activity at rates greater than the rate of increase in Logan Airport air passengers). Additional seasonal and holiday promotions are also offered.
Develop an additional Logan Express service.	**Implemented.** Massport opened a fourth Logan Express in Peabody, Massachusetts in September 2001, several years before the Section 61 Commitment date of the opening of Phase II of the West Garage Project. While the new service was initially planned to operate on a half-hour schedule like the Braintree, Framingham, and Woburn services, because of the dramatic air passenger reductions after September 11, 2001, (during Peabody's first week of service), to cut costs, Massport operated the Peabody Logan Express on hourly headways. In January 2004, in light of low levels of ridership on the Peabody Logan Express, Massport doubled service by going to a half-hourly schedule in an effort to stimulate ridership growth at Peabody. The service now operates on an hourly weekday schedule. In 2014, Massport initiated the interim Back Bay Logan Express pilot service, which provides travelers with three scheduled trips per hour between the Hynes Convention Center, Copley Square Station, and Logan Airport. The service continues as of the date of this EDR filing.
Enhancement of Existing HOV Services: Water Transportation	
In conjunction with the MBTA, Massport will pursue joint ticketing opportunities for the Hingham Commuter Boat and the Logan Airport Water Shuttle.	**Implemented.** This ticketing program was implemented in mid-1995 and discontinued in 2000 since many of the former users of this program now use the Harbor Express Service direct from Quincy to Logan Airport.
Massport is reviewing the fee schedules and operating requirements of the dock to make it more accessible and convenient to potential water taxi operators.	**Implemented.** In the fall of 1995, Massport made physical improvements to a low-freeboard float at the Logan Airport Dock to create a dock capable of accommodating smaller vessels such as water taxis. In the fall of 2002, Massport completed expansion of the Harborside Dock to accommodate the demand of additional vessels and to comply with handicapped accessibility requirements. The improved dock increases capacity from a two-float system to a seven-float system to accommodate the various water shuttles, taxis, and charter boats that are licensed to use it. Massport continues to provide free on-Airport shuttle service to the water shuttle dock.
Initiate a new Boston Harbor Water shuttle service.	**Implemented.** Harbor Express service, between Logan Airport and the South Shore, began in November 1996, well before the opening of Phase I of the West Garage in September 1998. In 2001, the MBTA took over operations of this service.

Table 9-1 West Garage Project Status Report (EEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Expand docking capacity at Logan Airport for water taxi and other services.	**Implemented.** Massport accommodates water taxi services, enhanced the dock as described above, provides communication links for passengers to call the taxi, and allows taxi passengers to use the free water shuttle buses to access the terminals from the dock. Water taxi information is posted on the Massport website. Details on water taxi services are provided in Chapter 5, *Ground Access to and from Logan Airport.*
Other Measures	
Coordinate with public and private entities to provide more extensive radio, television, and telephone announcements of poor traffic conditions with suggestions for alternative access modes.	**Implemented.** Callers to the Customer Information Line (1-800-23LOGAN) may access the latest traffic information, flight status, parking information, cell phone waiting lot information, or learn about alternative forms of transportation to and from Logan Airport. Starting in August 1999, real-time traffic information and parking became accessible on Massport's website. Massport regularly contacts the media to inform the public about roadway changes, parking shortages, and to encourage travelers to use HOV services. Similar information is disseminated on the Logan Airport e-mail subscriber list, the Massport website, Facebook, and on Twitter at twitter.com/bostonlogan.
HOV Marketing and advertising. Massport will continue the advertising and marketing programs for HOV services with an emphasis on promoting MBTA, Logan Express and water shuttle services to and from the Airport.	**Implemented.** Massport continues to market Logan Express services via Massport's website and other media. Massport continues to promote HOV services including availability, schedules, and fares to consumers through the Customer Information Line at 1-800-23LOGAN and the website that provides up to the minute information. HOV advertising boards, schedules, and maps are placed at all Logan Airport terminals, at the MBTA Blue Line Airport Station and at all shuttle bus drop-off/pick-up locations. Massport has actively promoted passenger water transportation in Boston Harbor for more than 20 years, playing a leadership role in policy development, planning, and promotions. This has included promoting vessel services at Logan Airport in the following ways: ▪ Annual updates and in-terminal distribution of a brochure promoting water transportation at Logan Airport; ▪ Annual updates of a harbor-wide water transportation map showing routes serving Logan Airport along with other routes and landings – Massport provides this map to the MBTA, area non-profits, and others interested in promoting passenger water transportation in Boston Harbor; ▪ Updated information promoting passenger water transportation at Logan Airport on 1-800-23LOGAN and www.massport.com; and ▪ Collecting, tracking, and disseminating passenger water transportation ridership data for Logan Airport passengers to aid in planning and facility development.

Table 9-1 West Garage Project Status Report (EEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Prepare an inventory of private scheduled services including origins/destinations, schedule, and cost.	**Implemented.** Massport continues to update and track information and services by hundreds of privately operated passenger services certified to operate at Logan Airport. Industry changes with such operations make publication of reliable service and schedule information impractical, if not impossible. However, Massport continued to expand and update information on transportation options to Logan Airport using the latest information technologies, including: ▪ Information and links to transportation companies on the Massport website. Some sites accessed through internet links provided passengers with online reservation services; ▪ Most scheduled service operators provided placards with current schedules posted in bus stop shelters located on the curb at each terminal. Individual bus schedules were also available at the information booths; and ▪ Transportation information database for online assistance at Logan Airport terminal information booths.
Proceed with environmental review and seek funding for construction of People Mover system.	**Implemented.** Massport completed the Environmental Assessment (EA) and Major Investment Study for the Logan Airport Intermodal Transit Connector (AITC). The AITC evolved out of the People Mover process and evaluated new access routes to both the MBTA Blue Line and the South Station Transportation Center. On February 25, 1997, Massport submitted to the U.S. House Committee on Transportation and Infrastructure an application for the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) funds for the next phase of environmental review, planning, and design of the AITC. Congressman J. Joseph Moakley was the congressional sponsor; the project also had the support from the Secretary of Transportation and the U.S. Environmental Protection Agency (EPA). The Logan AITC was included, for an unspecified funding level, in the 1997 ISTEA reauthorization bill. In 1998, Massport received a Certificate on a Notice of Project Change (NPC) for the People Mover from the Secretary of EEA and a Finding of No Significant Impact (FONSI) on an EA from the Federal Transit Authority. In June 2001, Massport and the MBTA executed an interagency agreement for the purchase of eight Silver Line dual mode buses and the Massport Board approved the expenditure of approximately $13 million for this purchase. In 2004, Massport and the MBTA finalized the 10-year/20 million-dollar Inter-Agency Operating & Maintenance Agreement. Initial Silver Line service to the Airport began in December 2004 and full service began in June 2005 (refer to *Chapter 5, Ground Access to and from Logan Airport* for additional details). Services continue to be adjusted to meet growing demand. In early 2018, Massport began consideration of an Automated People Mover (AMP) concept as a possible alternative for connection between the terminal area and the Massachusetts Bay Transportation Authority (MBTA) Blue Line Station (see Chapter 3, *Airport Planning* for more information).
Alternative Fuels Program. Massport is carrying out an extensive program to convert existing Massport-owned service vehicles to environmentally preferable sources.	**Implemented. Table 9-2** of this *2016 EDR* details Massport's progress in achieving these measures.
Massport will assess progress towards the achievement of HOV goals using on-Airport	**Implemented.** Massport has an ATMS plan that provides daily traffic counts at all gateways and other critical locations. Massport uses technologies that utilize on-Airport traffic signal controllers and loops for traffic counting. The

Table 9-1 West Garage Project Status Report (EEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Automated Traffic Monitoring Systems (ATMS).	Logan Airport ATMS uses technologies that detect vehicle movement (inductive loop lines and microwave sensors). The project is complete and the upgraded ATMS is functioning as planned and designed.
Massport will assess progress towards the achievement of HOV goals by monitoring parked vehicles using systems such as the parking and revenue control (PARC) system.	**Implemented.** Massport monitors all parking activity at Logan Airport and inventories all commercial parking facilities on a daily basis. Updated PARC systems were installed in the Terminal B Garage in 2004, with Central/West Garage following in 2005. Terminal E parking areas and the Economy Garage also have PARC systems.
Measuring, Monitoring, and Evaluating Ground Access Improvements	
Monitor HOV Services (Logan Express, MBTA, water shuttle, limousine/bus, and taxi).	**Implemented.** Massport maintains a "real time" log of dispatcher reports for Logan Express, the taxi pool, and the bus/limousine pool and other ground transportation operations at Logan Airport. Massport coordinates with the MBTA and the operators of all water shuttles serving Logan Airport to track ridership and service schedules. Daily Logan Express ridership and operations data are submitted monthly to Massport. Massport maintains a Passenger Water Transportation Ridership Summary on a monthly basis. Massport maintains a continuing record, the Ground Transportation Unit (GTU) Daily Event Log, of all occurrences impacting the Airport roadways, terminal curbs, and access roads. This log cites such events as accidents, lane closures, bus delays, as well as routine and non-transportation events. Massport's Ground Transportation Operations Center (GTOC) located in the Rental Car Center (RCC) is the 24/7 command center for all transportation information in and around Logan Airport. GTOC staff monitor up to the minute traffic information to ensure Logan Airport bus services are running efficiently.
Monitor passenger activity and employee modes of transportation.	**Implemented.** The 2016 air passenger survey was conducted in the spring of 2016 and is summarized in Chapter 5, *Ground Access to and from Logan Airport*.
Massport supports the use of Automated Vehicle Identification (AVI) to monitor, manage, and facilitate efficient traffic operations at Logan Airport and elsewhere on the regional transportation system.	**Implemented.** An AVI system for Massport's Logan Airport shuttles and Logan Express buses was implemented. All new buses are being procured with AVI/global positioning system (GPS), in anticipation of a planned "next bus" arrival notification system. In addition, the GTOC in the new RCC is outfitted with the required equipment to track the new clean-fuel unified bus fleet.
Track the effectiveness of ground access measures.	**Implemented.** Massport continues to track the effectiveness of its ground access mitigation programs in its annual Massachusetts Environmental Policy Act (MEPA) filings. See Chapter 5, *Ground Access to and from Logan Airport* for 2016 details.

Source: Massport
Note: Text in *italics* detailing the mitigation measures is from Section IV, Mitigation of the West Garage Final EIR, January 31, 1995.

Table 9-2 describes the Alternative Fuels Program, which was part of the West Garage Section 61 commitments.

Table 9-2 Alternative Fuels Program — Details of Ongoing Section 61 Mitigation Measures for the West Garage Project (as of December 31, 2016)

Program Element	Projected Date of Completion/ Acquisition	Status
Purchase four electric passenger utility vehicles	Winter 1995	**Implemented.**
Purchase five electric sedans	Winter and Summer 1995	**Implemented.**
Build compressed natural gas (CNG) quick-fill station	Spring 1995	**Implemented.** The CNG station has been operational since 1995. It is one of New England's largest retail CNG quick fill stations and serves approximately 34 Massport CNG vehicles (21 of which are the Massport-owned 42-foot CNG buses) along with a dozen Airport tenants including nearby hotel CNG shuttle bus fleets. In calendar year 2016, the station pumped approximately 34,345 gallon equivalents per month. Sixty-six percent of the fuel is purchased by Massport and 34 percent by outside vendors.
Purchase five electric buses	Spring and Summer 1995	**Implemented.** Massport purchased two electric buses and leased one. These vehicles operated at Logan Airport between 1996 and 2001. After more than six years of testing and evaluation, Massport determined that electric buses are neither durable nor dependable enough to function effectively in the demanding operating environment at Logan Airport. Massport's new unified bus fleet includes clean diesel/electric hybrid buses. Massport continues to evaluate electric and other alternative fuel vehicles (AFV) as new technologies become available.
Purchase five electric pick-up trucks	Spring 1995	**Implemented.**
Use soy-blend diesel fuel	Spring 1995	**Implemented.** Massport's shuttle fleet operated on soy diesel from 1995 to 1999. In 1999, all the buses were replaced with CNG buses. This fleet was fully replaced in 2012 by CNG and clean-diesel/electric hybrid buses.
Purchase additional AFVs	Spring 1995	**Implemented.** Refer to Chapter 7, *Air Quality/Emission Reductions* for a list of AFVs.
Purchase six CNG buses	Summer 1995	**Implemented.** The initial fleet of 26 CNG shuttle buses was fully replaced in 2012 with 32 60-foot clean diesel/electric hybrid buses and 18 42-foot CNG buses. Three CNG buses were added to the fleet in 2015, increasing the total from 18 to 21; and one additional CNG bus was added in 2016, increasing the total from 21 to 22.
Purchase four electric vans	Summer 1995	**Implemented.**
Install quick-charge kiosks for electric vehicles	Summer 1995	**Implemented but no longer in use.**
Develop slow-charge infrastructure	Ongoing	**Implemented.** The electric charging infrastructure included 15 inductive charging locations but these are not in use since there are no vehicles currently using inductive charging. In 2012, Massport installed 13 Level 2 electric vehicle (EV) charging stations to accommodate a total of 26 vehicles in the Central and Terminal B parking areas. The Framingham Logan Express Garage also has two EV charging stations.

Source: Massport

International Gateway Project (Terminal E) – EEA #9791

Permitting History:

- Certificate on the Final EIR issued on December 2, 1996.
- Section 61 Findings submitted to EEA on June 26, 1997.

Project Status

The International Gateway Project (**Figure 9-2**) expanded and upgraded Terminal E to provide better service to international passengers. The original Terminal E was opened in 1974 and over time became outdated and too small to accommodate the growth in international travel. This project is being constructed in phases:

- **Phase 1 – Complete.** This phase of the project included a weather-protected outside airside bus portico with an elevator and escalator linking the ground floor to the second floor to accommodate passengers arriving on remotely parked aircraft (that are unable to park at a gate because it is occupied by another aircraft).
- **Phase 2 – Complete.** This phase of the project enlarged Logan Airport's congested Federal Inspection Services (FIS) Facility, and improved the meeter/greeter lobby and the ticketing area of Terminal E to maximize passenger convenience and reduce processing times in the terminal. The project called for the reconstruction and expansion of Terminal E in and around the existing terminal while keeping it operational and safe. The new departure hall includes high ceilings, wood paneling, built-in artwork, and views of the city skyline. Additionally, to reduce curb and roadway congestion at Terminal E, this project also included a new separated roadway system for arrivals and departures.
- **Future Phase – Transitioned to Terminal E Modernization Project (EEA #15434).** The West Concourse element of the International Gateway Project and its three additional gates were approved but not constructed. These three gates are now included in the upcoming Terminal E Modernization Project.

Construction of Phase 1 and 2 of this project commenced in the summer of 1998. Phase 1 was completed in 2004. The departure level of the terminal, including the new ticketing hall and departure level roadway, opened in May 2003. Enlargement of the FIS Facility and construction of the new arrivals level was completed in July 2007. Phase 2 is now complete. Preliminary work was completed for the West Concourse including planning for three additional contact gates that were not constructed. Additional information on the status of this project is available in Chapter 3, *Airport Planning*.

As part of a separate new project, Massport is advancing plans for the modernization of Terminal E. The Terminal E Modernization Project will accommodate existing and long-range passenger forecasted demand for international service, and will include the three permitted but not built gates from the West Concourse the International Gateway Project, and four additional new aircraft contact gates. An ENF was filed in October 2015. The Draft EIR/EA was filed in July 2016, and the Final EA/EIR was filed in September 2016. FAA issued a FONSI on November 10, 2016, and a ROD on November 14, 2016 for the project (see Chapter 3, *Airport Planning*, for additional information). Final design is underway in anticipation of a 2018 construction start.

Table 9-3 lists each of the continuing mitigation measures for the International Gateway Project in the Section 61 Findings, along with Massport's progress in achieving these measures through the end of 2016. Many of the mitigation measures for this project have long since been implemented, but it is noted in the tables when there have been recent updates. Completed design and construction phase measures are described in previous EDRs.

FIGURE 9-2 International Gateway Project

2016 Environmental Data Report

Note: Runway 14-32 construction completed in November 2006

◆ International Gateway Project (Terminal E) - EEA #9791

0 500 1000 2000 Feet

**Table 9-3 International Gateway Project Status Report (EEA #9791)
Section 61 Mitigation Measures (as of December 31, 2016)**

Mitigation Measure	Status
Alternative Fuel Outreach Program	
Massport is working cooperatively with the Environmental Protection Agency (EPA) and regional utility providers in coordinating an ongoing outreach program aimed at promoting the use of clean-burning alternative fuels. This program, which is also supported by fuel providers, vendors, and state and federal agencies, will offer information to airport tenants in the following areas: ▪ *Notification of grant programs or other financial incentives for vehicle conversions.* ▪ *Assistance in cost-benefit analysis for conversion of conventionally fueled vehicles to AFVs.* ▪ *Assistance in placing airport tenants in contact with alternative fuel suppliers and product vendors.*	**Implemented but no longer in use.**
High Occupancy Vehicle (HOV) Promotion	
Massport will reserve terminal space for ground transportation ticket sales, reservations, and information.	**Implemented.** In a joint venture with the Massachusetts Bay Transportation Authority (MBTA) Charlie Card automated fare collection equipment was installed in all Logan Airport terminals in 2006. In mid-2012, in an effort to encourage greater transit ridership, Massport commenced a pilot program for free boarding of the Silver Line at Logan Airport. Free Silver Line boarding continued throughout 2016. Additional ground transportation information is provided om Massport's website at http://www.massport.com/logan-airport/to-from-logan/transportation-options/.
Attractive and distinctive signage and graphics will be utilized inside the terminal and out at the curb to clearly mark access to Logan Express, MBTA, water transportation, and other HOV options.	**Implemented.** Signage is installed in the terminal and at the curbside identifying HOV curb locations. In 2012, Massport installed new digital signage at all terminal Silver Line curb locations to indicate next bus wait times, which has improved passenger convenience.
As HOV services continue to develop and expand at Terminal E, Massport will expand its web page to encompass these new services and initiatives.	**Implemented.** Massport continues to reflect service changes on its website.
Massport and the MBTA will offer, on a trial basis, the sale of MBTA tokens via a vending machine in the baggage claim area of Terminal C.	**Implemented.** The MBTA Charlie Card machines are located at the MBTA's Blue Line Airport Station and in each of the Logan Airport passenger terminals. Massport continues to offer free service to Airport Station and the water shuttle dock with its fleet of compressed natural gas (CNG) and clean diesel/electric hybrid buses. Since the summer of 2012, Massport continues to sponsor a pilot program offering free rides on the Silver Line from Logan Airport to downtown Boston.

Source: Massport
Note: Text in *italics* detailing the mitigation measures is excerpted from the Section 61 Findings submitted to the EEA, June 26, 1997.

Replacement Terminal A Project – EEA #12096

Permitting History

- Certificate on the Final EIR issued on November 16, 2000.
- Section 61 Findings submitted to EEA on August 31, 2001.

Project Status

The Replacement Terminal A Project (**Figure 9-3**) replaced the original Terminal A with a main terminal linked to a satellite concourse. The new Terminal A opened on March 16, 2005.

In the spring of 2006, Delta Air Lines and Massport submitted an application for certification of Terminal A under the U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED®) Green Building Rating System™. LEED certification was awarded in June 2006, making Terminal A the first airport terminal in the world to be awarded LEED certification.

The following sustainable elements were incorporated into the design of Terminal A:

- **Water conservation** — low-flow toilets and drip, rather than spray, irrigation.
- **Atmosphere protection** — zero use of chlorofluorocarbon (CFC)-based, hydrochlorofluorocarbon (HCFC) based, or halon refrigerants.
- **Energy conservation** — special roofing and paving materials that reflect solar radiation. Solar panels were installed on the roof of Terminal A in 2012.
- **Materials and resources conservation** — more than 10 percent of all the building materials used to construct the terminal were from recycled materials.
- **Enhanced indoor environmental air quality** — low and volatile organic compound (VOC) free adhesives, sealants, paints, and carpets were used.
- **Sustainable sites** — bicycle racks were installed.

Table 9-4 lists each mitigation measure in the Section 61 Findings along with Massport's progress in achieving these measures through the end of 2016.

FIGURE 9-3 Replacement Terminal A Project | **2016 Environmental Data Report**

◆ Terminal A Replacement Project - EEA #12096

0 450 900 1800 Feet

Table 9-4 Replacement Terminal A Project Status Report (EEA #12096) Section 61 Mitigation Measures (as of December 31, 2016)

Mitigation Measure	Status
Project Design Mitigation	
Logan Transportation Management Association (TMA) Participation	
Delta Air Lines, Inc. to join Massport's Logan TMA and designate an Employee Transportation Advisor.	**Implemented.** Delta Air Lines joined the Logan TMA and designated an Employee Transportation Advisor.
Additionally, Delta Air Lines will provide the following services as part of their Transportation Demand Management Program through the Logan TMA Transportation subsidy for full-time Delta Air Lines employees at Logan Airport; ride matching/carpooling; vanpooling; guaranteed ride home; preferential parking for HOVs; shuttle to and from employee parking.	**Implemented.** Transportation Demand Management (TDM) services are provided through Delta Air Lines and the Logan TMA.
Recycling Program	
The Replacement Terminal A will be included in Massport's terminal recycling program.	**Implemented.** Paper, plastic, aluminum, glass, and cardboard are recycled at Terminal A. In 2013, Massport converted to single-stream recycling in all terminals. Massport established aggressive recycling goals as part of its 2015 Logan Airport Sustainability Management Plan and is actively working to reduce waste and increase its recycling rate. As part of this effort, Massport installed liquid diversion stations at the security checkpoint for Terminals A, B, C, and E in the spring of 2016. Passengers are now able to empty their bottles before security and re-fill them again on the secure side for the remainder of their journey.
High Occupancy Vehicle (HOV) Promotion	
HOV access can be accommodated on the departures level and will be designated near main entrances to the terminal building to ensure efficient and convenient unloading by air passengers who use these mode-types to access the Airport. *The inner-most curb of [the arrivals level] will be designated exclusively for HOVs and taxis, similar to the departures level.*	**Implemented.** Curbside HOV lanes give HOV modes preferential access to Terminal A for passenger convenience at both the arrival and departure levels. Coinciding with the opening of the Rental Car Center (RCC) (and its new on-Airport shuttle bus operations), in September 2013, Massport made improvements to the terminal curbsides to increase access for HOV/transit/shared-ride modes. The improvements followed several general principles: situate HOV modes to the curb closest to the terminal and locate the Airport's Blue Line/RCC shuttle stop adjacent to the Silver Line stop. Terminals B, C, and E underwent the most significant changes; in fact, the ground level of the Terminal B garage was converted to a taxi and limousine pick-up area, eliminating all commercial parking from that level, and allowing extra curb space to be better allocated among the remaining HOV and other modes. Terminal A, which already had the primary HOV modes pick-up at the terminal curb (and private vehicles pick-up at the second/outer curb), underwent the fewest changes (notably relocating the Silver Line bus stop to be adjacent to the Blue Line/RCC shuttle stop). The curb improvements also included adding electronic "next bus arrival time" displays for the Massport shuttles, MBTA Silver Line, and Logan Express buses.

Table 9-4 Replacement Terminal A Project Status Report (EEA #12096) Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Ground Service Equipment (GSE) Conversion	
In conjunction with the Project, Delta Air Lines will implement a program for conversion of its entire GSE fleet at Terminal A as soon as viable alternative fueled fleet vehicles become available and can be effectively integrated into Delta Air Lines' operations at Terminal A. Delta Air Lines will introduce battery powered baggage tugs and belt loaders with the replacement terminal and convert this portion of the GSE fleet by the end of 2008. This represents over 40 percent of Delta Air Lines' current GSE fleet.	**Implemented.** Terminal A incorporates infrastructure for GSE charging. In September 2009, Massport approved a 3-million-dollar loan to Delta Air Lines for the purchase of battery-powered baggage tugs and battery powered-baggage conveyor belt vehicles. Delta Air Lines purchased 50 electric baggage cart tugs, 25 electric baggage conveyor belt vehicles, and charging stations for each vehicle. Thirty-two GSE charger installations have been completed and are currently serving electric GSE.
Delta Air Lines will also examine the feasibility of locating a Compressed Natural Gas (CNG) fill station at Terminal A. The availability of a CNG fueling station would facilitate conventionally-fueled vehicles to be replaced with CNG-fueled vehicles where this vehicle option is offered. Delta Air Lines will introduce these vehicles into its GSE fleet as soon as they become available and are determined to be feasible and practicable for use at Terminal A.	**Implemented.** Delta Air Lines examined the feasibility of locating the CNG fill station at Terminal A and determined it to be infeasible, given that the GSE conversions are trending toward electric vehicles and electric vehicle infrastructure. A public access CNG fuel facility is available on the Airport at 81 North Service Road.
Where new alternative fuel vehicles (AFVs) are developed and determined to be cost effective and in available supplies, Delta Air Lines will integrate their use into its Terminal A GSE fleet operations.	**Implemented.** As described earlier, Delta Air Lines has purchased electric baggage tugs and belt loaders and will continue to determine the feasibility of integrating other alternative fuel GSE, as available.
Finally, Delta Air Lines will provide Massport with an annual status report/update on the GSE conversion program at Terminal A, for inclusion in Massport's annual Environmental Data Report (EDR).	**Implemented.** Terminal A includes 32 electric charging stations for Delta Air Lines' electric ramp vehicles. Delta Air Lines continues to study which AFVs and infrastructure are best suited for its future GSE operations.
Operational Mitigation Measures	
Minimizing nighttime movement of aircraft to and from hardstand positions.	**Implemented.** In accordance with the Noise Rules, Massport continues to restrict nighttime movement of aircraft under their own power between 10:00 PM and 7:00 AM, and Massport also requires towing during this time period.

Table 9-4 Replacement Terminal A Project Status Report (EEA #12096) Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Using single engine taxiing and pushback to the extent feasible and practicable, recognizing that such use is always at the discretion of the pilot in charge of the aircraft based upon his or her experience and safety and operational considerations.	**Implemented.** Massport has conducted two surveys of Logan Airport air carriers (2006 and 2009) to understand the extent single engine taxiing is used at Logan Airport. Massport annually issues letters to air carriers in support of single engine taxiing when consistent with safety procedures. Massport is an active member of the Federal Aviation Administration (FAA) Partnership for Air Transportation Noise and Emissions Reduction (PARTNER) program on reducing noise and emissions. In 2009, Massport offered to facilitate the undertaking by the Massachusetts Institute of Technology (MIT) of a more detailed survey of pilots at Logan Airport to better understand the use of single engine taxiing. MIT completed its survey and issued a paper in March 2010 (as provided in the *2010 EDR*). The MIT survey confirms earlier Massport survey findings that single engine taxiing is an important operational measure used by airlines to conserve fuel and is extensively used at Logan Airport. Based on the more detailed survey results, Massport will tailor future communication to airlines to further encourage the use of single engine taxiing, when safe to do so, within the Logan Airport operational context. In 2016, Massport sent letters to the Boston Airline Community and the Logan Airport user community encouraging them to consider the use of single engine taxiing when safe to do so. This is provided in Appendix L, *Reduced/Single Engine Taxiing at Logan Airport Memorandum* of this *2016 EDR*.
Testing alternative de-icing methods to reduce the amount of glycol usage.	**Ongoing.** Delta Air Lines is currently participating in the *Logan Deicer Management Feasibility Study* to evaluate alternatives to reduce discharges to Boston Harbor. The study report was submitted to the U.S. Environmental Protection Agency (EPA) in May 2017.

Source: Massport
Note: Text in *italics* detailing the mitigation measures is excerpted from the Section 61 Findings submitted to the EEA, August 31, 2001.

Logan Airside Improvements Planning Project – EEA #10458

Permitting History

- Certificate on the Final EIR issued on June 15, 2001.
- Section 61 Findings dated June 8, 2001, on the Final EIR.
- In June 2002, FAA filed a Final Environmental Impact Statement (Final EIS) and issued the ROD in August 2002 approving a unidirectional runway and other improvements, but deferred a decision on the centerfield taxiway pending additional review by FAA.
- In November 2003, the Superior Court of the Commonwealth modified a 1976 injunction prohibiting construction of a new runway at Logan Airport, pending further environmental review. The injunction modification allowed construction of the runway in accordance with the Secretary of EEA's Certificate on the Final EIR and FAA's ROD on the Final EIS.
- In accordance with the Secretary of EEA's Certificate on the Final EIR, Massport amended its final Section 61 Findings issued in 2001 to incorporate mitigation measures added or refined through the federal environmental review process. As a result, Massport amended its initial Section 61 Findings on October 21, 2004, to include mitigation measures required of it in FAA's ROD.
- In April 2007, FAA issued a ROD on the centerfield taxiway improvements based on its review of supplemental information.

Project Status

- Project construction commenced in 2004. Runway 14-32 opened on November 23, 2006. The first full year of operation of Runway 14-32 was 2007.
- Realignment of the southwest corner taxiway system was completed in 2007.
- Taxiway D extension was completed in 2010.
- Taxiway N realignment remains under consideration.
- Reduction in approach minimums on Runway 15R and 33L was implemented in 2013 following completion of the 33L Light Pier replacement and FAA testing of new Instrument Landing System (ILS) equipment.

The Logan Airside Improvements Planning Project (**Figure 9-4**) involved the construction of a new unidirectional Runway 14-32 and centerfield taxiway, extension of Taxiway D, realignment of Taxiway N, improvements to the southwest corner taxiway system, and reduction in approach minimums on Runways 22L, 27, 15R, and 33L. Reduction in approach minimums on Runway 15R and 33L were approved in the EIS. However, implementation for approach minimum reductions depended upon realignment of the ILS. The construction impacts of relocating the ILS localizer and new Category III ILS equipment were addressed in the environmental review of the RSA enhancements for Runway 33L (EOEA #14442). The Category III ILS began operations in 2013.

Table 9-5 summarizes the mitigation measures contained in the amended Section 61 Findings issued on October 21, 2004, and reports on the status of implementation. **Table 9-5** addresses only ongoing requirements, and it is noted when there are recent updates. Documentation on design and construction measures is provided in previous EDRs.

FIGURE 9-4 Logan Airside Improvements | **2016 Environmental Data Report**

Note: Runway 14-32 construction completed in November 2006

◆ Improved Taxiways

● Reductions in Approach Minimums

0 500 1000 2000 Feet

**Table 9-5 Logan Airside Improvements Planning Project (EEA #10458)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016)**

Mitigation Measures	Status
Runway 14-32 Operations and Construction Mitigation	
Operational procedures for unidirectional Runway 14-32 will include over water flight operations only, arrival operations in east-to-west direction from Runway 32 approach end, and departure operations from west-to-east direction from the Runway 14 departure end. Massport will enter into contract with appropriate government body and/or community group(s) to enforce intended unidirectional runway, if requested. Lighting, marking, and instrumental components of Runway 14-32 will be designed for a unidirectional runway. No parallel or other type taxiway facility will be constructed to allow east-to-west direction departures from the Runway 32 end. *The Federal Aviation Administration (FAA) endorsed the unidirectional limitations on Runway 14-32 and has agreed to develop air traffic control procedures to ensure safe and efficient operation of the unidirectional limitation, subject to variances that may be required to accommodate particular aircraft emergencies.*	**Implemented.** Runway 14-32 was constructed for unidirectional operation. All lighting, marking, and navigational instrumentation was constructed and is operated for unidirectional use only. There is no parallel or other type of taxiway facility that would facilitate east-to-west direction departures from the Runway 32 end. The construction mitigation measures were incorporated into the final design specifications and were implemented during construction. Runway 14-32 opened on November 23, 2006.
Wind-Restricted Use of Runway 14-32	
Restrict the use of Runway 14-32 to those times when winds are equal to or greater than 10 knots from the northwest or southeast (between 275 degrees and 005 degrees, or 095 degrees and 185 degrees, respectively).	**Implemented.** Massport provided initial data to support FAA's effort. FAA implements the wind restriction in compliance with the federal Record of Decision (ROD).
Mitigation Policies/Programs	
Regional Transportation Policy	
Engage in promoting increased utilization of regional airports. *Cooperative transportation planning with the various transportation agencies to ensure an integrated regional transportation infrastructure (i.e., improved highways, public transportation, high-speed rail, private transportation services to improve regional airport access).*	**Implemented.** During 2001, Massport, together with FAA and the six New England Regional State Aviation Directors, developed a scope of work and selected a technical team to undertake the New England Regional Aviation System Plan (NERASP) Update Study. In 2002, the Massport Board approved 10 percent funding with a 90-percent federal match toward the $1.6 million study. Please refer to Chapter 4, *Regional Transportation*, for additional information on Massport's ongoing cooperation on regional transportation efforts.
Massport will continue to exercise operational control over Worcester Regional Airport.	**Implemented**. Massport exercised operational control over Worcester Regional Airport as part of its agreement with the City of Worcester, which went into effect on January 15, 2000. In April 2004, Massport and the City of Worcester agreed to a three-year extension of the Operating Agreement, extending Massport's operation of Worcester Regional Airport through June 2007. Subsequently, both parties agreed to a further extension. Legislation was passed in 2009 requiring Massport to assume ownership of Worcester Regional Airport. Massport's ownership of Worcester Regional Airport commenced on July 1, 2010.

Table 9-5 Logan Airside Improvements Planning Project (EEA #10458)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Massport will continue to attract new air service to Worcester Regional Airport	**Implemented.** Massport continues to work with carriers and make other facility improvements to develop and sustain commercial service from Worcester. Massport is investing $100 million over the next 10 years to revitalize and grow commercial operations at Worcester Regional Airport. As a result of this collaboration, JetBlue Airways has already handled over 500,000 passengers at Worcester Regional Airport since commencing operations in late 2013. Starting in May 2018, JetBlue Airways will offer flights to John F. Kennedy International Airport in New York, NY. Additionally, American Airlines will offer flights to Philadelphia International Airport starting October 2018.
Traveler and air service awareness will be provided to Worcester Regional Airport via marketing campaigns.	**Implemented.** Massport continues to aggressively market the Airport to potential commercial air service carriers. Massport worked with JetBlue Airways to begin service out of Worcester Regional Airport in November 2013. JetBlue currently serves two Florida destinations from Worcester. JetBlue recently announced plans to start service between Worcester Regional Airport and John F. Kennedy International Airport in 2018.
Develop and maintain an aviation information database to include: aviation trend tracking reports for distribution to interested parties; statistical summaries of passenger levels, aircraft operations and airline schedule data at major New England regional airports; include a summary of regional airport trends and service developments in an Annual Report.	**Implemented.** Massport collects regional airport data. A summary of individual airport activity is published annually in the Environmental Data Reports (EDRs) and Environmental Status and Planning Reports (ESPRs).
Participate in other regional/state aviation forums.	**Implemented.** The New England Regional Aviation System Plan (NERASP) study was published in October 2006. Massport continues to participate in regional and state aviation forums as they exist. Please refer to Chapter 4, *Regional Transportation*, for additional information on Massport's ongoing cooperation on regional transportation efforts.
Continue to work with FAA/regional airport directors to complete a New England Airports System Study to evaluate regional airports performance. FAA committed to work with other participants in the preparation of the study.	**Implemented.** The New England Regional Aviation System Plan (NERASP) study was published in October 2006.
Encourage transportation initiatives (i.e., commuter rail, rail or other links between regional airports) by relevant agencies or other governmental bodies through Transportation Bond Bill or other legislative initiatives to implement an improved effective regional transportation system.	**Implemented.** Massport continues to provide support for regional transportation legislation and funding for other modes of transportation including the Massachusetts Bay Transportation Authority (MBTA) Silver Line and water transportation. Massport's support was instrumental in the opening of the Anderson Regional Transportation Center (RTC) in Woburn, which provides a station building for ticketing, baggage and passenger services, approximately 2,400 parking spaces for daily and overnight parking, loading platforms for Logan Express and local buses, improved access from Interstate 93 via a new interchange constructed and opened by the Massachusetts Department of Transportation (MassDOT, formerly the Massachusetts Highway

Table 9-5 Logan Airside Improvements Planning Project (EEA #10458)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
	Department), and a new high-level platform commuter rail station.
Continue to support inter-city rail planning through the Boston Metropolitan Planning Organization (MPO).	**Implemented.** Massport continues to actively participate in the Boston MPO and contributes to the policy discussions in all modes of transportation.
Allow Massport's Logan Express satellite parking lots and stations available for third-party bus and park-and-ride connections to other regional airports, including Worcester, Manchester, and Providence.	**Implemented.** Upon request and review, Massport will continue to allow third party bus operators to provide service to regional airports from Logan Express facilities. In 2007, Massport enacted an agreement with Manchester-Boston Regional Airport to allow operation of a shuttle service between Manchester-Boston Regional Airport and the Anderson Regional Transportation Center (RTC) in Woburn. That pilot program was replaced by hourly van service in 2008.
Sound Insulation	
Sound insulation is being provided within the Boston Logan Airside Improvements Planning Project Mitigation Contour including the affected residences of Chelsea, East Boston, Winthrop, and Revere. Through special project mitigations, FAA funding will be provided for residences with building code considerations to allow for the necessary upgrades thereby ensuring eligibility and participation in the sound insulation program. If FAA funding is unavailable to complete sound insulation to residences within the DNL 65 dB contour as a result of project implementation, Massport will provide the funding.	**Implemented.** Sound insulation is being implemented in full compliance with state and federal regulatory requirements and mitigation commitments. Since 1986, Massport has sound insulated nearly 6,000 residential buildings totaling over 11,515 dwelling units. See Chapter 6, *Noise Abatement,* for additional details on sound insulation.
Preferential Runway Advisory System (PRAS)	
Massport will develop and implement a PRAS monitoring system and a new distribution system for reporting that will expand the contents of Massport's Quarterly Noise Reports and will involve the expansion of the distribution list to include the Logan Airport Citizens Advisory Committee (CAC). Runway utilization, dwell, and persistence reports will be included in the ESPR filings with MEPA. Massport will continue to work with FAA to design additional reports to enhance the attainment of PRAS and Massport will begin to work with CAC to update PRAS. The current PRAS system will remain in place until superseded.	**Implemented.** Massport, FAA, and the CAC initiated a noise study of Logan Airport. PRAS review and reporting was incorporated into the noise study. During Phase 2 of the on-going Boston Logan Airport Noise Study (BLANS) the Logan Airport CAC voted to abandon PRAS because it had not achieved the intended noise abatement. Phase 3 of the BLANS focused on the development of an updated Runway Use Program. Operational tests of a new program began in November 2014 and continued through September 2016. The BLANS project ended in 2016 without the Logan Airport CAC agreeing on a new Runway Use Program. A final BLANS project report was issued in April 2017. For additional information, refer to Chapter 6, *Noise Abatement*. Runway utilization, dwell, and persistence reports continue to be included in the annual ESPR and EDR filings.

Table 9-5 Logan Airside Improvements Planning Project (EEA #10458)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Noise Abatement Study	
FAA has committed to undertake a noise abatement study that will include enhancing existing or developing new noise abatement measures applicable to aircraft overflight impacts, which will take into account environmental benefit, operational impact, aviation safety and efficiency, and consistency with applicable legal requirements. The scope of this study has been completed through the joint efforts of FAA, the CAC, and Massport as required by the ROD. Massport will work with the CAC and FAA to assess the existing PRAS at Logan Airport in accordance with Section 10.0 of the Section 61 Findings and will continue to participate in the noise study as contemplated in the ROD.	**Implemented.** FAA, in conjunction with Massport and the Logan Airport CAC, initiated the Boston Overflight Noise Study (BONS). Phase 1 of the study, completed in early 2007, defined and sought to implement changes to flight tracks to minimize impacts from aircraft overflights, which do not require a detailed Environmental Assessment (EA). Federal funding for Phase 2 was requested early to ensure seamless continuation of the study and transition. Phase 2 of the BLANS was completed in 2012. It addressed additional noise abatement alternatives that will require detailed analysis to meet FAA environmental requirements. Massport is working with the Logan Airport CAC and FAA on Phase 3 of the BONS Study to design a runway use plan for the Airport. Logan CAC could not agree on a runway use program and Phase 3 was completed in August 2012.
Peak Period Monitoring and Demand Management Program (DMP)	
Massport will develop and implement a Peak Period Pricing (PPP) program or an alternative DMP. Massport will identify standards to allow airlines to accurately predict scheduling costs and modify accordingly. Massport will establish and maintain a monitoring system. *Massport will comply with its commitments with respect to PPP or alternate DMP. FAA has indicated in the ROD that it stands ready to assist Massport in this endeavor.*	**Implemented.** In July 2004, Massport filed a proposed rule with the Office of the Massachusetts Secretary of State to formally initiate the state rulemaking process and public review to establish a peak period surcharge during designated peak delay periods at Logan Airport. The filing was followed by a public comment period that lasted through November 15, 2004. During the comment period, Massport conducted two public hearings. The Massport Board voted to establish the peak period surcharge program on January 16, 2005, and the program has been in place since then (see 740 CMR 27.00 et. al.). Please refer to Appendix K, *2016 Peak Period Pricing Monitoring Report* for additional details.

Table 9-5 Logan Airside Improvements Planning Project (EEA #10458)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Single Engine Taxi Procedures	
Develop and implement a program designed to maximize the use of single engine procedures by all tenant airlines, consistent with safety requirements, pilot judgment and federal law requirements.	**Implemented.** Massport supports the use of single engine taxiing when it can be done safely, voluntarily, and at the discretion of the pilot. Massport has conducted two surveys of Logan Airport air carriers (2006 and 2009) to understand the extent single engine taxiing is used at Logan Airport. Massport has also issued letters to air carriers in support of single engine taxiing when consistent with safety procedures. Massport is an active member of the FAA Partnership for Air Transportation Noise and Emissions Reduction (PARTNER) program on reducing noise and emissions. In 2009, Massport offered to facilitate the undertaking by the Massachusetts Institute of Technology (MIT) of a more detailed survey of pilots at Logan Airport to better understand the use of single engine taxiing. MIT completed its survey and issued a paper in March 2010 (as provided in the *2010 EDR*). The MIT survey confirms earlier Massport survey findings that single engine taxiing is an important operational measure used by airlines to conserve fuel and is extensively used at Logan Airport. In 2016, Massport issued letters to air carriers in support of single engine taxiing when consistent with safety procedures. A copy of these letters is included in Appendix L, *Reduced/Single Engine Taxiing at Logan Airport Memorandum* of this *2016 EDR*.
Report on Progress of Logan Transportation Management Association (TMA)	**Implemented.** Chapter 5, *Ground Access to and from Logan Airport* discusses the status of the Logan TMA and efforts to increase Logan TMA membership and overall high occupancy vehicle (HOV) access to Logan Airport. The focus is on expanding Logan TMA services, broadening HOV options, and supporting all major Logan Airport tenants to become members and actively participate in the Logan TDM strategies. A local "Sunrise Shuttle" has been operating since 2007. New work includes: convening an interdepartmental working group focused on rideshare/employee commutes; increasing outreach to employees about transportation options; and hosting Employee Commute Fairs in 2017.

Source: Massport
Note: The mitigation measures in *italics* are those that were referenced in FAA's ROD and later incorporated into the Section 61 Findings amended on October 21, 2004.

Southwest Service Area (SWSA) Redevelopment Program, EEA #14137

Permitting History

- Certificate on the Final EIR issued on May 28, 2010.
- Section 61 Findings submitted to EEA on June 29, 2010.

Project Status

Massport continues redevelopment of the SWSA and completed the Rental Car Center (RCC) in 2014. In addition to customer service benefits, consolidation of the rental car operations and their shuttle buses into one coordinated operation has resulted in reduced vehicle miles traveled (VMT) and reduced air emissions. See Chapter 5, *Ground Access to and from Logan Airport*, for additional information on VMT reductions.

Construction of enabling projects commenced in late summer 2010 as final design of the facility continued through 2011. All RCC facilities (the Garage Structure, Customer Service Center, permanent Quick Turnaround Areas (QTAs) 1 and 2, and temporary QTAs 3 and 4) would be constructed first. The first rental car companies moved into the QTA 1 in mid-2013 and the remaining companies by early 2014. By the end of 2015, the project was completed and fully operational. Logan Airport's new bus fleet, comprising 21 Compressed Natural Gas (CNG) buses and 32 clean diesel/electric buses, has fully replaced the entire fleet of diesel rental car shuttle buses now that the RCC is fully operational. An additional CNG bus was put into service in 2016, increasing the total to 22 CNG buses. Additionally, in keeping with its commitment to sustainability, Massport is proud that the RCC was awarded Logan Airport's first LEED Gold certification in 2015.

Table 9-6 outlines Section 61 mitigation commitments of the SWSA Redevelopment Program, which Massport, the construction contractors, and the rental car companies have implemented as part of the design, construction, and operation of the facility. This project is now complete, and there is updated progress for each mitigation measure.

Table 9-6 Southwest Service Area (SWSA) Redevelopment Program (EEA #14137)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016)

Mitigation Measure	Status
Site Design	
Stormwater Management	
Improve quality of runoff by upgrading stormwater management facilities site-wide, reducing the volume of flow to the Maverick Street Outfall by increasing pervious area site-wide, utilization of Low Impact Design elements, and replacing uncovered parking areas with buildings.	**Implemented.** These stormwater design features were included in the final project design and are part of the project. The stormwater features include 27 Stormceptors that were constructed as part of this project. Stormceptors are prefabricated, underground units that separate oils, grease, and sediment from stormwater runoff when installed as part of a pipe conveyance system.
Design new sanitary and drainage systems to result in an overall reduction in combined sewer overflow volumes at the Porter Street Outfall and eliminate discharge to Maverick Street Outfall and Bird Island Flats/West Outfall.	**Implemented.** The sanitary sewer system adds new connections at Gove Street and Harborside Drive. Sanitary flows to the Maverick Street sewer were significantly reduced once the connection was completed. The stormwater analysis showed an overall reduction in the post-development stormwater flows for the project, as well as reductions in flows to the Porter Street and West Outfalls and elimination of stormwater flow to the Maverick Street Combined Sewer. Both the sanitary sewer system and stormwater drainage system are completed.
Remediation and Underground Fuel Storage Systems	
Remove all existing car rental fueling systems and associated tanks and replace with current, state-of-the-art vehicle fueling and washing facilities.	**Implemented.** This element has been implemented as part of the Quick Turnaround facilities. Massport will be installing state-of-the-art car wash drying equipment in 2018 for seasonal operation to alleviate worker and customer safety issues associated with ice.
Noise Reduction Measures	
Eliminate individual rental car shuttle buses and combine Massport Airport Station buses (routes 22/33/55) through the Unified Bus System; thereby, reducing the overall number of rental car-related buses circulating on-airport and associated noise.	**Implemented.** Massport purchased a new bus fleet which was put into operation in 2012. The new bus fleet, comprising 21 compressed natural gas (CNG) buses and 32 clean diesel/electric buses, has fully replaced the entire fleet of diesel rental car shuttle buses with the Rental Car Center (RCC) opening in 2013. One additional CNG bus was put into service in 2016, increasing the total from 21 to 22 buses.
Incorporate noise reduction strategies into site design, such as solid fences/walls, gateway signs/walls, and landscaped berms.	**Implemented.** All noise reduction measures were constructed. In 2017, at the request of the Rental Car companies, Massport evaluated installation of state-of-the art vehicle drying systems that would eliminate safety issues arising from freezing at the end of the washing cycle. Based on availability of new low noise drying equipment, in fall 2018, Massport plans to install drying equipment in each of the four vehicle Quick Turnaround Areas (QTA). The new equipment will be operated primarily during daytime hours, seasonally when freezing conditions typically occur.

Table 9-6 Southwest Service Area (SWSA) Redevelopment Program (EEA # 14137) Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Airport Transportation System Improvements	
Reduce the rental car shuttle bus fleet by approximately 70 percent through the creation of the Unified Bus System when compared to the 2007 Existing Condition and future No-Build/No-Action Conditions.	**Implemented.** Massport purchased a new Unified Bus Fleet of diesel/electric hybrid and CNG buses. The initial buses were put into operation in 2012. Full implementation of the new bus fleet occurred when the RCC opened in the fall of 2013.
Reduce rental car shuttle bus terminal curbside congestion through the creation of the Unified Bus System resulting in reduced emissions.	**Implemented** upon project opening. Massport purchased a new Unified Bus Fleet which was put into initial operation in 2012.
Utilize clean- and low-emission fuel for the Unified Bus System to further reduce emissions.	**Implemented** upon project opening. Massport has purchased a new Unified Bus Fleet. The new fleet is comprised of diesel/electric hybrid and CNG buses.
Install Intelligent Transportation System features, as part of the Unified Bus System to further reduce emissions and improve operational efficiency.	**Implemented** upon project opening. Massport purchased a new Unified Bus Fleet which was put into initial operation in 2012.
Implement new wayfinding signage to increase the efficiency of the circulating vehicles within and around the SWSA.	**Implemented** upon project opening.
Pedestrian and Bicycle Facilities	
Provide new pedestrian and bicycle facilities, including secure and covered bicycle storage at the Customer Service Center (CSC) and QTA buildings for employees, customers, and the general public, as well as shower/changing facilities within the QTA buildings for employees.	**Implemented.**
Provide enhanced pedestrian connections to and from the SWSA, airport terminals, the Logan Office Center, Memorial Stadium Park, Bremen Street Park, the Harborwalk, on-airport buses, public transit (MBTA Airport Station), along Porter Street, and surrounding East Boston neighborhoods.	**Implemented.**
Provide street and pedestrian-level lighting and advanced warning signals and/or systems at crosswalks.	**Implemented.**
Transportation Demand Management (TDM) Plan	
Provide limited SWSA employee parking on-site.	**Implemented.**
Provide new access to public transit through the Unified Bus System (direct connection to MBTA Blue Line at Airport Station) and new/enhanced pedestrian facilities at the station.	**Implemented.**
Require rental car companies to participate in the Logan Transportation Management Association (TMA).	**Implemented.** This requirement is included in new Rental Car Center (RCC) tenant leases.
Alternative-Fuel Vehicles	
The rental car companies would provide fuel-efficient and/or alternative-fueled rental vehicles (quantity to be determined by the rental car companies).	**Implemented.** This requirement is included in new RCC tenant leases.

Table 9-6 Southwest Service Area (SWSA) Redevelopment Program (EEA # 14137)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Off-Airport Improvements/Benefits	
Reconstruct Frankfort Street/Lovell Street intersection to provide a new traffic signal control and pedestrian-related improvements (for temporary impacts of the relocation of the Bus and Limousine Pools to the North Service Area (NSA) during construction).	**Implemented.**
Reduce the amount of off-airport car shuttling to and from off-airport locations, further reducing traffic on Route 1A and local roadways surrounding the airport due to the consolidated and expanded rental car "ready/return" parking spaces and QTA areas at the SWSA.	**Implemented** upon project opening.

Source: Massport.
Note: The mitigation measures in *italics* are those that were referenced in FAA's ROD, and later incorporated into the Section 61 Findings as amended on June 29, 2010.

Logan Airport Runway Safety Area (RSA) Project – EEA #14442

Permitting History

- Certificate on the Final EA/EIR issued on March 18, 2011.
- FAA issued a Finding of No Significant Impact (FONSI) on April 4, 2011, which documents that the proposed Federal action is consistent with the National Environmental Policy Act of 1969 (NEPA) and other applicable environmental requirements and will not significantly affect the quality of the human environment with the mitigation requirements referenced in **Table 9-7**.
- Section 61 Findings were submitted to EEA on May 27, 2011, and published in the *Environmental Monitor* on June 8, 2011.
- Certificate on the Notice of Project Change (NPC) for the replacement of the Runway 33L approach light pier was issued on March 9, 2012.
- On April 12, 2012, FAA found that the replacement of the Runway 33L approach light pier was a Categorical Exclusion and thus exempt from further consideration under NEPA.

Project Status

- The first construction season for the Runway 33L RSA commenced in June 2011 and was completed in November 2011. The second construction season started in June 2012 and was completed in November 2012.
- Replacement of the Runway 33L approach light pier commenced in July 2012 and was completed in November 2012. The upgraded Category III system was put in service in 2013.
- The Runway 22R improvements were completed in 2014.

As described in previous EDRs/ESPRs, Massport has periodically undertaken RSA improvement projects at other Logan Airport runways. Massport has completed safety improvements for Runways 22L, 4L/4R, and 27 under

EEA #5122. In 2005, Massport began undertaking safety improvements at Runway 22R with the construction of an Engineered Materials Arresting System (EMAS) bed at the end of the runway in compliance with FAA directives, although no MEPA review was needed. In 2006, as part of a separate project, Massport installed an EMAS bed at the Runway 33L End. The Logan Airport RSA Project considered further enhancements to the Runway 33L and Runway 22R RSAs. Massport prepared a combined EA in accordance with NEPA and an EIR in accordance with MEPA for the proposed enhancements at the Runway 33L and Runway 22R RSAs. The ENF was filed with MEPA on June 30, 2009, and the Draft EA/EIR was submitted to FAA and EEA on July 15, 2010. The Final EA/EIR was submitted to FAA and EEA on January 30, 2011. **Figure 9-5** shows the location of RSA projects at Logan Airport.

The Runway 33L RSA improvements include a 600-foot long RSA with an EMAS bed, portions of which are on a 460-foot long by 303-foot wide pile-supported deck extending over Boston Harbor. Additional elements of the RSA improvements include two emergency access ramps located on either side of the deck and relocation of the perimeter access road. Construction of the pile-supported deck was completed in November 2012.

The Runway 33L RSA project replaced the inner 500 feet of the light pier. As construction progressed on the Runway 33L RSA improvements, Massport determined that it would be feasible to replace the remaining Runway 33L approach light pier. In the summer of 2012, Massport began replacing approximately 1,900 feet of the existing timber light pier that extends approximately 2,400 feet southeast of Runway End 33L. The existing timber pier was replaced with a new concrete structure along the runway centerline, approximately 10 feet south of the old pier, using concrete pilings. The in-kind replacement reduced the total number of pilings significantly (from over 500 to approximately 150). As part of the reconstruction, the new light pier was also constructed to accommodate upgraded navigational aids. The pier improvements provide the infrastructure necessary to support navigational aids that facilitate implementation of the reduced aircraft approach minimums previously reviewed and approved by FAA in a ROD dated August 2, 2002, for the *Logan Airside Improvements Planning Project (Airside Project)* (EEA #10458). Massport filed a NPC with MEPA for the proposed light pier replacement on January 31, 2012. On March 9, 2012, the EEA Secretary issued an NPC Certificate determining that no further MEPA review was required for the light pier replacement. On April 12, 2012, FAA found that the replacement of the Runway 33L approach light pier was eligible for a Categorical Exclusion and thus exempt from further review under NEPA.

The Runway 22R improvements that were completed in 2014 enhanced the existing RSA at this location by constructing an inclined safety area (ISA) similar to the ISA constructed at the Runway 22L end. Construction of the Runway 22R ISA is completed. **Table 9-7** lists the Section 61 mitigation commitments for the Logan Airport RSA Project and Massport's progress in achieving these measures.

FIGURE 9-5 Runway End Safety Improvements | **2016 Environmental Data Report**

◆ Runway End Safety Improvements

0 500 1000 2000 Feet

**Table 9-7 Logan Airport Runway Safety Area Improvement Program (EEA # 14442)
Section 61 Mitigation Commitments to be Implemented (as of December 31, 2016)**

Mitigation Measure	Status
Protected Resources	
Eelgrass (Runway-End 33L Only)	
Develop a mitigation program that will replace lost eelgrass area and functions by creation of new eelgrass, at a 3:1 replacement to loss ratio.	**Implemented.** Eelgrass was transplanted in 2011, but did not survive through 2012. In 2013, state and federal agencies agreed that Massport's implementation of a conservation mooring program would be a suitable replacement alternative to the initial eelgrass transplant. In 2015, Massport completed the replacement of nearly 240 traditional moorings, located in eelgrass habitat, with conservation moorings. The moorings are located in Boston and four other Commonwealth harbors. Under contract to Massport, the Massachusetts Division of Marine Fisheries conducted monitoring of the installations in 2014, 2015, 2016, and 2017.
Salt Marsh (Runway-End 22R Only)	
Restore new salt marsh at a 2:1 replacement to loss ratio.	**Implemented** as part of Runway 22R habitat mitigation at Rumney Marsh. Construction was completed in 2016.
Monitor compensatory salt marsh for success and invasive plant species, and implement an invasive species control plan.	**Implemented** upon completion of Runway 22R habitat mitigation at Rumney Marsh in 2017.
Shellfish	
Monitor pilings and substrate at Runway 33L.	**Implemented.** Monitoring conducted summer 2013, 2014, 2015, and 2017.
Restore approximately 1.1 acres of habitat.	**Implemented** as part of habitat mitigation at Rumney Marsh.
Harvest and transplant shellfish from the footprint of the Runway 22R Inclined Safety Area (ISA).	**Not Implemented.** The Massachusetts Division of Marine Fisheries (MassDMF) identified a risk of shellfish disease in the Logan Airport flats, including Runway 22R and determined that the shellfish should not be relocated.
Execute Memorandum of Agreement with the Massachusetts Division of Marine Fisheries for resource enhancement.	**Implemented.** A Memorandum of Agreement (MOA) with MassDMF was executed on July 30, 2012 and all requirements of the MOA have been implemented.
State-Listed Rare Species	
Identify equivalent area of pavement for removal to maintain area of available habitat at Logan Airport for the upland sandpiper if required by the Massachusetts Natural Heritage and Endangered Species Program.	**To be implemented.** The Massachusetts Natural Heritage and Endangered Species Program (NHESP) has determined that construction time of year restrictions will avoid impacts to state-listed species. These seasonal restrictions will be implemented when construction of Taxiway C-1 is initiated in 2018.

Table 9-7 Logan Airport Runway Safety Area Improvement Program (EEA # 14442) Section 61 Mitigation Commitments to be Implemented (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Protected Resources	
Cultural Resources	
Develop an Unanticipated Discovery Plan in accordance with the Board of Underwater Archaeological Resources' Policy Guidance.	**Implemented.** An Unanticipated Discovery Plan was developed in accordance with the Board of Underwater Archaeological (BUA) Resources' Policy Guidance and approved by BUA. No resources were discovered during construction.
Water Quality	
Develop and implement a comprehensive Soil Erosion and Sediment Control Plan in accordance with NPDES and MassDEP standards.	**Implemented.** A comprehensive Soil Erosion and Sediment Control Plan was developed and implemented at the outset of Runway 33L construction in June 2011 and maintained through the end of construction in 2012.

Source: Massport.
Note: The mitigation measures in *italics* are those that were referenced in FAA's ROD and later incorporated into the Section 61 Findings as amended on May 27, 2011.

Terminal E Modernization – EEA #15434

Permitting History

- Certificate on the ENF issued on December 16, 2015
- Certificate on the Draft EIR issued on September 16, 2016.
- Certificate on the Final EIR issued on November 10, 2016
- Section 61 Findings approved on January 19, 2017.
- FAA Finding of No Significant Impact (FONSI)/Record of Decision issued on November 14, 2016.

Project Status

The Terminal E Modernization Project is being planned and designed to be constructed in two phases. At the completion of Phase 2, the project will include the addition of seven new gates to Terminal E (three of which were already approved under the Massachusetts Environmental Policy Act (MEPA) in 1996, but were never constructed). The existing concourse, terminal core, and terminal roadway frontages (collectively, the "Project") will also be extended. Implementation of the Project will better accommodate the current and projected increased demand for international travel that is expected to occur whether or not the Project is implemented.

As of the date of this document filing, Massport has selected a final design engineer and construction management team. Design is advancing with the goal of commencing construction of Phase 1 in 2018. Phase 1 is planned to include four of the seven new gates. To accommodate this initial phase of construction, the existing Logan Gas Station will be located to the Southwest Service Area along Hotel Drive and Jeffries Street. Construction of Phase 1 is expected to be completed in Spring 2019.

Phase 2 is anticipated to commence after 2020.

FIGURE 9-6 Terminal E Modernization Project | **2016 Environmental Data Report**

◆ Terminal E Modernization Project - EEA #15434

0 500 1000 2000 Feet

Table 9-8 Terminal E Modernization Project (EEA #15434)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016)

Mitigation Measure	Status
Overall Project Benefits	
Provide pedestrian access between Terminal E and MBTA Airport Blue Line-Station.	Pedestrian access between Terminal E and Airport Station will be implemented as part of Phase 2. The connection could be implemented in the form of a moving sidewalk or an Automated People Mover (APM). Future EDR/ESPRs will provide updates on design status and what concept is being advanced.
Construct roadway and curb improvements to improve vehicle flow, HOV access, and reduce air and GHG emissions.	Final design is being advanced consistent with the commitments in the Final Environmental Assessment (EA)/Environmental Impact Report (EIR).
Site Terminal E additions so as to buffer the adjacent neighborhoods from aircraft noise.	Final design is being advanced consistent with the commitments in the Final EA/EIR.
Overall Project Benefits	
Seek LEED certification at Silver level or better; meet or exceed MA LEED Plus program goals.	Final design is being advanced consistent with the commitments in the Final EA/EIR.
Provide 400 Hz of power and pre-conditioned air at the new aircraft gates.	400 Hz power and preconditioned air will be installed at the new gates when constructed.
Site Planning and Sustainable Design/Greenhouse Gas Reduction	
▪ *Incorporate sustainable design in design, construction, and operations including:*	Final design is being advanced consistent with the commitments in the EA/EIR.
▪ *Improved building envelope*	Final design is being advanced consistent with the commitments in the EA/EIR.
▪ *Improved Air Handling Units;*	Final design is being advanced consistent with the commitments in the EA/EIR.
▪ *Efficient water loops*	Final design is being advanced consistent with the commitments in the EA/EIR.
▪ *Reduced interior lighting power density*	Final design is being advanced consistent with the commitments in the EA/EIR.
▪ *Specify roofing materials with a minimum reflectance rating of 0.70 and emittance value of at least 0.75 for a minimum of 75% of the available roof area. Install non-glare roofing materials.*	Final design is being advanced consistent with the commitments in the EA/EIR.

Table 9-8 Terminal E Modernization Project (EEA #15434)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Site Planning and Sustainable Design/Greenhouse Gas Reduction	
• *Incorporate infrastructure for collection, storage, and handling of recyclable materials.*	Final design is being advanced consistent with the commitments in the EA/EIR.
• *Require contractor to develop a construction waste management plan that requires diversion or reduction of construction waste by at least 75%.*	Final design is being advanced consistent with the commitments in the EA/EIR.
• *Establish a project-specific goal for sourcing materials extracted, harvested, recovered, and or manufactured within New England.*	Final design is being advanced consistent with the commitments in the EA/EIR.
• *Design project to achieve energy efficiencies of a minimum of 20% below the MA Energy Code.*	Final design is being advanced consistent with the commitments in the EA/EIR.
• *Include water conservation devices that reduce water use by 20% below code.*	Final design is being advanced consistent with the commitments in the EA/EIR.
• *Include a minimum of 25,000 square feet of roof top solar photovoltaic system (approximately 300kW). Heat restroom hot water with solar units.*	Final design is being advanced consistent with the commitments in the EA/EIR.
• *Incorporate occupancy sensors in all indoor areas to reduce electrical demand.*	Final design is being advanced consistent with the commitments in the EA/EIR.
Evaluate other energy efficiency/greenhouse gas reduction measures as project design progresses.	Final design is being advanced consistent with the commitments in the EA/EIR.

Table 9-8 **Terminal E Modernization Project (EEA #15434)**
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Air Quality	
Reduce operational-related carbon dioxide (CO2) emissions associated with the Project by a minimum of 30% percent.	Final design is being advanced consistent with the commitments in the Final EA/EIR.
Stormwater Management	
Replace and upgrade stormwater management.	Final design is being advanced consistent with the commitments in the Final EA/EIR.
Construction Period Impacts	
In accordance with DEP's Clean Air Construction Initiative, the Authority will require that construction contractors to install emission control devices such as diesel oxidation catalyst and/or particulate filters on certain equipment types (i.e., front-end loaders, backhoes, excavators, cranes, and air compressors).	These measures will be incorporated during construction.
Retrofitting of certain construction equipment types with emission controls such as diesel oxidation catalyst and/or particulate filters.	These measures will be incorporated during construction.
Selection of high efficiency "temporary" space heating /cooling systems.	These measures will be incorporated during construction.
Remediate subsurface contamination, as necessary, if encountered during tank removals or other excavation activities as part of construction (in compliance with the Massachusetts Contingency Plan).	These measures will be incorporated during construction.
Soil treatment and reuse on site as part of a Soil Management Plan.	These measures will be incorporated during construction.
Voluntary compliance with the requirements of City of Boston noise ordinances, including restrictions on the types of equipment that can be used, and limitations on the hours when certain activities can take place (the City of Boston noise ordinance establishes restrictions during the construction hours between 7:00 PM and 7:00 AM).	These measures will be incorporated during construction.
Construction worker vehicle trip limitation, including requiring contractors to provide off- airport parking and use of high-occupancy vehicle transportation modes for employees.	These measures will be incorporated during construction.
Implement Indoor Air Quality (IAQ) Management Plan during construction.	These measures will be incorporated during construction.

Table 9-8 Terminal E Modernization Project (EEA #15434)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Mitigation Measure	Status
Construction Traffic Operations	
Construction-related traffic will be required to access and egress through the North Gate using only state and federal highways and the Airport roadway network. Construction-related traffic on local East Boston roadways will be prohibited.	These measures will be incorporated during construction.
Construction Traffic Operations	
Construction employee parking spaces will not be permitted on the construction site nor will provisions be made for them elsewhere on-airport with the exception of a small number of spaces for supervisory personnel. The Authority will require contractors on this Project to implement construction worker vehicle trip management measures, including requiring off-Airport parking and HOV transportation modes for contractor employees.	These measures will be incorporated during construction.
Police details will be employed, as needed, to manage traffic and ensure public safety.	These measures will be incorporated during construction.
Construction Air Quality	
Construction emissions will be reduced and controlled by mandatory contractor implementation of the following best practices:	These measures will be incorporated during construction.
Encouragement for construction-worker site access/egress using dedicated buses and vans;	These measures will be incorporated during construction.
Reduction of exposed erodible surface areas to the extent feasible;	These measures will be incorporated during construction.
Covering of exposed surface areas with pavement or vegetation in an expeditious manner and periodic watering;	These measures will be incorporated during construction.
Minimizing equipment idling times;	These measures will be incorporated during construction.
Reduction of on-site vehicle speeds;	These measures will be incorporated during construction.
Ensuring contractor implementation of appropriate fugitive dust and equipment exhaust controls;	These measures will be incorporated during construction.
Use of low- or zero-emissions equipment to the maximum extent feasible; and	These measures will be incorporated during construction.

Table 9-8 Terminal E Modernization Project (EEA #15434)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2016) (Continued)

Use of covered haul trucks during materials transportation.	These measures will be incorporated during construction.
Construction Noise	
Require construction equipment to deploy noise-reduction measures, such as the use of proper mufflers, measures to limit noise from truck traffic. Primarily operate only during daylight hours (7:00 A.M. to 7:00 P.M.).	These measures will be incorporated during construction.