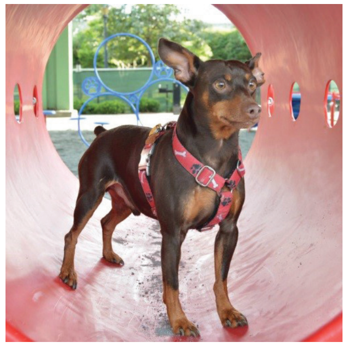
Boston-Logan International Airport



EDR

2015 Environmental Data Report

December 2016
EOEA #3247

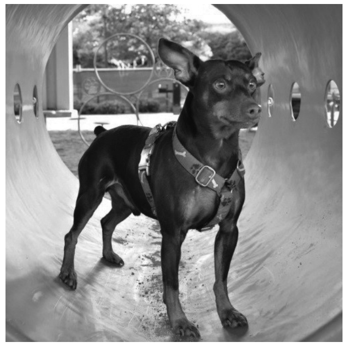
SUBMITTED TO
Executive Office of Energy and
Environmental Affairs, MEPA Office

SUBMITTED BY
Massachusetts Port Authority
Strategic & Business Planning

PREPARED BY
vhb

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

Boston-Logan International Airport



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December 15, 2016

The Honorable Matthew Beaton, Secretary
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, Massachusetts 02114

Re: ***Boston-Logan International Airport 2015 Environmental Data Report* (*2015 EDR*) - EEA #3247**

Dear Secretary Beaton:

On behalf of the Massachusetts Port Authority (Massport), I am pleased to submit for your review, the *Boston-Logan International Airport 2015 Environmental Data Report* (*2015 EDR*). Massport is proud of its decades-long commitment to providing regular and extensive information to the public and regulators on Logan Airport operational and environmental conditions. This includes detailed information on passenger activity levels and aircraft operations; ground access; planning activities; and updates on mitigation programs. Massport is the only airport in the United States that has consistently reported on environmental conditions on an annual basis since 1978. This unique "environmental report card" documents our commitment to sharing information on how Massport operates Logan Airport safely and efficiently, while striving to minimize impacts to the community and environment. New this year, Massport has included a Spanish-version of the Executive Summary in the printed and electronic versions of the *2015 EDR*.

In 2015, Logan Airport served an all-time high of 33.4 million passengers, exceeding the 2014 historic peak. Despite the increase in passengers, aircraft operations at Logan Airport remained significantly below the peak of 507,449 operations experienced in 1998 when Logan Airport served 26.5 million passengers. This cutback of over 130,000 annual flight operations since 1998, combined with improvements in aircraft engine technology, has resulted in significant reductions in community environmental impacts associated with noise exposure and air emissions. Airlines serving Logan Airport continue to upgrade their fleets with newer and larger aircraft with improved environmental performance and operational efficiencies.

The Boston metropolitan area remains a key region in the nation's finance, technology, biotechnology, healthcare, and education sectors; such favorable economic conditions drive Logan Airport's sustained demand for air travel. As a result of the thriving regional economy, 2015 also showed an increase in passenger activity levels that marked a continued recovery from the recent economic recession. A significant increase in passenger demand for international air service to existing and new destinations also occurred in 2015 with eight new markets being served.

In an effort to address continuing parking challenges, in late 2015, Massport completed the West Garage Parking Consolidation Project by constructing 2,050 parking spaces as an addition to the West Garage and at the existing surface lot between the Logan Office Center and the Harborside Hyatt. In September 2015, Massport officially opened the Bremen Street Dog Park with a well-received new recreational area for dogs and their owners. In October 2015, Massport initiated public review of the Terminal E Modernization Project, which will add seven new gates to the terminal and as of this filing, has completed all required environmental review. Throughout 2015, Massport continued to identify strategies to reduce drop-off/pick-up trips which cause unnecessary vehicle miles traveled and associated emissions.

As described throughout the *2015 EDR*, Massport remains fully committed to minimizing the effects of Airport operations over which it has control and to a continued collaboration with the community. The contents of the *2015 EDR* are outlined below.

Content and Structure

The *2015 EDR* responds fully to the Secretary's Certificate on the *Boston-Logan International Airport 2014 Environmental Data Report,* including responding to all comments. The document reports on the status of airport operations, environmental conditions, and Massport milestones achieved in 2015 and provides updates on more recent significant Logan Airport planning activities. The EDR also updates 2015 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 *2015 EDR* also includes:

- Secretary's Certificate on the *Boston-Logan International Airport 2014 EDR* and other comment letters received on the *2014 EDR*;
- Recent certificates received on the *Terminal E Modernization Project Environmental Notification Form* and *Draft and Final Environmental Impact Reports* which included items to be addressed in future EDRs and the forthcoming *2016 Environmental Planning and Status Report (ESPR);*
- Proposed scope for the *2016 ESPR;*
- Distribution list; and
- Supporting technical appendices (included in the attached CD).

Review Period, Distribution, and Consultation

A 30-day public comment period for the *2015 EDR* will begin on **December 21, 2016**, the publication date of the next Environmental Monitor, and will end on **January 20, 2017**. The distribution list included as Appendix D indicates which listed parties will receive a digital and/or printed copy of the *2015 EDR*. The full *2015 EDR* will also be available on Massport's website (www.massport.com).

A consultation session on the *2015 EDR* is scheduled **for January 11, 2017 at 6 PM in the Noddle Room on the 1st floor of the Logan Airport Rental Car Center**. Additional copies of the *2015 EDR* may be obtained by calling (617) 568-1040 or emailing mgove@massport.com during the public comment period.

Massport hopes that you and the other reviewers of the *2015 EDR* find it informative. We look forward to your review of this document and to close consultation with you and other reviewers in the coming weeks. Please feel free to contact me at (617) 568-3524, if you have any questions.

Sincerely,

Massachusetts Port Authority

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

cc: *2015 EDR* Distribution List (Appendix D in the *2015 EDR*)
Flavio Leo, Michael Gove, Massport

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Introduction/Executive Summary

Introduction

Massport is pleased to continue its practice of providing the community with 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 2015 Environmental Data Report (EDR)*. Logan Airport, owned and operated by the Massachusetts Port Authority (Massport), is New England's primary international and domestic airport. This *2015 EDR* is one in a series of annual environmental review documents submitted 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 *2015 EDR* follows the *2014 EDR* and reports on 2015 conditions. In 2015 at Logan Airport, the air quality and noise environment are substantially better than conditions reported during 1990 and 2000. This improvement is a result of both Massport's efforts to mitigate environmental impacts and airline industry trends towards quieter and cleaner aircraft and greater efficiency.

The scope for this *2015 EDR* was established by the Secretary of the Executive Office of Energy and Environmental Affairs' (EEA) Certificate dated November 12, 2015, which is included in Appendix A, *MEPA*

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").

Certificates and Responses to Comments. This *2015 EDR* updates and compares the data presented in the *2014 EDR*, and for 2015 presents information on:

- Activity Levels (including aircraft operations, passenger activity, and cargo)
- Airport Planning activities 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 *2015 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. Historical data are included in the technical appendices (CD only).

For the first time, this *2015 EDR* includes a Spanish translation of the Executive Summary. This translated version is included after the English-version of the Executive Summary.

EOEA # 3247

Submitted By

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

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Logan Airport Planning Context

Logan Airport, New England's primary domestic and international airport, plays a key role in the metropolitan Boston and New England passenger and freight transportation networks and is a significant contributor to the regional economy. 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. Logan Airport serves as a regional connecting hub for small northern New England markets and the Massachusetts maritime counties of Barnstable, Dukes, and Nantucket; the Airport is also the busiest air cargo center in New England.

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 and a well-connected roadway system. 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 2015, 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.[2] 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 three years alone has contributed more than $1.4 billion per year to the local economy and $44 million in new incremental tax revenue through income and sales.[3]

In 2015, over 15,000 people were employed at Logan Airport. This included approximately 1,040 Massport airport staff and administration 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 jobs and contributed nearly $13.4 billion annually to the local economy; this includes all on-Airport businesses, construction, visitor, and multiplier impacts.[4]

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2 Airports Council International, 2015 North American Air Traffic Report.
3 InterVISTAS. 2015. Economic Impact of Recent International Routes.
4 MassDOT Statewide Airport Economic Impact Study Update, 2014.

FIGURE 1-1 Aerial View of Logan Airport | **2015 Environmental Data Report**

FIGURE 1-2 Logan Airport and Environs | **2015 Environmental Data Report**

2015 Highlights and Key Findings

This section provides a brief overview of key findings, by chapter, at Logan Airport in 2015. Additional information concerning Airport activities is provided in subsequent chapters. This section also highlights Massport's efforts to further sustainability through specific projects and initiatives with a sustainability leaf, and summarizes Massport's sustainability program at its end.

Activity Levels

- The total number of air passengers increased by 5.7 percent to 33.4 million in 2015, compared to 31.6 million in 2014 (**Figures 1-3** and **1-4**). The 2015 passenger level represents a new record high for Logan Airport.
- Passenger aircraft operations accounted for 91 percent of total aircraft operations in 2015. The total number of aircraft operations at Logan Airport increased from 363,797 in 2014 to 372,930 in 2015, a 2.5-percent increase. This was preceded by a 0.7-percent increase from 2013 to 2014. 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 33.4 million in 2015, which saw 134,519 fewer operations.
- Air carrier efficiency continued to increase, with the average number of passengers per aircraft operation at Logan Airport increasing from 87.0 in 2014 to 89.7 in 2015. 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.

Figure 1-3 Logan Airport Annual Passenger and Operations, 2000, 2014, 2015

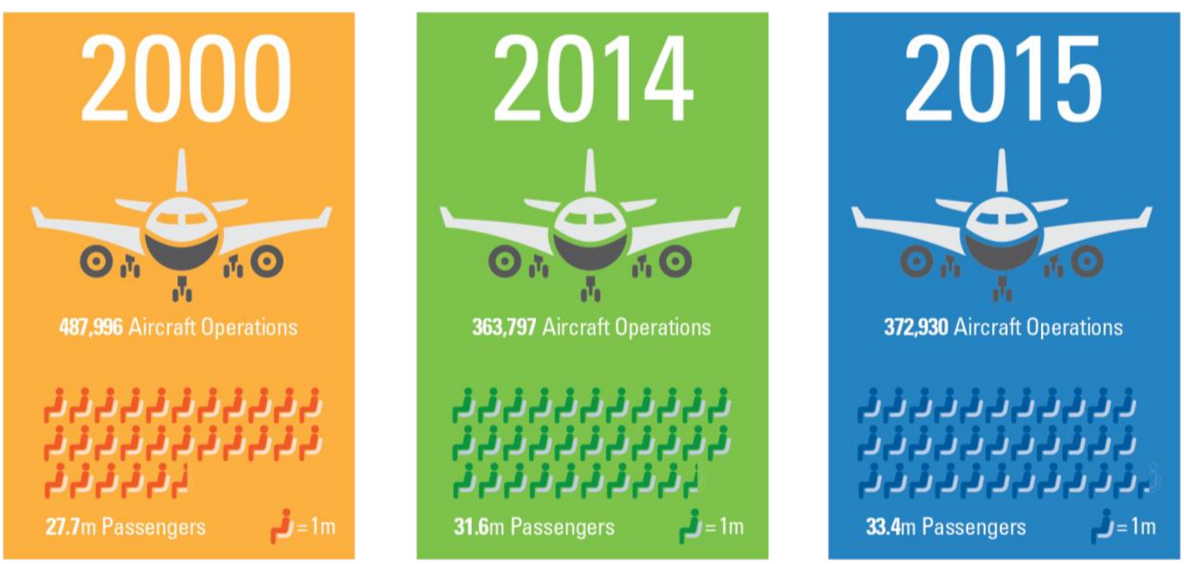
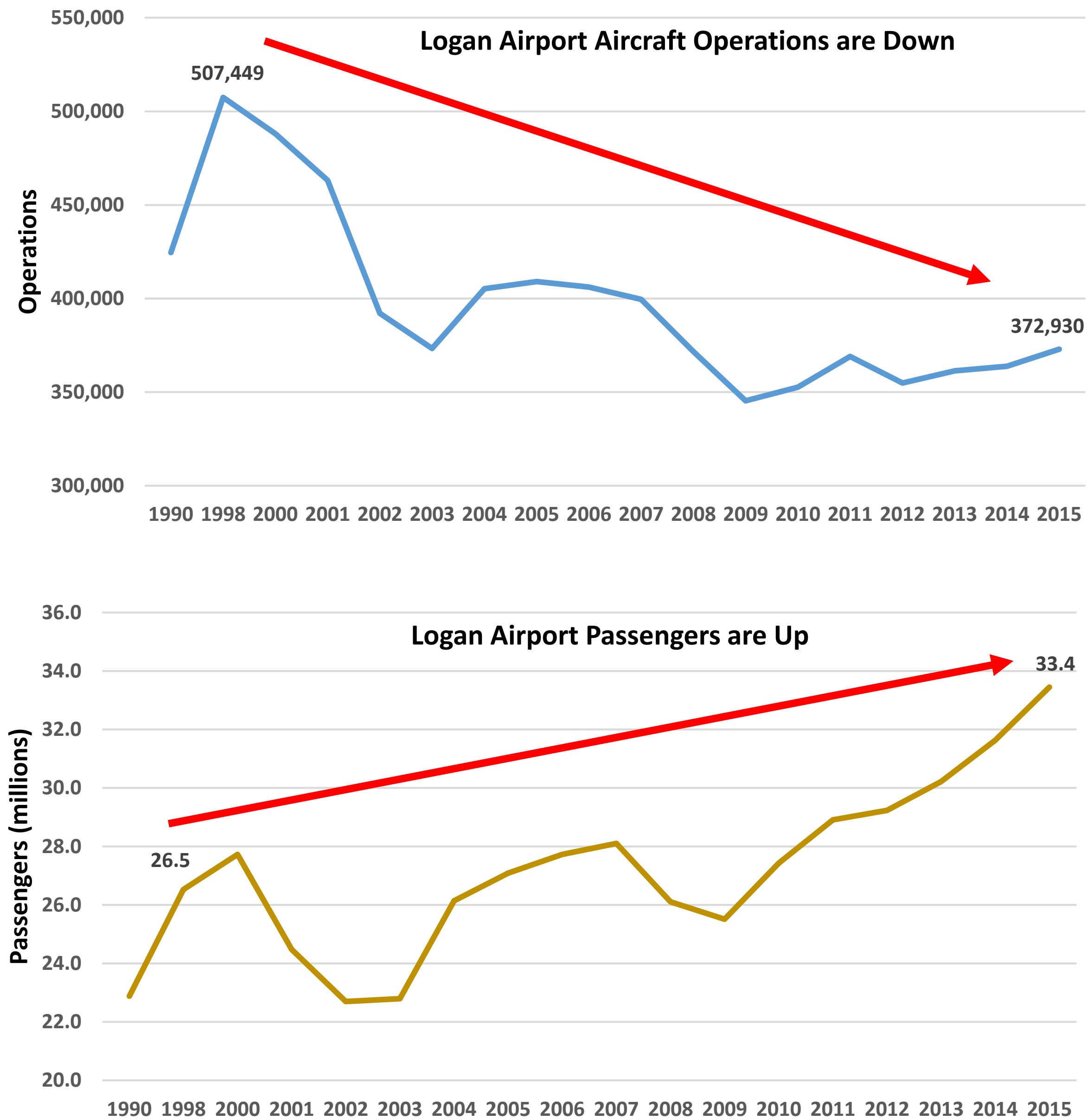


Figure 1-4 Logan Airport Annual Passenger Activity Levels and Operations, 1990, 1998, 2000-2015



Source: Massport.

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

Logan Airport is an important origin and destination (O&D)[5] 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.[6] There has been growth in both domestic and international passenger numbers. In 2015, there were approximately 5.5 million international and 27.8 million domestic passengers (excluding general aviation [GA]).

Annual domestic passengers' activity levels increased from 26.5 million in 2014 to 27.8 million in 2015,[7] a 4.8-percent increase. 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 5.0 million in 2014 to 5.5 million in 2015, a 10.9-percent increase. International passengers made up approximately 16.1 percent of total Airport passengers in 2015, and this is projected to increase steadily to nearly 20 percent of the total by 2030 or sooner. The strong international passenger growth was driven by the economic attractiveness of the metropolitan Boston region and the strength of Boston as an O&D market. New international destinations from Logan Airport in 2015 included Mexico City, Hong Kong, Tel Aviv, and Shanghai.

A series of factors, including the key factor of continued local and regional economic growth, have combined to produce this exceptional passenger growth. The *2016 ESPR* will update operations and passenger activity levels through 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. Following a two-year strategic planning effort, Massport has identified priority planning projects and initiatives to accommodate the increased demand in international travel, to enhance ground access to and from the Airport, as well as improve on-Airport roadways and parking. Select planning initiatives 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 includes interior and exterior improvements. The project does not include any new gates, but is reconfiguring three existing gates to accommodate Group VI aircraft (including the Airbus A380 and Boeing 747-8 primarily used by international air carriers). An addition to the west side of Terminal E will allow passenger holdrooms to be reconfigured to accommodate the larger passenger loads associated with larger aircraft. The project also includes modifications to the airfield to meet required Federal Aviation Administration (FAA) safety and design

5 "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.

6 Between 2010 and 2015, 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).

7 Excluding general aviation (GA) passengers.

standards to accommodate the larger aircraft. An Environmental Assessment (EA) was filed, and FAA issued a Finding of No Significant Impact (FONSI) on July 29, 2015. Construction is underway with a planned 2017 completion.

- **Terminal E Modernization Project.** To accommodate existing and long-range forecasted demand for international service in an efficient, environmentally sound manner that also improves customer service, Massport is planning to modernize the existing international Terminal E. Modernizing Terminal E 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. 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. Previously, a satellite FIS facility was planned and permitted in 2001 for Terminal B, but never constructed (EEA # 9791). As part of Phase 2, the Terminal E Modernization Project will also construct a weather-protected direct connection between Terminal E and the Massachusetts Bay Transportation Authority (MBTA) Blue Line Airport Station, which will improve the passenger experience and convenience. As part of this project, the existing on-Airport gas station will be relocated to the Southwest Service Area (SWSA). Massport filed an Environmental Notification Form (ENF) in October 2015 and a joint federal Draft Environmental Assessment/state Draft Environmental Impact Report (Draft EA/EIR) in July 2016. On September 16, 2016, the Secretary of EEA issued a Certificate on the Draft EIR finding that the project adequately and properly complies with MEPA. Massport filed the Final EA/EIR on September 30, 2016. On November 10, 2016, the FAA issued a FONSI and 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. The project is in the conceptual design phase and initial construction will likely begin in 2018. Future EDRs and ESPRs will provide updates as final design and construction proceeds.
- **Terminal C to E Connector.** The Terminal C to E Connector provides a new post-security connection between Terminals C and E on the Departures Level. Approximately 18,900 square feet of interior renovations were made to the existing building, with limited (approximately 3,500 square feet) new exterior construction. The connector provides passengers with a new access point to Terminal E. 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 Airline 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 (now 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.

Ground Access and Parking Projects

A series of recent 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. In 2010, construction began on the new RCC, and 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. In keeping with Massport's commitment to sustainability, the Authority is proud that the RCC was awarded Logan Airport's first Gold Certification in Leadership in Energy and Environmental Design (LEED®) in 2015. The status of mitigation efforts for the RCC is provided in Chapter 9, *Project Mitigation Tracking*.
- **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. Three additional new CNG buses were put into service in the summer of 2015, increasing the total from 18 to 21 buses. The new 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.** This project reduces commercial traffic through East Boston by providing a direct link, along a former rail corridor, from Logan Airport's North Service Area to Chelsea for Airport-related vehicle trips.
- **The Economy Parking Garage.** This project 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 addition.
Source: Massport

- **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.[8] The project commenced in the spring of 2015 and was completed in late 2015.
- **Logan Airport Parking Project.** As one element of its comprehensive ground transportation strategy, Massport proposes to build up to 5,000 new 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 (see Chapter 3, *Airport Planning,* for a detailed description). The construction of additional commercial parking spaces at Logan Airport is predicated on a regulatory change,[9] by the Massachusetts Department of Environmental Protection (MassDEP), whereby MassDEP would amend the existing Logan Airport Parking Freeze to allow for some additional commercial parking spaces at Logan Airport. MassDEP has conducted a stakeholder process, which will be followed by initiating the process to amend the Parking Freeze regulation. Massport expects to initiate a parallel process with EEA by filing an ENF for new parking facilities sometime in early 2017.

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. 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 (**Figure 1-5**).

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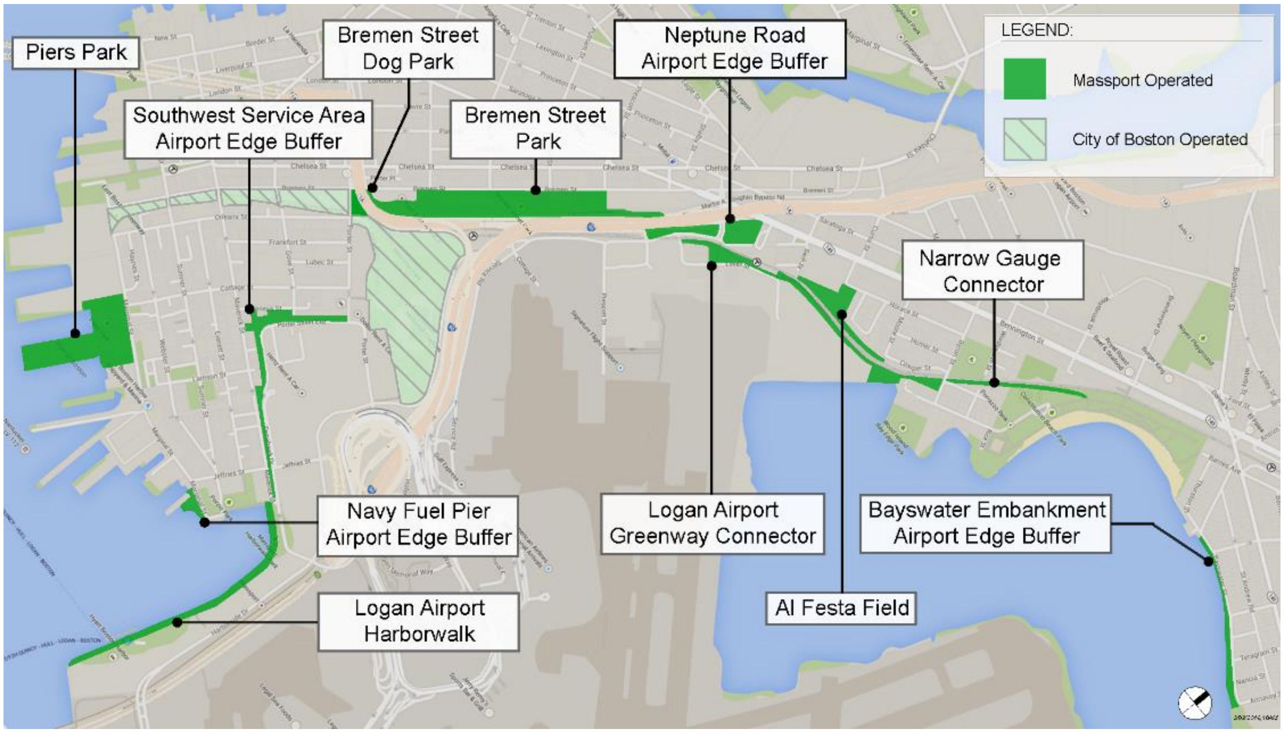
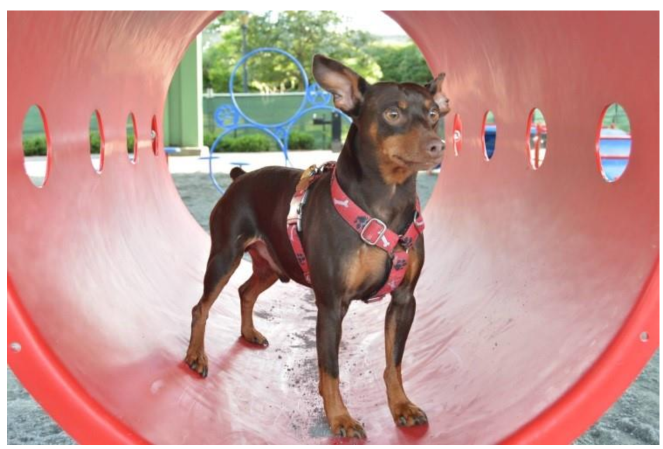
8 310 Code of Massachusetts Regulations 7.30 and 40 CFR 52.1120.
9 310 Code of Massachusetts Regulations 7.30.

Figure 1-5 Parks Owned and Operated by Massport and City of Boston



Source: Massport.

- **Bremen Street Dog Park.** In September 2015, Massport officially opened the Bremen Street Dog Park. This recreational area allows for all types and sizes of dogs to utilize the 22,655-square foot space located on the corner of Bremen and Porter Streets in East Boston.

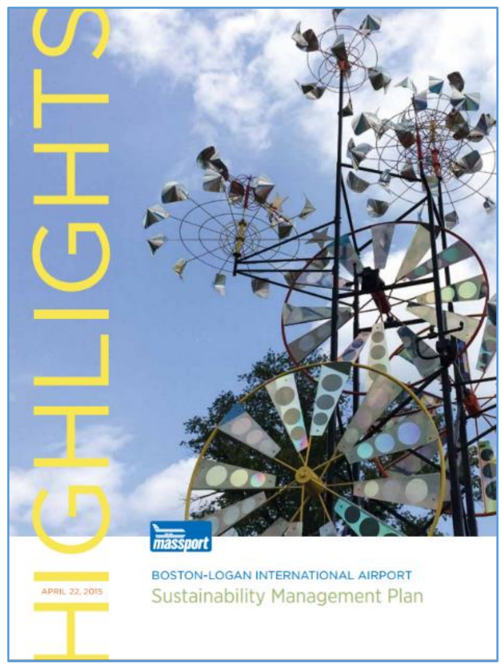


A dog plays at the recently completed Bremen Street Dog Park.
Source: Massport

- **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 Boston Harbor, 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. In 2015, there were 11,545 East Boston Greenway users that were recorded by the counters.

Planning Initiatives

- **Strategic Planning.** In 2013, Massport began a strategic planning effort to position the Authority's aviation, maritime, and real estate lines of business, and its administrative support structures and workforce to meet the region's 21st century transportation and economic development challenges. The strategic planning initiative's primary goal was to formulate a vision for Massport as a transportation and economic development engine for the Commonwealth of Massachusetts in the 21st century.
- **Resiliency Planning.** At the end of 2013, Massport initiated the Disaster and Infrastructure Resiliency Planning (DIRP) Study for Logan Airport, the Port of Boston, and Massport's waterfront assets in South and East Boston. 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 will make recommendations regarding short-term adaptation strategies to make Massport's facilities more resilient to the likely effects of climate change. Massport published *Flood Proofing Design Guidelines* in November 2014, with a revision in April 2015.
- **Runway Incursion Mitigation (RIM) and Comprehensive Airfield Geometry Analysis.** As FAA began to close out their comprehensive nationwide runway safety area improvements program in 2015, their safety focus shifted to analysis of the airfield geometry. The new comprehensive multi-year RIM program will identify, prioritize, and develop strategies to help airports across the U.S. enhance airfield safety. In January 2016, Massport issued a Request for Proposals to study airfield geometry issues at Logan Airport. Future EDRs and ESPRs will provide updates on this initiative and those efforts are likely to require permitting under state or federal regulations.
- **Logan Airport Sustainability Management Plan (SMP).** In 2013, Massport was awarded a grant by the 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 broad view of sustainability including economic vitality, operational efficiency, natural resource conservation, and social responsibility considerations, and is intended to promote and integrate sustainability Airport-wide and to coordinate on-going sustainability efforts across the Authority. A copy of the SMP Highlights Report can be found at https://www.massport.com/environment/sustainability-management-plan.



Logan Airport Sustainability Management Plan
Source: Massport

- **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 2015 SMP. The first Annual Sustainability Report was published in April 2016, and can be found at https://www.massport.com/environment/sustainability-management-plan/2016-logan-airport-annual-sustainability-report/.

Regional Transportation

Logan Airport and a system of 10 other commercial service, reliever, and GA airports[10] (regional airports) anchor the New England region. Together, these 11 airports accommodate nearly all of New England's commercial[11] air travel demand (**Figure 1-6**). 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.

- Passenger traffic in the New England region in 2015 represented a record high for the region, returning to passenger levels prior to the 2008/2009 economic downturn and exceeding the historical peak of 48.0 million in 2005. The total number of air passengers using New England's commercial service airports, including Logan Airport, increased by 4.1 percent from 46.8 million annual air passengers in 2014 to 48.7 million in 2015.
- Of the 48.7 million passengers using New England's commercial service airports in 2015, 68.6 percent of passengers (33.4 million) used Logan Airport compared to 67.6 percent (31.6 million) in 2014.
- Total aircraft operations in the New England region (including Logan Airport) remained flat in 2015, increasing 0.3 percent from 987,652 operations in 2014[12] to 991,041 operations in 2015.

Figure 1-6 New England Regional Transportation System

- Worcester Regional Airport (ORH) is an important aviation resource that accommodates corporate GA activity and commercial airline services. Massport has continued investment in Worcester Regional Airport by acquiring and modernizing Worcester Regional Airport to better serve 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

10 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 the FAA to relieve congestion at Commercial Service Airports and to provide improved general aviation access to the overall community. General Aviation Airports are public-use airports that do not have scheduled service or have less than 2,500 annual passenger boardings.

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

12 Reflects updated calendar year 2014 aircraft operation statistics for some regional airports based on updated FAA tower counts since the publication of the *2014 EDR*. See Table 4-1 for more details.

collaboration, JetBlue Airways has already handled over 350,000 passengers at ORH since commencing operations in late 2013.

- Massport recently started construction on Worcester's Category (CAT) III Instrument Landing System to enhance operational and safety conditions 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.

- Hanscom Field (BED) 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 some 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 2015, consistent with Hanscom Field's role as a premier corporate airport, new hangars are being built to accommodate the need for corporate jet services.
- Massport is supporting MassDOT's efforts to expand Boston's South Station to meet the current and future demand for rail mobility within Massachusetts and along the 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 service or via taxi or other unscheduled modes. Overall, NEC ridership reached a new record in 2015, surpassing 2014 record levels. Amtrak's share of the Northeast total passenger market has increased substantially since the introduction of Acela Express service in 2000. In fiscal year 2015, the NEC carried 11.7 million passengers on its Acela Express and Northeast Regional services, up 0.5 percent from the prior year. Acela Express accounted for 3.5 million passengers, while the Northeast Regional accounted for 8.2 million passengers.

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 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 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. Despite Massport's industry-leading efforts promoting and providing HOV/shared-ride mode use, private passenger vehicle trips continue to increase with growth in air travel. As Logan Airport air traveler numbers have increased, a constrained parking supply at Logan Airport has resulted in an increase in "drop-off/pick-up" vehicle trips. The greater number of vehicle trips means increasing VMT and attendant emissions – the opposite effect of what the Logan Airport Parking Freeze regulation was intended to achieve.

Massport is implementing multiple strategies 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,[13] which generate up to four vehicle trips instead of two. Massport has continued 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 close to 30 percent.[14] Measures implemented by Massport to increase HOV use 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 to increase HOV mode share.

Continuing improvements to support HOV include: new Back Bay Logan Express pilot service (since May 2014); free MBTA Silver Line outbound (from Logan Airport) boardings; a new 1,100-car parking garage at the Framingham Logan Express; reduced holiday travel parking rates at Logan Express facilities; increased parking rates on the Airport; and support for private coach bus and van operators.

Key findings in 2015 are:

- Current Annual Average Daily Traffic (AADT) and annual average weekday daily traffic (AWDT) values are 2 and 5 percent (respectively) lower than peak recorded (2007) on-Airport traffic volumes despite a 19.0-percent increase in passenger levels from 2007 to 2015. VMT over the same timeframe has decreased by roughly 9 percent, although, due to changes in modeling procedures, a direct VMT comparison cannot be made.
- The total number of air passengers increased by 5.7 percent to 33.4 million in 2015, compared to 31.6 million in 2014. During the same period, VMT on-Airport increased by 6.5 percent. There are likely many factors that contribute to the change in VMT. These factors will be further investigated in the *2016 ESPR*.
- Massport continued to be in full compliance with the Logan Airport Parking Freeze regulations in 2015. Daily parking demand in 2015 more frequently approached the Parking Freeze cap as compared to 2014, despite an increase in terminal area parking rates on July 1, 2014. As one element of its comprehensive transportation strategy, Massport proposes to build up to 5,000 new 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. The construction of additional commercial parking spaces at Logan Airport is predicated on a regulatory change,[15] by MassDEP, whereby MassDEP would amend the existing Logan Airport Parking Freeze to allow for some additional commercial parking spaces at Logan Airport. MassDEP has conducted a stakeholder consultation, which will be followed by initiating the process to

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13 Drop-off/Pick-up modes can include private vehicles, taxis, and black car services. For example, if an air passenger is dropped off when they depart on an air trip and is picked-up when they 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 or black car that may not carry a passenger during all segments of travel to and from Logan Airport.

14 According to the *2013 Logan Airport Air Passenger Ground Access Survey*, 27.8 percent of air passengers accessing Logan Airport used HOV modes of travel.

15 310 Code of Massachusetts Regulations 7.30.

amend the Parking Freeze regulation. Massport expects to initiate a parallel process with EEA by filing an ENF for new parking facilities sometime in early 2017.

- The *2014 EDR* reported a 10.5-percent decrease in on-Airport VMT. This reflects Massport's efforts to reduce VMT through the opening of the RCC, which: (1) consolidated rental car operations to one location; (2) provides one unified rental car shuttle; (3) relocated the taxi and limousine/bus pool closer to terminal area roadways; and (4) included additional improvements to alternative transportation systems.
- Massport is currently offering a pilot program, Back Bay Logan Express, to determine whether a frequent, direct, express bus service increases HOV service from the City of Boston. This particular service has been valuable in providing an alternative to air passengers and employees who have been 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 to the Airport. After the re-opening of Government Center Station in March 2016, this pilot program has continued. Ridership in 2015 for the Back Bay Logan Express totaled 290,796 passengers, an average of about 805 riders per day. In 2014, the service averaged 624 riders per day, with a total of 152,892 passengers between April 28 and December 31, 2014.

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

Aviation Environmental Design Tool (AEDT)

In 2015, the FAA introduced a new combined noise and air quality modeling tool, the Aviation Environmental Design Tool (AEDT). This new tool is a software system that dynamically models aircraft performance in space and time to produce fuel burn, emissions, and noise information. As of 2015, the FAA requires airports to use AEDT for National Environmental Policy Act (NEPA) projects and soundproofing eligibility. Massport undertook initial modeling of noise and air using AEDT; however, Massport has technical concerns related to the initial results at Logan Airport. Following a briefing with the FAA, it was decided that the initial AEDT results would not be published in the *2015 EDR* (pending further technical discussions with FAA's Office of Environment and Energy). Therefore, 2015 modeling for noise was performed with the FAA's Integrated Noise Model (INM) and the Emissions and Dispersion Modeling System (EDMS) for air emissions.

Massport is actively evaluating the new model and working with the FAA to develop the types of Logan Airport-specific adjustments for the AEDT model that have been used for many years in INM. Once approved by FAA, the adjustments will allow the model to more accurately reflect the noise environment at Logan Airport. Several of these custom adjustments cannot yet be implemented directly in AEDT and will need to be evaluated by Massport and approved by FAA. Massport has reached out to FAA for consideration and approval of these adjustments and, if completed in a timely fashion, AEDT is expected to be the official model for next year's *2016 ESPR*. Additional information on AEDT is provided in Chapter 6, *Noise Abatement,* and Chapter 7, *Air Quality/Emissions Reduction.*

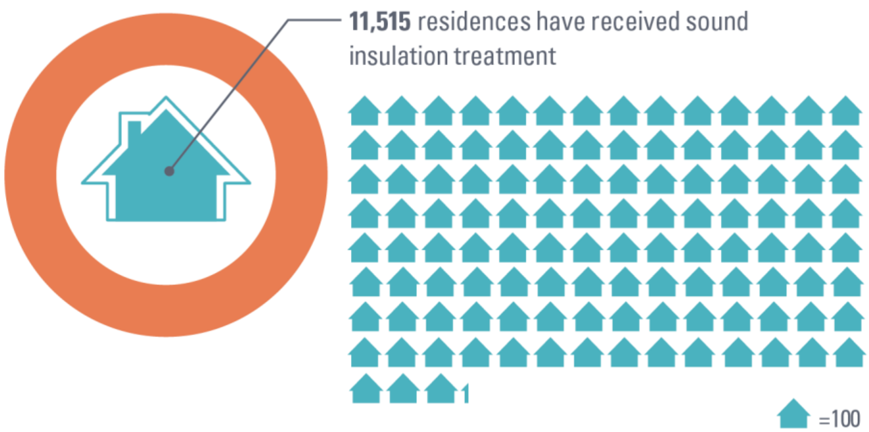
The Secretary's Certificate on the *2014 EDR* states that 2015 noise contours and air quality emissions should be modeled using AEDT and compared to the most recent version of INM and EDMS. For the reasons outlined above, this *2015 EDR* does not include AEDT results. Massport is actively working with the FAA to review preliminary results and to develop, at FAA's discretion, Logan Airport-specific model adjustments.

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 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[16]).

Massport is a national leader in sound insulation mitigation. To date, Massport has provided sound insulation for a total of 11,515 residential units, and will continue to seek funding for sound insulation for properties that are eligible and whose owners have chosen to participate (**Figure 1-7**). 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.

Figure 1-7 Residences Treated through Massport Residential Sound Insulation Program (RSIP)



Since 2000, the number of daily aircraft operations at Logan Airport has declined by almost 25 percent (from 1,355 operations per day in 2000 to 1,022 operations per day in 2015) while aircraft have been experiencing increasing passenger loads. Passenger volumes continue to increase at a higher rate than aircraft operations. In 2015, the overall number of air passengers was up by 20.6 percent compared to 2000. This trend reflects an increase in the use of larger aircraft in the fleet, airline consolidation, and increased load factors on the part of airlines. Compared to 2000, in 2015:

- Jet operations made up 86 percent of operations compared to 66 percent in 2000;
- Overall operations were down by 23.6 percent while overall passengers were up by 20.6 percent compared to 2000; and
- The number of people exposed to Day-Night Average Sound Level (DNL) 65 decibels (dB) has declined by 20.6 percent since 2000.

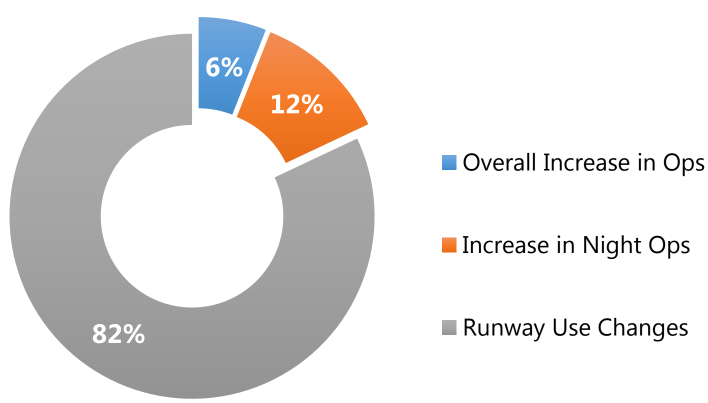
16 Nighttime hours are defined as 10:00 PM to 7:00 AM.

For 2014 and 2015, differences between measured and modeled noise values have narrowed even more than reported in previous EDRs and ESPRs.[17] This improved accuracy in modeled results corresponds with the Airport's noise measurement equipment and monitoring system and its ability to correlate measured noise events with individual flight tracks, combined with the improvements in the INM database.

Compared to 2014, the 2015 DNL 65 dB noise contours were larger in most areas around the Airport due to changes in: (1) runway usage, primarily as a result of wind and weather conditions, (2) an increase in the number of nighttime operations, and (3) an increase in the number of overall operations. The overall number of people exposed to DNL values greater than or equal to 65 dB increased by 58.0 percent, from 8,922 people in 2014 to 14,097 people in 2015.[18] Noise contour changes specific to 2015 in comparison to 2014 are discussed below.

1. Runway use changes from 2014 to 2015 were the largest factor in the increase in the number of people exposed to DNL values greater than or equal to 65 dB in 2015.
   - The DNL contour increased in East Boston and slightly in South Boston due to an increase in Runway 22R departures in 2015. Increased departures from Runway 22L also resulted in increases in Winthrop.
   - Increased arrivals to Runways 22L and 27 at night contributed to increases in Revere and Winthrop.
   - Unlike 2014, 2015 reflects almost a full year of the head-to-head night noise abatement procedures on Runway 15R-33L. While this reduces overall noise exposure by concentrating operations over water rather than over populated areas, it increases start-of-takeoff-roll noise in East Boston, north and west of the Runway 15R end.
   - Lower use of Runway 4R for arrivals in 2015 resulted in a reduction in the contour south of the Airport.
2. An additional factor influencing noise contour changes in 2015 was a 5.7-percent increase in nighttime operations (from 48,056 nighttime operations in 2014 to 50,786 nighttime operations in 2015). This increase in overall operations and nighttime operations is still well below the peak of 54,038 annual operations at night reached in 1999. As airlines have expanded to new destinations, the number of commercial operations, and in turn the number of nighttime

Figure 1-8 Reason for Increase in Number of People Exposed to DNL Values Greater than or Equal to 65 dB



17 Several factors have resulted in better agreement between measured versus modeled levels. Beginning with the *2009 EDR*, flight track data and measurement data have come from the new monitoring system. The more accurate flight track data are used for the modeling inputs and for the measured aircraft event correlation.

18 Population data were derived from the most recent 2010 United States Census block data.

operations, has increased. In 2015, there was an increase of 7.5 nighttime operations per day compared to 2014.[19]

3. The overall increase in operations was smaller than the increase in nighttime operations (2.5 percent overall versus 5.7 percent nighttime), but contributed to the expansion of the noise contours.

The DNL and population levels in 2015 remain well below the peak levels reached in 1990 and are less than in the year 2000 when 17,745 people were exposed to DNL levels greater than or equal to DNL 65 dB.

As shown in **Figure 1-9**, the 2015 DNL 65 dB contour is somewhat larger than the 2014 DNL 65 dB contour. Almost all of the residences exposed to levels greater than or equal to DNL 65 dB in 2015 have been eligible in the past to participate in Massport's residential sound insulation program (RSIP).

Additional information is provided in Chapter 6, *Noise Abatement*.

19 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.

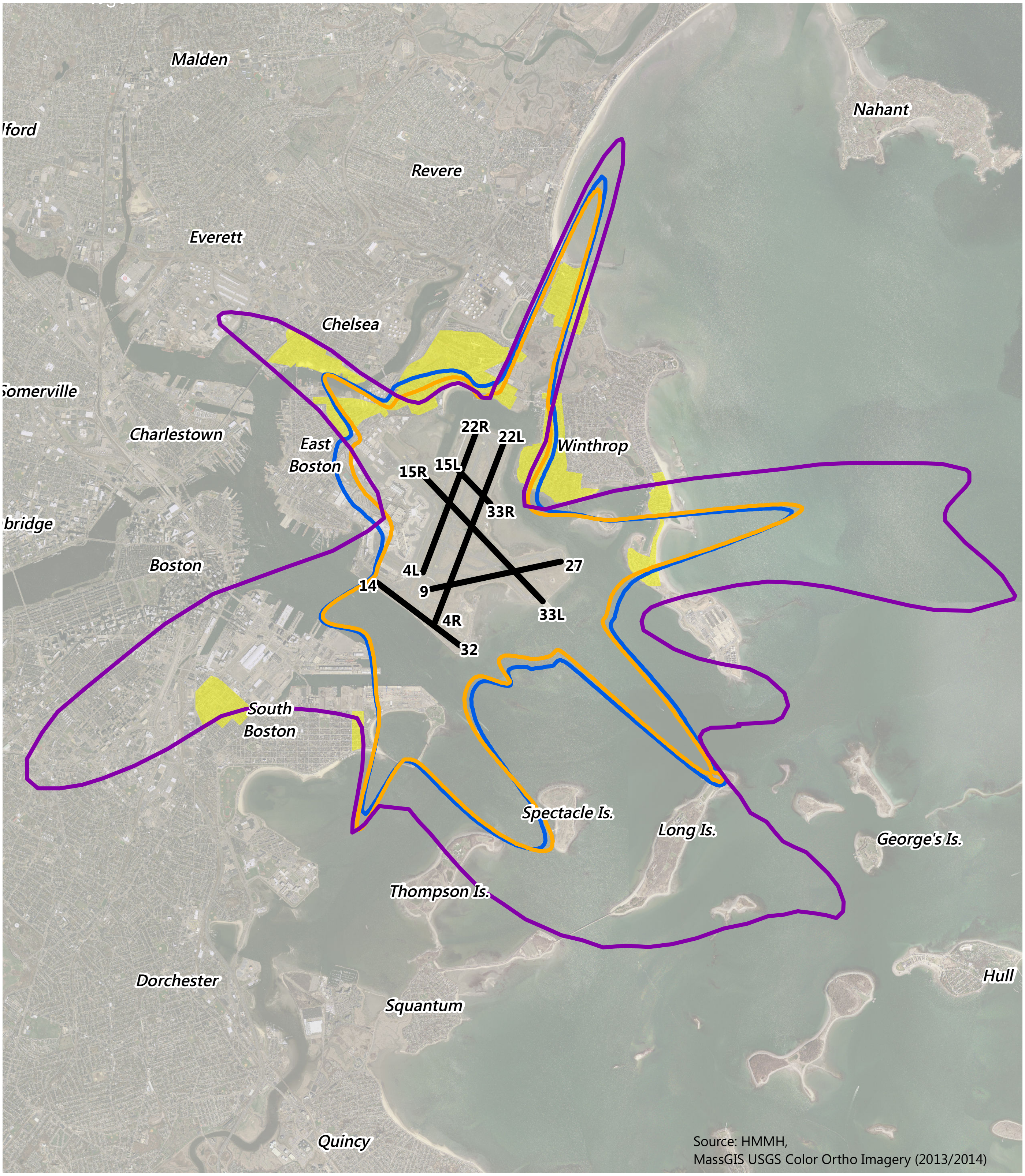


FIGURE 1-9 DNL 65 dB Contour Comparison with Historical Contour

2015 Environmental Data Report

- 1990 DNL Contour
- 2014 DNL Contour (INM 7.0d)
- 2015 DNL Contour (INM 7.0d)
- Sound Insulation Areas

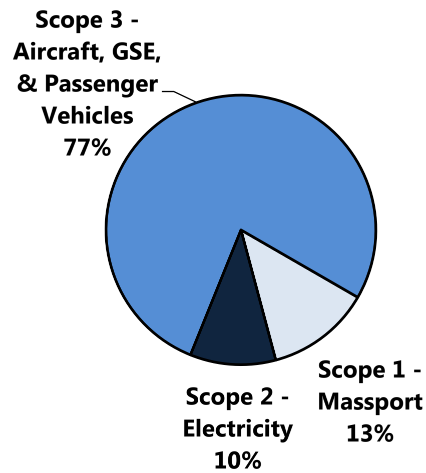
0 1750 3500 7000 Feet

Air Quality/Emissions Reduction

Total air quality emissions from all sources associated with Logan Airport in 2015 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 fewer aircraft operations and reduced emissions. In 2015, calculated emissions of volatile organic compounds (VOCs), oxides of nitrogen (NO_x), carbon monoxide (CO), and particulate matter (PM) went up slightly compared to 2014. The increase in emissions for VOCs, NO_X, CO, and PM are primarily due to the corresponding increase in aircraft landing and take offs (LTOs) and airfield taxi times.

- Total emissions of VOCs increased by 1 percent in 2015 to 1,188 kilograms (kg)/day compared to 1,177 kg/day in 2014, which is still well below 1990 and 2000 levels.
- Total NO_x emissions increased by approximately 5 percent in 2015, to 4,262 kg/day compared to 2014 levels of 4,040 kg/day. To a lesser extent, this increase is also attributable to the increase in natural gas use by stationary sources. The increase in 2015 is still well below 1990 and 2000 levels.
- Total CO emissions increased by about 3.5 percent in 2015 to 7,243 kg/day, from 6,987 kg/day in 2014; emissions in 2015 were still well below 1990 and 2000 levels.
- Total PM_{10}/$PM_{2.5}$ emissions also increased by about 3 percent in 2015 to 98 kg/day, from 95 kg/day in 2014.
- For nine consecutive years, Massport has voluntarily prepared a greenhouse gas (GHG) emissions inventory for the Logan Airport EDR. In 2015, total GHG emissions grew by 6 percent. As reported in past year EDRs, Logan Airport-related GHG emissions in 2015 comprised less than 1 percent of statewide totals.
- Massport's voluntary Air Quality Initiative (AQI)[20] has tracked NO_x emissions since the benchmark year of 1999. In the final year of this program (2015), total NO_x emissions were 632 tons per year (tpy) lower than the 1999 benchmark. This represents an overall decrease of 27 percent in NO_x emissions over the past 15 years. Between 1999 and 2015, the greatest reductions of NO_x emissions were associated with aircraft, ground service equipment (GSE), and on-Airport motor vehicles at 17 percent, 71 percent, and

Figure 1-10 Sources of GHG Emissions, 2015



Note: 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.

20 Massport adopted the AQI as a 15-year voluntary program with the overall goal to maintain NO_X emissions associated with Logan Airport at, or below, 1999 levels. This reporting year, 2015, marks the final year of the program's operation. However, NO_x will continue to be reported in future EDRs/ESPRs as part of the Logan Airport emissions inventory.

87 percent reductions, respectively. Massport will continue to report on NO_x emissions as part of the Logan Airport emissions inventory in future EDRs/ESPRs.

Chapter 7, *Air Quality/Emissions Reduction* provides additional information.

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 2015.

- The most recent International Organization for Standardization (ISO) 14001 Environmental Management System (EMS) certification audit took place in June 2014, and a certificate was issued in July 2014; and is valid through July 2017. Massport holds regular meetings to meet regulatory requirements and improve environmental performance beyond compliance.
- Massport's Stormwater Pollution Prevention Plan (SWPPP) addresses stormwater pollutants in general and also addresses deicing and anti-icing chemicals, potential bacteria, fuel and oil, and other potential sources of stormwater pollutants.[21]
- In 2015, approximately 99 percent of samples were in compliance with standards (Table J-15). 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 160 samples (inclusive of oil and grease, total suspended solids, and pH at North, West, Porter Street, and Maverick Street Outfalls), 158 were at or below National Pollutant Discharge Elimination System (NPDES) permit limits.
  - One outfall sample out of a total of 20 samples at the North Outfall and one sample out of a total of 19 samples at the West Outfall exceeded the regulatory limits of the NPDES permit for oil and grease and total suspended solids (TSS), respectively. The oil and grease exceedance at the North Outfall was reported in February 2015 and the TSS exceedance at the West Outfall was reported in September 2015, as required.

21 The 2015 Annual Certificates of Compliance were submitted to the Environmental Protection Agency (EPA) and MassDEP on December 17, 2015, for Massport and each co-permittee.

- In 2015, there were 16 oil and hazardous material spills that required reporting to MassDEP, seven of which involved a storm drainage system.[22] 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.

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

Sustainability 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 1-11 EONS Approach to Sustainability

Consistent with the Airports Council International - North America's (ACI-NA) definition of Airport Sustainability[23] (**Figure 1-11**), 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 *2015 EDR* more fully describe, where appropriate.

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 the FAA to prepare a SMP for Logan Airport. The Logan Airport SMP planning effort began in

22 State environmental regulations require that oil spills of 10 gallons or more in volume be reported to MassDEP.
23 Airport Council International (ACI). Airport Sustainability: A Holistic Approach to Effective Airport Management. Undated. http://www.aci-na.org/static/entransit/Sustainability%20White%20Paper.pdf. Accessed July 17, 2013.

May 2013 and was completed in April 2015. The Logan Airport SMP takes a broad view of sustainability including economic vitality, social responsibility, operational efficiency, and natural resource conservation considerations. The Logan Airport SMP is intended to promote and integrate sustainability Airport-wide and to coordinate on-going sustainability efforts across the Authority. 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 (**Table 1-1**) 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/environment/sustainability-management-plan.

Logan Airport Sustainability Goals

As part of the Logan Airport SMP, Massport set goals to improve Logan Airport's performance in ten sustainability categories: energy and GHG emissions; water conservation; community, employee, and passenger well-being; materials, waste management, and recycling; resiliency; noise abatement; air quality improvement; ground access and connectivity; water quality/stormwater; and natural resources. **Table 1-1** 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 annual sustainability report in 2016, which is available on Massport's website at https://www.massport.com/environment/sustainability-management-plan/2016-logan-airport-annual-sustainability-report/.

Table 1-1 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 (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. Some recent examples of LEED-certified buildings at Logan Airport are the new RCC and the Green Bus Depot (**Figure 1-12** and **Table 1-2**). 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 1-12 LEED-Certified Facilities at Logan Airport

Rental Car Center, LEED Gold Certified (2015)

Green Bus Depot, LEED Silver Certified (2014)

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

Terminal A, LEED Certified (2006)

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 1-2 LEED-Certified Facilities at Logan Airport

Terminal A (LEED Certified) Completed 2005/2006

- 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

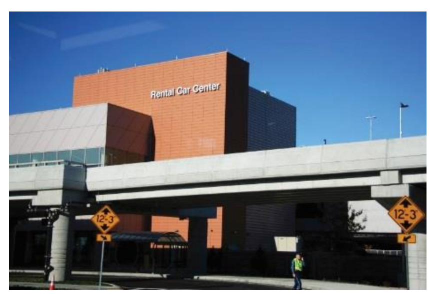
Signature Flight Support General Aviation Facility (LEED Certified) Completed 2007/2008

- Mechanisms to reduce water use
- Natural day lighting paired 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 Certified) Completed 2012

- 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 Certified) Completed 2013



- Green building materials
- Rooftop solar panels
- Bike and pedestrian access and connections
- Natural day lighting paired with 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

Logan Airport Environmental Review Process

This *2015 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 the Executive Office of Environmental Affairs (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[24] 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 and 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.

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* presented conditions for calendar year 2014.

This *2015 EDR* provides a comprehensive, cumulative analysis of the effects of all Logan Airport activities based on actual passenger activity and aircraft operation levels in 2015, and presents environmental

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

management plans for addressing areas of environmental concern. Massport proposes to prepare a *2016 ESPR* to report on activity levels and environmental conditions for that year and projections through 2035, and anticipates publishing this report in early 2018. 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[25] environmental review is triggered, projects are reviewed under the NEPA environmental review process.

Organization of the *2015 EDR*

The remainder of this *2015 EDR* includes:

- **Spanish Executive Summary,** a translated version of the Executive Summary is included after the English-version of Chapter 1, *Introduction/Executive Summary*.
- **Chapter 2, *Activity Levels***, presents aviation activity statistics for Logan Airport in 2015 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 2015. 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 2015 and updates recent regional planning activities.
- **Chapter 5*, Ground Access to and from Logan Airport***, reports on transit ridership, roadways, traffic volumes, and parking for 2015.
- **Chapter 6, *Noise Abatement***, updates the status of the noise environment at Logan Airport in 2015 and describes Massport's efforts to reduce noise levels.
- **Chapter 7, *Air Quality/Emissions Reduction***, provides an overview of Airport-related air quality in 2015 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.

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25 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 9, *Project Mitigation Tracking***, reports on Massport's progress in meeting its MEPA Section 61[26] mitigation commitments for specific Airport projects.

Supporting appendices include:

MEPA Appendices: These include the Secretary of EEA's Certificate on the *2014 EDR*, comment letters received on the *2014 EDR* and responses to those comments, Secretary Certificates on the annual reports issued for reporting years 2011 through 2014, a list of reviewers to whom this *2015 EDR* was distributed, and a proposed scope for the *2016 ESPR*. Also included in this section are the Secretary's Certificates on the Terminal E Modernization Project ENF, Draft EA/EIR, and Final EA/EIR.

Appendix A – MEPA Certificates and Responses to Comments[27]
Appendix B – Comment Letters and Responses
Appendix C – Proposed Scope for the 2016 ESPR
Appendix D – Distribution List

Technical Appendices:[28] These include detailed analytical data and methodological documentation for the various environmental analyses presented in and conducted for this *2015 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 – 2015 and 2016 Peak Period Pricing Monitoring Report
Appendix L – Reduced/Single Engine Taxiing at Logan Airport Memoranda

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26 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.

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

28 Technical appendices are included on the attached CD.

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Introducción/Resumen Ejectivo

(Spanish Executive Summary)

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1

Introducción/Resumen Ejecutivo

Introducción

Mediante este *“2015 Environmental Data Report” (Informe de Datos Ambientales del 2015) (2015 EDR)* del Aeropuerto Internacional de Boston-Logan*,* Massport se complace en continuar con su práctica de informar a la comunidad entregando un extenso registro de datos, de casi tres décadas, sobre el desarrollo de tendencias ambientales, planificación del desarrollo, niveles de operaciones y de pasajeros y los compromisos de mitigación ambiental relacionados con el Aeropuerto Internacional de Boston-Logan (en adelante, Aeropuerto Logan o Aeropuerto). El Aeropuerto Logan, perteneciente y operado por la “Massachusetts Port Authority” (Autoridad de Puertos de Massachusetts) (Massport), es el principal aeropuerto internacional y nacional de la región de Nueva Inglaterra. Este informe *2015 EDR* es uno de los muchos documentos de revisión ambiental que desde 1979 se vienen sometiendo ante “Massachusetts Environmental Policy Act Office” (la Oficina de la Ley de Políticas Ambientales de Massachusetts) (MEPA),[1] con el fin de informar sobre los impactos ambientales acumulativos como consecuencia de las operaciones y actividades del Aeropuerto Logan. El Aeropuerto Logan es el primer aeropuerto de la nación que se le prepara un reporte anual de evaluación ambiental y además Massport continúa siendo líder en publicación de informes ambientales.

Informes de Datos Ambientales Anuales e Informes de Estado y Planificación Ambiental desde 1991.

Aproximadamente cada cinco años, Massport prepara un “Environmental Status and Planning Report” (Informe de Situación y Planificación Ambiental) (ESPR), en el que se entrega una visión histórica y prospectiva del Aeropuerto Logan. En los informes anuales EDR, que se preparan entre cada informe ESPR, se entrega una revisión de las condiciones ambientales para el año en curso y su comparación con el año anterior. De acuerdo a los informes EDR/ESPR sometidos anteriormente, los impactos ambientales asociados con el Aeropuerto Logan han ido disminuyendo. Este *2015 EDR* viene a continuación del *2014 EDR* y reporta las condiciones ambientales del año 2015. En 2015, la calidad del aire y del ruido ambiental ha mejorado considerablemente en el Aeropuerto Logan en comparación con las condiciones existentes en los años 1990 y 2000. Este mejoramiento obedece tanto a los esfuerzos por parte de

1 Capítulo 30, Secciones 61-62H, sobre Leyes Generales de Massachusetts La ley MEPA se implementó mediante las regulaciones publicadas en el Código 301 de las Regulaciones de Massachusetts (CMR) 11.00 (las "Regulaciones de MEPA").

Massport en mitigar los impactos ambientales, así como a las tendencias de la industria aeronáutica en fabricar naves menos ruidosas y menos contaminantes y con una mayor eficiencia.

El alcance de este *2015 EDR* fue establecido por el Certificado emitido por el Secretario de la "Executive Office of Energy and Environmental Affairs" (Oficina Ejecutiva de Energía y Asuntos Ambientales) (EEA) con fecha 12 de Noviembre de 2015, incluido en el Apéndice A, *Certificados y Respuestas de MEPA a los comentarios*. En este *2015 EDR* se actualizan y comparan los datos presentados en el *2014 EDR*, y se presenta información del año 2015 referente a lo siguiente:

- Niveles de actividad (incluidas las operaciones aeronáuticas, actividad de pasajeros y de carga)
- Actividades de Planificación del Aeropuerto y proyectos futuros
- Papel que cumple el Aeropuerto Logan en la red de transporte regional
- Acceso Terrestre hacia y desde el Aeropuerto
- Reducción del ruido
- Reducción de Emisiones Contaminantes para mejorar la Calidad del Aire
- Cumplimiento con la Calidad del Agua y el Medioambiente
- Compromisos de Mitigación Ambiental
- Sostenibilidad y resiliencia

Con el objeto de aumentar el uso de este informe *2015 EDR* como documento de referencia, se incluyen los datos históricos de las condiciones ambientales en el Aeropuerto Logan desde 1990, en los casos en que dicha información histórica esté disponible. Estos datos históricos están incluidos en los apéndices técnicos (exclusivamente en CD).

Por primera vez, este informe *2015 EDR* incluye una traducción al español del Resumen Ejecutivo. La versión traducida está localizada a continuación de la versión en inglés del Resumen Ejecutivo.

EOEA # 3247

Sometido por

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Aeropuerto Logan Contexto de planificación

El Aeropuerto Logan, principal aeropuerto internacional y nacional de la región de Nueva Inglaterra, cumple un papel determinante en las redes de transporte de pasajeros y carga de la zona metropolitana de Boston y de la región de Nueva Inglaterra y es un contribuyente importante para la economía regional. El Aeropuerto Logan cumple una gran cantidad de funciones en las rutas locales de transporte aéreo, de la región de Nueva Inglaterra y en las rutas nacionales. Es el principal aeropuerto que presta sus servicios al área metropolitana de Boston, el principal aeropuerto de la región de Nueva Inglaterra para servicios de larga distancia y un importante aeropuerto internacional de los E.E.U.U. para servicios transatlánticos. El Aeropuerto Logan sirve como centro de conexión regional para los pequeños mercados de la región de Nueva Inglaterra del norte y de los condados marítimos de Massachusetts: Barnstable, Dukes y Nantucket; el Aeropuerto es también el centro de carga aérea de mayor actividad en la región de Nueva Inglaterra.

Los límites del Aeropuerto abarcan aproximadamente 2.400 acres (10 km^2) de las zonas East Boston y Winthrop, e incluye un túnel submarino de aproximadamente 700 acres (2,8 km^2) dentro de la bahía de Boston. El Aeropuerto Logan, que aparece en las **Figuras 1-1** y **1-2**, es uno de los aeropuertos con mayor restricción de tierras de la nación y está rodeado en tres de sus costados por la Boston Harbor (Bahía de Boston).

El Aeropuerto Logan está cerca del centro de Boston, al que se puede llegar a través de dos líneas de transporte público y un sistema de vialidad bien conectado. El aeropuerto consta de seis pistas, totalizando una longitud aproximada de 15 millas (9,3 km) de pistas de aterrizaje y de con un área aproximada de 240 acres (1 km^2) de pavimento de concreto armado y asfalto. El Aeropuerto Logan tiene cuatro terminales de pasajeros (Terminales A, B, C y E), cada uno con instalaciones propias de venta y emisión de boletos, reclamo de equipaje y transporte terrestre. Massport sigue evaluando e implementando mejoras en la seguridad, eficiencia operacional y accesibilidad del Aeropuerto Logan hacia y desde el área metropolitana de Boston y al mismo tiempo supervisa de manera minuciosa los impactos que provocan las operaciones del Aeropuerto al medio ambiente.

En el año 2015, el Aeropuerto Logan ocupó el decimoséptimo lugar entre los aeropuertos comerciales de los E.E.U.U. con mayor actividad en función del número de pasajeros comerciales, y decimoctavo lugar entre los aeropuertos comerciales de los E.E.U.U. con mayor actividad en relación con los movimientos aéreos.[2] Boston es un importante destino nacional e internacional, y las compañías aéreas buscan expandir el servicio internacional en el Aeropuerto Logan en función de la demanda de pasajeros actual y futura. Durante los últimos tres años, el nuevo servicio internacional por sí solo ha contribuido con más de $1,4 billones anuales a la economía local y con $44 millones más gracias al nuevo impuesto fiscal adicional aplicado a los ingresos y ventas. [3]

En el año 2015, más de 15.000 personas fueron empleadas para trabajar en el Aeropuerto Logan. Esta cifra incluía aproximadamente 1.040 empleados aeroportuarios y administrativos de Massport. La "*Massachusetts Statewide Airport Economic Impact Study Update*" (*Actualización del Estudio de Impacto Económico Aeroportuario del Estado de* Massachusetts) de la Massachusetts Department of Transportation Aeronautics Division's (División Aeronáutica del Departamento de Transporte de Massachusetts) (MassDOT) reveló que en el año 2014, el

2 Consejo Internacional de Aeropuertos, Informe de Tráfico Aéreo de América del Norte 2015.
3 InterVISTAS. 2015. Impacto Económico de Rutas Internacionales Recientes.

Aeropuerto Logan financió alrededor de 132.000 trabajos y contribuyó con alrededor de $13,4 billones anuales a la economía local; esto incluye todos las actividades comerciales aeroportuarias, de construcción, de visitantes y sus impactos multiplicadores.[4]

4 Actualización del Estudio de Impacto Económico del Aeropuerto en el Estado de MassDOT, 2014.

FIGURA 1-1 Vista Aérea del Aeropuerto Logan

2015 Environmental Data Report

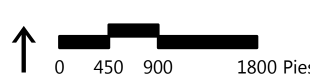


FIGURA 1-2 **Aeropuerto Logan y sus Alrededores**

Hechos destacados y Hallazgos Importantes de 2014

En esta sección se entrega un breve resumen, por capítulo, de los hallazgos importantes encontrados en el Aeropuerto Logan en 2015. La información adicional relacionada con las actividades del Aeropuerto se entrega en los siguientes capítulos. En esta sección también se destacan los esfuerzos que ha hecho Massport para fomentar la sostenibilidad a través de proyectos e iniciativas específicas con una hoja de sostenibilidad y al final se incluye un resumen del programa de sostenibilidad de Massport.

Niveles de actividad

- En el 2015, el número total de pasajeros aumentó 5,7 por ciento y llegó a 33,4 millones de pasajeros, en comparación con los 31,6 millones en el 2014 (**Figuras 1-3** y **1-4**). El nivel de pasajeros en el 2015 representa un nuevo récord para el Aeropuerto Logan.
- En el 2015 las operaciones aéreas de pasajeros representaron el 91 por ciento del total de las operaciones aeronáuticas. El número total de operaciones aeronáuticas en el Aeropuerto Logan aumentaron de 363.797 en el 2014 a 372.930 en el 2015, lo que representa un aumento del 2,5 por ciento. Esto fue precedido por un aumento de 0,7 por ciento desde el 2013 al 2014. A pesar de este aumento, las operaciones aeronáuticas en el Aeropuerto Logan se mantuvieron por debajo de las 487.996 operaciones del año 2000 y del pico histórico de 507.449 operaciones alcanzado en 1998. En 1998, el Aeropuerto Logan atendió a 26,5 millones de pasajeros, contra 33,4 millones en 2015, contando con 134.519 operaciones menos.
- En el Aeropuerto Logan, la eficiencia del transporte aéreo sigue aumentando, con un aumento en el promedio de pasajeros por operación aeronáutica del 87,0 por ciento en el 2014 al 89,7 por ciento en el 2015. El aumento en el número de pasajeros por vuelo refleja un cambio en no utilizar naves aéreas más pequeñas para aumentar los factores de carga, así como las líneas aéreas siguen concentrándose en el control de la capacidad y mejorar la eficiencia.

Figura 1-3 Pasajeros y operaciones anuales del Aeropuerto Logan, 2000, 2014, 2015

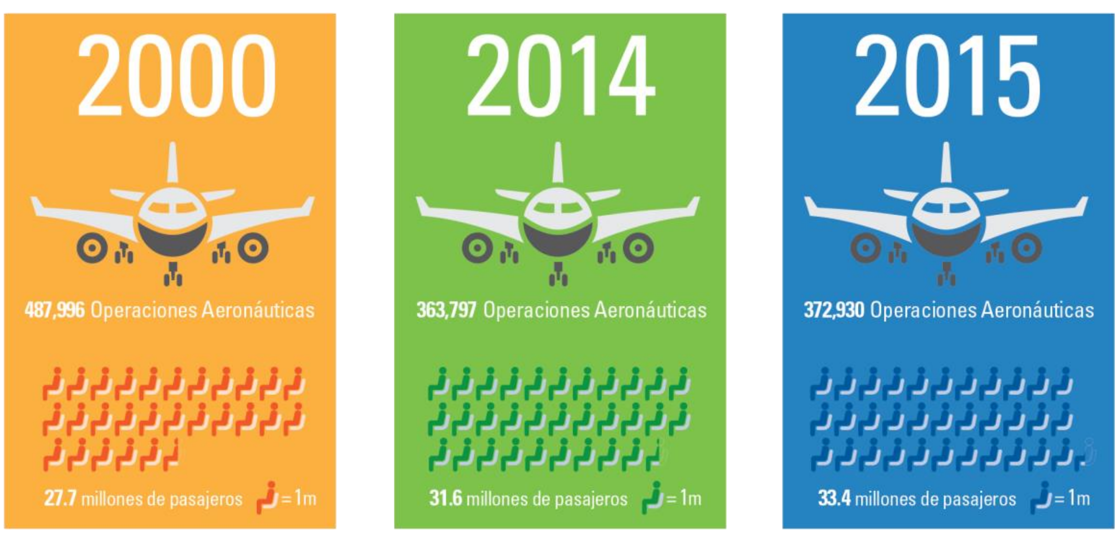
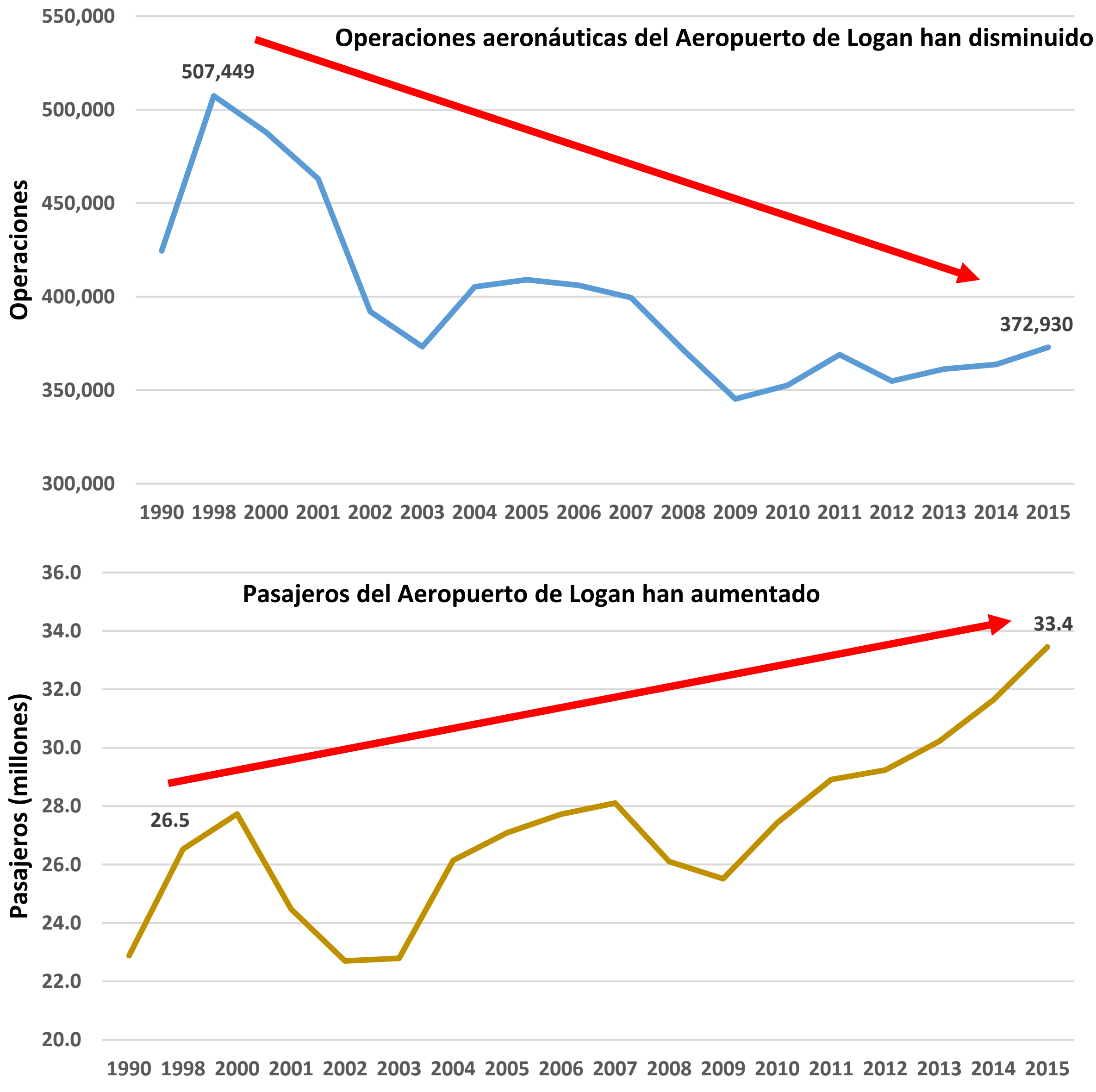


Figura 1-4 Niveles de actividad de pasajeros y operaciones anuales del Aeropuerto Logan, 1990, 1998, 2000-2015



Fuente: Massport.

Nota: 1998 representa el punto histórico más alto en términos de operaciones aeronáuticas para el Aeropuerto de Logan.

El Aeropuerto Logan es un aeropuerto importante de origen y destino (O&D)[5] tanto a nivel nacional como internacional y es uno de los principales aeropuertos de los E.E.U.U. con crecimiento más rápido, en función del número de pasajeros, durante los últimos cinco años.[6] Tanto el número de pasajeros en vuelos nacionales como en vuelos internacionales ha experimentado un crecimiento. En el 2015, habían alrededor de 5,5 millones de pasajeros internacionales y 27,8 millones de pasajeros nacionales (excluyendo la "general aviation" [aviación civil] [GA]).

En el 2014, la actividad anual de pasajeros en vuelos nacionales aumentó de 26,5 millones a 27,8 millones en el 2015[7], lo que representa un aumento del 4,8 por ciento. Mientras la cantidad de pasajeros en vuelos nacionales e internacionales es cada vez mayor, la demanda de pasajeros en vuelos internacionales sigue aumentando a una tasa más rápida que la demanda de pasajeros en vuelos nacionales. El total de pasajeros en vuelos internacionales en el Aeropuerto Logan aumentó de 5,0 millones en el 2014 a 5,5 millones en el 2015, lo que representa un aumento del 10,9 por ciento. Los pasajeros en vuelos internacionales representaron alrededor del 16,1 por ciento del total de pasajeros del Aeropuerto en el 2015 y se proyecta que este porcentaje aumentará sostenidamente a alrededor del 20 por ciento del total de pasajeros para el 2030 o antes. El fuerte crecimiento de pasajeros en vuelos internacionales fue motivado por la atracción económica de la región metropolitana de Boston y la fortaleza de Boston como mercado de O&D. Los nuevos destinos internacionales del Aeropuerto Logan en 2015 incluyeron a la Ciudad de México, Hong Kong, Tel Aviv y Shangai.

Un sinnúmero de factores, incluyendo el factor clave de un crecimiento económico sostenido tanto a nivel local como regional, se han combinado para generar este excepcional crecimiento de pasajeros El informe *2016 ESPR* actualizará las operaciones y niveles de actividad de pasajeros hasta el año 2035.

En el Capítulo 2, *Niveles de Actividad,* se presenta información adicional.

Planificación del Aeropuerto

Las instalaciones del Aeropuerto Logan se han adaptado a los últimos aumentos en actividad y operaciones en la zona de operaciones aéreas, pero las instalaciones internas, las pistas de aterrizaje y el estacionamiento del aeropuerto se han visto colapsados por el aumento de pasajeros. Después de dos años de esfuerzo de planificación estratégica, Massport ha identificado proyectos e iniciativas de planificación prioritarios para adaptar al Aeropuerto al incremento de la demanda de viajes internacionales, mejorar el acceso terrestre hacia y desde el Aeropuerto, así como también mejorar las vías y estacionamientos del Aeropuerto. Las iniciativas de planificación seleccionadas se describen a continuación. En el Capítulo 3, *Planificación del Aeropuerto,* se describe el estado actual de todos los proyectos de planificación.

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5 El tráfico de "origen y destino" se refiere al tráfico de pasajeros cuyo origen y destino es en un aeropuerto o mercado en particular. Un fuerte mercado de O&D como el de Boston, genera una importante demanda de pasajeros locales, donde muchos pasajeros inician y terminan su viaje en ese mercado. El tráfico de O&D es diferente al tráfico de conexión, el cual se refiere al tráfico de pasajeros cuyo viaje de origen o de destino no termina en el aeropuerto sino que simplemente se conecta a través del aeropuerto en tránsito hacia otros destinos.

6 Entre 2010 y 2015, el Aeropuerto Logan fue el octavo aeropuerto de los E.E.U.U. con crecimiento más rápido en función del tráfico de O&D de pasajeros (Encuesta U.S. DOT O&D).

7 Con exclusión de pasajeros de la aviación civil (GA).

Proyecto de la Terminal y de la Zona Aéreas

- **Proyecto de Renovación y Mejoras de la Terminal E**. Para adaptarse al servicio regular de un avión del Grupo VI (más ancho y más largo) en la Terminal E, este proyecto incluye mejoras tanto al interior como al exterior de la terminal. El proyecto no incluye nuevas puertas de embarque, pero se están remodelando tres puertas existentes para que se adapten a los aviones del Grupo VI (incluido el Airbus A380 y el Boeing 747-8 que son utilizados principalmente por compañías aéreas internacionales). Agregar un espacio adicional en el lado oeste de la Terminal E que permitirá remodelar salas de espera de pasajeros para que reciban el mayor tráfico de pasajeros asociado con los aviones de mayor tamaño. El proyecto también incluye modificaciones en la zona de operaciones aéreas para cumplir con las regulaciones de seguridad y diseño de la "Federal Aviation Administration" (Administración Federal de Aviación) (FAA) para recibir los aviones de mayor tamaño. Se presentó una "Environmental Assessment" (Evaluación Ambiental) (EA) y la FAA emitió un "Finding of No Significant Impact" (Hallazgo Sin Impacto Significativo) (FONSI) el 29 de Julio de 2015. La construcción está en marcha y su finalización está planificada para 2017.
- **Proyecto de Modernización de la Terminal E.** Para adaptarse a la demanda actual y futura a largo plazo con el objeto de brindar un servicio internacional ambientalmente eficiente, Massport ha planificado modernizar la Terminal E internacional actual. La modernización de la Terminal E agregará las tres puertas de embarque aprobadas en 1996 como parte del proyecto "International Gateway West Concourse" (Pasillo de la Entrada Oeste) (EEA # 9791), pero que nunca fue construido y la construcción de cuatro puertas de embarque más. Se ha planificado que la instalación se construya en 2 fases – en la Fase 1 se agregarán cuatro puertas y en la Fase 2 se agregará tres puertas. El edificio será orientado para que funcione como una barrera acústica. Se están planificando el servicio de atención de nuevos pasajeros y las salas de espera, así como también "Federal Inspection Services" (Servicios Federales de Inspección) (FIS) e instalaciones de Protección de Aduanas y Fronteras adicionales para complementar las áreas actuales de FIS en la Terminal E. Anteriormente, en el año 2001 se planificó y se permiso una instalación de FIS satelital para la Terminal B, pero ésta nunca fue construida (EEA # 9791). Como parte de la Fase 2, el Proyecto de Modernización de la Terminal E también se construirá una conexión directa entre la Terminal E y la Estación "Airport" de la "Blue Line" (Línea Azul) del metro de la "Massachusetts Bay Transportation Authority" (Autoridad de Transporte de la Bahía de Massachusetts) (MBTA), la cual estará protegida contra la intemperie, lo que mejorará la experiencia y comodidad de los pasajeros. Como parte de este proyecto, la estación de gasolina que hay en el Aeropuerto será reubicada al Southwest Service Area (Área de Servicio del Suroeste) (SWSA). En Octubre de 2015, Massport presentó un "Environmental Notification Form" (Formulario de Notificación Ambiental) (ENF) y en Julio 2016, sometió conjuntamente una "Draft Environmental Assessment/Environmental Impact Report" (Evaluación Ambiental Preliminar federal/Informe Preliminar de Impacto Ambiental estatal) (EA/EIR Preliminar). El 16 de Septiembre de 2016, el Secretario de EEA emitió un Certificado sobre el hallazgo Preliminar de EIR, en el que se establece que el proyecto cumple cabalmente con MEPA. Massport presentó el EA/EIR Definitivo el 30 de Septiembre de 2016. El 10 de Noviembre de 2015, la FAA emitió un FONSI y el 14 de Noviembre de 2016, la FAA emitió un "Record of Decision" (Registro de Decisión) (ROD) sobre el proyecto, donde establecía que Massport ahora puede actualizar el "Airport Layout Plan" (Plan de Diseño de la Planta Física del Aeropuerto) (ALP) junto con el Proyecto de Modernización de la Terminal E propuesto. El proyecto se encuentra en la fase de diseño conceptual y el inicio de la construcción es probable que empiece en 2018. En los EDR y ESPR futuros se entregarán las actualizaciones, a medida que se vayan concretando los procedimientos de diseño y construcción definitivos.

- **Conector de la Terminal C con la E.** El Conector de la terminal C con la E ofrece una nueva conexión para los pasajeros en tránsito (después del puesto de seguridad de la "Transportation Security Administration" (Administración para la Seguridad en el Transporte) (TSA) entre las puertas de embarque de los Terminales C y E. Se realizaron aproximadamente 18.900 pies cuadrados (1.800 m^2) de renovaciones interiores al edificio existente, incluyendo una nueva construcción exterior (3.500 pies cuadrados (330 m^2) aproximadamente). El conector ofrece a los pasajeros un nuevo punto de acceso a la Terminal E. El conector ofrece una mejor circulación de pasajeros dentro de los pasillos de las puertas de embarque (que están después del puesto de seguridad de la TSA), un área adicional de salas de espera en la Terminal E, una remodelación del espacio de oficinas, comercios y servicios comerciales, y un nuevo espacio consolidado para escaleras estructurales y mecánicas. Este proyecto finalizó en Mayo de 2016.
- **Proyecto de Optimización de Líneas Aéreas en la Terminal B.** Igual que las últimas renovaciones y mejoras en la Terminal B, Puerto de Embarque A, Massport está modernizando sus instalaciones en el Puerto de Embarque B para cumplir con las necesidades de las líneas aéreas (lo que refleja principalmente la fusión de American Airlines y US Airways) y para ofrecer instalaciones que mejoren la experiencia de viaje de los pasajeros. Las mejoras planificadas incluyen un pasillo de venta y emisión de boletos más grande, un área de salida de equipaje mejorada, un pasillo para el área de reclamo de equipaje más grande y áreas de comercios más grandes y con una sala de espera de mayor capacidad en la puerta de embarque. El proyecto consolidará las operaciones de American Airlines en solo uno de los puertos de embarque de la terminal (ahora funcionan en dos lugares diferentes de la terminal); además todas las puertas del Puerto de Embarque B de la Terminal B se conectarán (después del puesto de seguridad de la TSA). En el proyecto también se establecerán operaciones de control para un mejor rendimiento y una mejor experiencia de los pasajeros.

Proyectos de Acceso Terrestre y de Estacionamiento

Una serie de proyectos se han diseñado para producir beneficios ambientales substanciales, particularmente en las áreas eficientes de acceso terrestre y en aquellas áreas asociadas con las reducciones de emisiones contaminantes de la calidad del aire del Aeropuerto y del sector de East Boston, tal como se documenta a continuación.

- **El Programa de Redesarrollo (EEA 14137) del "Southwest Service Area" (Área de Servicio del Suroeste) (SWSA) del "Rental Car Center" (Centro de Alquiler de Automóviles) (RCC).** El RCC está totalmente operativo y todos los beneficios del proyecto empezaron a concretarse en el 2014. La consolidación de las operaciones de alquiler de automóviles y el servicio expreso de autobuses operado coordinadamente con una sola flota de autobuses produjo un mejor servicio, una menor cantidad de "vehicle miles traveled" (millas recorridas por vehículos) (VMT) hacia y desde el Aeropuerto, lo cual trajo consigo una reducción de gases contaminantes expulsados al aire y mejoras en el sistema de aguas pluviales. En 2010, se inició la construcción del nuevo RCC y en Septiembre de 2013 se iniciaron las operaciones de alquiler de automóviles y autobuses en la instalación centralizada. En el 2014, se completaron el resto de las áreas de recogida rápida de pasajeros, las paradas de taxi, de autobuses y de limusinas y los muelles de SWSA. Como Massport sigue comprometido con la sostenibilidad, está orgullosa de que en el 2015 el RCC fue premiado con la primera Certificación de Oro en Leadership in Energy and Environmental Design (Liderazgo de Diseño Energético y Ambiental) (LEED®) que recibe el Aeropuerto Logan. El estado de los esfuerzos de mitigación ambiental para el RCC está incluido en el Capítulo 9, *Seguimiento de la Mitigación Ambiental del Proyecto*.

- **Nueva flota de buses del Aeropuerto Logan**, Consta de 21 autobuses a “compressed natural gas” (gas natural licuado) (CNG) y 32 buses híbridos a diésel/electricidad, con la operatividad del RCC, estos autobuses han reemplazado en su totalidad a la flota diésel de autobuses expresos de las empresas de automóviles de alquiler. En el verano de 2015, se agregaron a este servicio tres autobuses nuevos a CNG, aumentando el total de 18 a 21 autobuses. La nueva flota de autobuses ha mejorado su eficiencia operacional y ha reducido la frecuencia de transporte de 100 a 30 autobuses por hora.
- **El Patio de Mantenimiento de Autobuses Ecológicos-Plata de LEED** del Aeropuerto Logan sirve como instalación de mantenimiento para la nueva flota de autobuses con combustibles menos contaminantes. Esta reubicación de las operaciones de mantenimiento de autobuses fuera de la ciudad ha hecho que Massport reduzca el tráfico de autobuses en los sectores de East Boston y Chelsea.
- **El Desvío Martin A. Coughlin.** Este proyecto reduce el tráfico comercial a través del sector East Boston al ofrecer, a lo largo de la antigua vía férrea, un enlace vehicular de acceso directo al aeropuerto entre el Área de Servicio Norte del Aeropuerto Logan hasta el sector de Chelsea
- **El Estacionamiento Económico.** Este proyecto simplificó y redujo la circulación en el Aeropuerto al consolidar muchas áreas de estacionamiento que congestionaban el Aeropuerto en un solo y exclusivo lugar que es asistido por una única ruta de transporte. La circulación del tráfico general en el Aeropuerto ha disminuido, lo que ha dado como resultado importantes beneficios operacionales y ambientales.
- **Proyecto de Consolidación del West Garage (Estacionamiento Oeste).** Massport consolidó 2.050 puestos de Estacionamiento temporal al adicionarlos al Estacionamiento Oeste y al lote existente entre el Centro de Oficinas Logan y el hotel Harborside Hyatt. El área adicionada del West Garage (Estacionamiento Oeste) está ubicada en el sitio del estacionamiento existente del Hotel Hilton. La construcción de estos puestos incluyó a todos los puestos restantes permitidos bajo el Congelamiento del Estacionamiento del Aeropuerto Logan.[8] El proyecto se inició en la primavera de 2015 y finalizó a fines de 2015.

Adición de West Garage.
Fuente: Massport

- **Proyecto de Estacionamiento del Aeropuerto Logan.** Massport propone la incorporación hasta un máximo de 5.000 nuevos espacios de Estacionamiento comercial en el Aeropuerto Logan como uno de los elementos de su estrategia de transporte terrestre integral. La meta del Proyecto de Estacionamiento del Aeropuerto Logan es disminuir el número de pasajeros que eligen modos ambientalmente perjudiciales para recoger y dejar pasajeros, generando hasta cuatro viajes en vehículo en lugar de dos (consultar Capítulo 3, *Planificación del Aeropuerto,* para obtener una descripción detallada). La construcción de espacios de Estacionamiento comerciales adicionales en el Aeropuerto Logan se basan en un cambio regulatorio,[9] por parte del Massachusetts “Department of Environmental Protection”

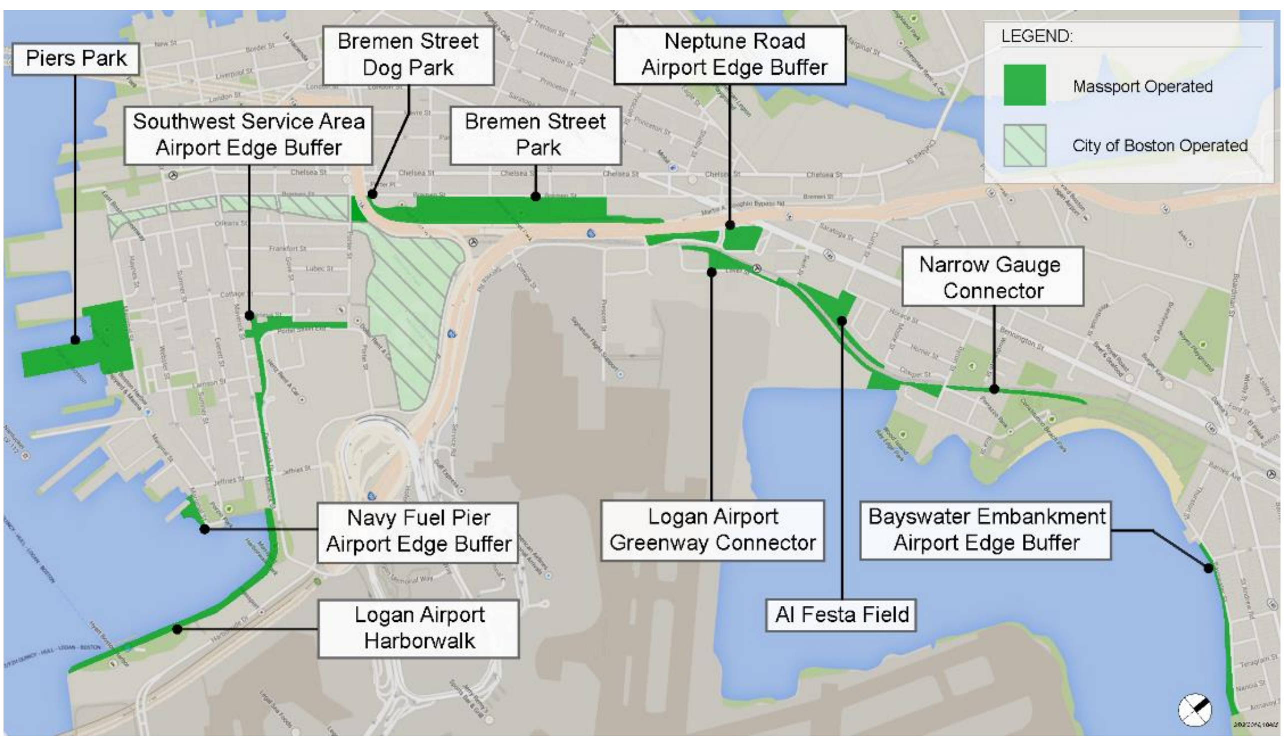
8 Regulaciones 7.30 y 40 CFR 52.1120 del Código 310 de Massachusetts.
9 Regulaciones 7.30 del Código 310 de Massachusetts.

(Departamento de Protección Ambiental de Massachusetts) (MassDEP), mediante el cual MassDEP modificaría el Congelamiento del Estacionamiento del Aeropuerto Logan para permitir algunos espacios de estacionamiento comerciales adicionales en el Aeropuerto Logan. MassDEP ha realizado una consulta entre las partes interesadas, la que proseguirá con el inicio del proceso para modificar la regulación del Congelamiento del Estacionamiento. Massport espera iniciar un proceso paralelo con la EEA mediante la presentación de un ENF para las nuevas instalaciones de estacionamiento a comienzos de 2017.

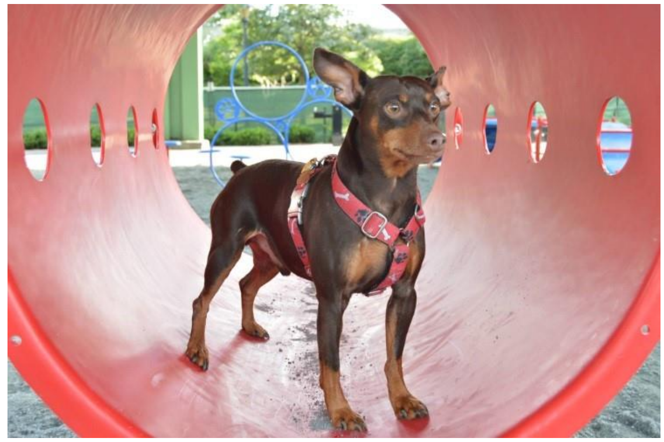
Proyectos de Parques y Espacios Abiertos

Massport ha aprobado un máximo de $15 millones para la planificación, construcción y mantenimiento de cuatro áreas de barreras limítrofes del Aeropuerto y dos parques a lo largo del perímetro del Aeropuerto Logan. Estas barreras ahora están terminadas e incluyen la Barrera de Bayswater, Barrera del Muelle de Carga de Combustible de la Armada, la Fase 1 de la Barrera SWSA y la Fase 2 de la Barrera SWSA. Estas áreas se encuentran en una propiedad perteneciente a Massport, ubicada a lo largo del límite perimetral del Aeropuerto Logan y su propósito es ofrecer barreras con un paisaje atractivo entre las operaciones del Aeropuerto y los vecindarios adyacentes del sector East Boston. El diseño de la barrera se hizo en un proceso público abierto de planificación comunitaria consultándole a los vecinos del Aeropuerto Logan y a otras personas interesadas. En la actualidad, el sector East Boston disfruta de 3,3 millas (5,3 km) y más de 33 acres (0,3 km^2) de espacios verdes desarrollados o administrados por Massport directamente o en asociación con otros entes y en respuesta a la comunidad del sector East Boston (**Figura 1-5**).

Figura 1-5 Parques que pertenecen y que son operados por Massport y la Ciudad de Boston



Fuente: Massport.



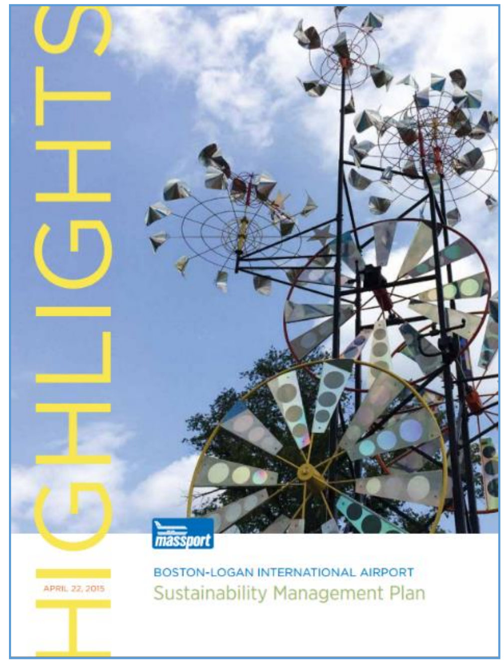
Un perro juega en el recién inaugurdo Parque para Perrros de la Calle Bremen.
Fuente: Massport

- **Parque para Perros de la Calle Bremen.** En Septiembre de 2015, Massport inauguró oficialmente el Parque para Perros de la Calle Bremen. Esta área recreativa permite que todo tipo de razas y tamaños de perros utilicen el espacio de 22.655 pies cuadrados (2.000 m^2) ubicados en la esquina de las Calles Bremen y Porter en el sector de East Boston.
- **El Conector de Trocha Angosta.** La culminación del proyecto del Conector de Trocha Angosta de 1/3 de milla (0,5 km) de longitud durante la primavera de 2016 representa la parte final de la Vía Verde del sector de East Boston, que se une el Conector de la Vía Verde del sector de East Boston con la Playa Constitución finalizado por Massport en el 2014, por el "Department of Conservation and Recreation" (Departamento de Conservación y Recreación) de Massachusetts. Este proyecto permite que los peatones y ciclistas recorran el Puerto de Boston, a través del Parque de la Calle Bremen y la nueva Biblioteca del sector de East Boston, llegando hasta Wood Island Marsh y por último a la Playa Constitution cruzando tan solo dos vías. Existen contadores de peatones y de ciclistas a lo largo del conector de la Vía Verde. En 2015, 22.545 usuarios de la Vía Verde de Boston fueron contabilizados por los contadores.

Iniciativas de Planificación

- **Planificación Estratégica.** En 2013, Massport emprendió el esfuerzo de planificación estratégica para posicionar las líneas de negocio de la aviación, marítima y de bienes raíces de Massport y sus estructuras de apoyo administrativo y fuerza de trabajo para cumplir con los desafíos del transporte y desarrollo económico del siglo 21. La meta principal de la iniciativa de planificación estratégica era formular una visión de Massport como motor del transporte y desarrollo económico para la Comunidad de Massachusetts en el siglo 21.
- **Planificación de Resiliencia.** A fines de 2013, Massport inició el "Disaster and Infrastructure Resiliency Planning Study" (Estudio Planificación de Resiliencia ante Desastres e Infraestructura) (DIRP) para el Aeropuerto Logan, el Puerto de Boston y los activos en el muelle en los sectores de South Boston y East Boston. El Estudio DIRP incluye un análisis de los peligros, en el que se modela un aumento del nivel del mar y el impacto de una tormenta, y proyecciones de temperatura, precipitaciones y aumentos previstos en eventos climáticos extremos. El Estudio de DIRP hará recomendaciones en relación con las estrategias de adaptación de corto plazo para procurar que las instalaciones de Massport sean más resilientes frente a los posibles impactos del cambio climático. Massport publicó las *Directrices de Diseño a Prueba de Inundaciones* en Noviembre de 2014, con una revisión en Abril de 2015.

- **"Runway Incursion Mitigation" (Atenuación de incursiones en Pistas de aterrizaje) (RIM) y Análisis Geométrico de la Zona de Operaciones Aéreas.** A medida que la FAA empezó a cerrar su programa integral de mejoras de áreas de seguridad de pistas en toda la nación en el 2015, su enfoque de seguridad se dirigió al análisis geométrico de la zona de operaciones áreas. En el nuevo programa integral de RIM, el que abarca muchos años, se identificarán, priorizarán y desarrollarán estrategias para ayudar a los aeropuertos a través de los E.E.U.U. con la finalidad de mejorar la seguridad de sus zonas de operaciones aéreas. En Enero de 2016, Massport presentó una Solicitud para Propuestas donde se estudian los problemas geométricos en las zonas de operaciones aéreas del Aeropuerto Logan. Los EDR y ESPR futuros entregarán actualizaciones sobre esta iniciativa y es probable que tales esfuerzos exijan la autorización conforme a las regulaciones estatales o federales.



Plan de Administración de Sustentabilidad del Aeropuerto Logan.
Fuente: Massport

- **"Sustainability Management Plan" (Plan de Administración de Sostenibilidad) (SMP) del Aeropuerto Logan.** En 2013, Massport recibió una subvención de la FAA para preparar un SMP para el Aeropuerto Logan. El esfuerzo de planificación de SMP del Aeropuerto Logan empezó en Mayo de 2013 y terminó en Abril de 2015. El SMP del Aeropuerto Logan tiene una visión amplia de la sostenibilidad, incluido el dinamismo económico, eficiencia operacional, conservación de recursos naturales y consideraciones de responsabilidad social, y tiene el propósito de fomentar e integrar la sostenibilidad en todo el Aeropuerto y de coordinar los esfuerzos de sostenibilidad permanente a través de Massport. Una copia del Informe de Hechos Destacados de SMP se puede encontrar en el sitio https://www.massport.com/environment/sustainability-management-plan.
  - **Informe de Sostenibilidad Anual del Aeropuerto Logan.** En el Informe de Sostenibilidad Anual del Aeropuerto Logan se presenta un resumen del avance de los esfuerzos de sostenibilidad en el Aeropuerto Logan basándose en las metas y objetivos de sostenibilidad de Massport establecidos en el SMP 2015. El primer Informe Anual de Sostenibilidad se publicó en Abril de 2016, y se puede encontrar en el sitio https://www.massport.com/environment/sustainability-management-plan/2016-logan-airport-annual-sustainability-report/.

Transporte Regional

En región de Nueva Inglaterra se anclan: El Aeropuerto Logan y el sistema de otros 10 aeropuertos con servicios comerciales, aeropuertos de relevo y civiles[10] (aeropuertos regionales). Juntos, estos 11 aeropuertos se adaptan a casi toda la [11] demanda de viajes aéreos comerciales de la región de Nueva Inglaterra (**Figura 1-6**). El Aeropuerto Logan funciona como mercado de O&D nacional y es la principal puerta de entrada internacional para la región. El servicio de ferrocarriles Amtrak que conecta Boston con las áreas metropolitanas de Nueva York/Washington D.C. hacia el sur y con Portland, Maine hacia el norte, también presta sus servicios a la región.

Figura 1-6 Sistema de Transporte Regional de Nueva Inglaterra

- El tráfico de pasajeros en la región de Nueva Inglaterra representó en el 2015 un récord para la región, volviendo a los niveles de pasajeros que había antes de la crisis económica de 2008/2009 y superando el pico histórico de 48,0 millones de pasajeros de 2005. El número total de pasajeros aéreos que usan los aeropuertos del servicio comercial de la región de Nueva Inglaterra, incluido el Aeropuerto Logan, aumentó un 4,1 por ciento, pasando de 46,8 millones de pasajeros anuales en 2014 a 48,7 millones en el 2015.
- De los 48,7 millones de pasajeros en el 2015 que usaron los aeropuertos del servicio comercial de la región de Nueva Inglaterra en 2015, el 68,6 por ciento de los pasajeros (33,4 millones) usó el Aeropuerto Logan, en comparación con el 67,6 por ciento (31,6 millones) en el 2014.
- Las operaciones totales de aviones en la región de Nueva Inglaterra (incluido el Aeropuerto Logan) se mantuvieron prácticamente sin variación en 2015, aumentando un 0,3 por ciento, de 987.652 operaciones en el 2014[12] a 991.041 operaciones en el 2015.
- El Aeropuerto Regional de Worcester (ORH) es un importante recurso de aviación que recibe la actividad de GA corporativa y los servicios de aerolíneas comerciales. Massport continúa invirtiendo en el Aeropuerto Regional de Worcester con la adquisición y modernización del Aeropuerto de Worcester para que sirva mejor la demanda de vuelos comerciales hacia la región central de Massachusetts.

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10 **Los Aeropuertos de Servicio Comercial son aeropuertos de propiedad pública que tienen a los menos 2.500 embarques de pasajeros durante cada año calendario y que reciben un servicio de pasajeros programado. Los Aeropuertos de Relevo son aeropuertos diseñados por la FAA para atenuar la congestión en los Aeropuertos de Servicio Comercial y para ofrecer un mejor acceso a la aviación civil de la comunidad en general. Los Aeropuertos de Aviación Civil son aeropuertos de uso público que no tienen un servicio programado o que tienen menos de 2.500 embarques de pasajeros anuales.**

11 **El servicio de aerolínea comercial se define como un transporte aéreo que ofrecen las compañías aérea para compensar o alquilar. En cambio, la aviación civil (GA) se refiere a toda actividad de aviación que no sea una aerolínea comercial ni operaciones militares.**

12 **Refleja las estadísticas de operaciones de aviones del año calendario 2014 actualizado para algunos aeropuertos regionales basados en los conteos de torre de FAA desde la publicación del *2014 EDR*. Consultar la Tabla 4-1 para obtener más detalles.**

  - Conjuntamente Massport y la Ciudad de Worcester están invirtiendo 100 millones de dólares durante los próximos 10 años para revitalizar y crecer las operaciones comerciales aéreas en el Aeropuerto Regional de Worcester. Como resultado de este esfuerzo conjunto, ya JetBlue Airways ha prestado sus servicios a más de 350.000 pasajeros en ORH desde que inició sus operaciones aéreas a finales del 2013.
  - Recientemente, Massport inició la construcción del "Category III Instrument Landing System" (Sistema de Aterrizaje por Instrumentos de Categoría III) en Worcester para mejorar las operaciones y condiciones de seguridad aéreas al mismo nivel de operación de todos los aeropuertos de la región de Nueva Inglaterra. Este proyecto mejorará significativamente la confiabilidad climática del Aeropuerto Regional de Worcester, que por largo tiempo ha sido un impedimento para utilizar más este aeropuerto.
- El Aeropuerto Hanscom (BED) es un aeropuerto de aviación civil de servicio completo que acoge una amplia variedad de actividades de aviación civil, vuelo privado, servicios de vuelo cortos, así como también algunos charters y cargas livianas. Ubicado en Bedford, MA a alrededor de 20 millas (32 km) al noroeste del Aeropuerto Logan, el Aeropuerto Hanscom es una importante instalación de la región de Nueva Inglaterra para la aviación comercial y corporativa y cumple un papel esencial como aeropuerto de relevo de aviación civil para el Aeropuerto Logan. En el 2015, en coherencia con el papel que cumple el Aeropuerto Hanscom como principal aeropuerto corporativo, se construyeron nuevos hangares para adaptarse a las necesidades de los servicios de jets corporativos.
- Massport está apoyando los esfuerzos de MassDOT para ampliar la Estación de trenes Sur de Boston con el objeto de que cumpla con la demanda actual y futura de movilidad ferroviaria dentro de Massachusetts y a lo largo del Northeast Corridor (Corredor Noreste) (NEC). El NEC de Amtrak es una línea ferroviaria entre ciudades que funciona entre la Estación de trenes Sur de Boston y Washington DC, vía la Ciudad de Nueva York. Otros destinos importantes que atiende la ruta incluye Providence, Rhode Island; New Haven, Connecticut; Filadelfia, Pennsylvania; y Baltimore, Maryland. Los pasajeros del Aeropuerto Logan se pueden conectar directamente con la Estación de trenes Sur de Boston a través del servicio de transporte rápido de autobuses Silver Line o a través de un taxi o de otros modos no programados. En términos generales, el transporte de pasajeros de NEC alcanzó un nuevo récord en el 2015, superando los niveles máximos de 2014. La participación de Amtrak en el mercado total de pasajeros del Noreste ha aumentado sustancialmente desde la introducción del servicio Acela Express en el 2000. En el año fiscal 2015, el NEC transportó 11,7 millones de pasajeros en sus servicios Acela Express y Regional de Noreste, un 0,5 por ciento más en comparación con el año anterior. Acela Express atendió a 3,5 millones de pasajeros, mientras que Regional de Noreste atendió a 8,2 millones de pasajeros.

En el Capítulo 4, *Transporte Regional,* se presenta información adicional.

Acceso Terrestre hacia y desde el Aeropuerto Logan

Massport tiene una estrategia integral para diversificar y mejorar las opciones de transporte terrestre para pasajeros y empleados. La estrategia de transporte terrestre se ha diseñado para ofrecer una amplia variedad de opciones de "high-occupancy vehicles" (vehículos de alta ocupación) (HOV), transporte público, manejo compartido para viajar hacia y desde el Aeropuerto Logan y reducir al máximo los viajes en vehículo, ofreciendo cómodas conexiones de transporte público de ida y vuelta, en bicicleta o a pie para el Aeropuerto. La estrategia también tiene como finalidad ofrecer un estacionamiento en el Aeropuerto para los pasajeros que opten por manejar o con opciones de HOV limitadas. La estrategia de Massport tiene el propósito de limitar los impactos en el medioambiente y en la comunidad y, al mismo tiempo, ofrecer a los pasajeros y empleados muchas alternativas para un viaje cómodo hacia y desde el Aeropuerto Logan. A pesar de los esfuerzos que ha hecho Massport, empresa líder en la industria, por fomentar y ofrecer el uso del modo HOV/manejo compartido, los viajes en vehículos de pasajeros privados siguen aumentando con el crecimiento de los viajes aéreos. Como el número de viajeros aéreos del Aeropuerto Logan ha aumentado, el suministro de un estacionamiento restringido en dicho aeropuerto ha generado un aumento de los viajes de vehículos para "dejar/recoger" pasajeros. El mayor número de viajes de vehículos significa un aumento de las VMT y emisiones contaminantes correspondientes – el efecto opuesto de lo que se pretendía lograr con la regulación de Congelamiento del Estacionamiento del Aeropuerto Logan.

Massport está implementando muchas estrategias para limitar los impactos ambientales y para reducir el número de vehículos privados que llegan al Aeropuerto Logan y, en particular, los modos ambientalmente indeseables para dejar y recoger pasajeros,[13] lo cual genera hasta cuatro viajes de vehículos en lugar de dos. Massport ha seguido invirtiendo y operando en el Aeropuerto Logan con la meta de mantener y aumentar la participación del modo HOV – grandes cantidades de pasajeros y empleados del Aeropuerto que llegan por transporte público u otros modos HOV/manejo compartido. El Aeropuerto Logan sigue estando clasificado como uno de los principales aeropuertos de los E.E.U.U. en términos de su participación del modo HOV/transporte público cercana al 30 por ciento.[14] Las medidas que ha implementado Massport para aumentar el uso de HOV incluyen una combinación de estrategias relacionadas con la tarificación (incentivos y desincentivos), disponibilidad de servicios e información para el viajero. Debido a la diversa demografía de los viajeros del Aeropuerto Logan, ninguna medida individual cumplirá la meta de aumentar la participación del modo HOV.

Las mejoras permanentes para apoyar el modo HOV incluyen: nuevo servicio piloto de Logan Express de Back Bay (desde Mayo de 2014); embarques de salida gratuitos en la línea de autobuses Silver Line de MBTA (desde el Aeropuerto Logan); un nuevo Estacionamiento con capacidad para 1.100 automóviles en Logan Express de Framingam; tarifas de Estacionamiento reducidas para viajes de vacaciones en las instalaciones de Logan Express; tarifas de Estacionamiento más caras en el Aeropuerto; y apoyo para operadores de autobuses y camionetas (van) privadas.

Los hallazgos importantes de 2015 son los siguientes:

- Los valores del "annual average daily traffic" (tráfico diario promedio anual) (AADT) y del "annual average weekday daily traffic" (tráfico diario por día de semana promedio anual) (AWDT) son 2 y 5 por ciento (respectivamente), menores que los volúmenes del récord registrado (en el 2007) en el Aeropuerto, a pesar del aumento del 19,0 por ciento en los niveles de pasajeros del 2007 al 2015. Durante el mismo período, las VMT han disminuido aproximadamente un 9 por ciento, aunque, debido a los cambios en los procedimientos de modelación de tráfico, no se puede hacer una comparación de las VMT directas.

13 Los modos de Dejar/Recoger pueden incluir vehículos privados, taxis y servicios de automóviles de lujo. Por ejemplo, si un pasajero es depositado cuando va a partir en un viaje por avión y es recogido cuando vuelve, ese solo pasajero genera un total de cuatro viajes de acceso terrestre: dos para el viaje de depositarlo (uno para entrar al Aeropuerto Logan, uno para salir del Aeropuerto Logan) y dos para el viaje de recogida del pasajero (uno para entrar al Aeropuerto Logan, uno para salir del Aeropuerto Logan). El pasajero puede ser depositado y recogido en un vehículo privado, en un taxi o en un automóvil de lujo que no puede transportar a otros pasajeros durante todos los segmentos del viaje hacia y desde el Aeropuerto Logan.

14 De acuerdo con la *Encuesta de Acceso Terrestre de Pasajeros al Aeropuerto Logan de 2013*, el 27,8 por ciento de los pasajeros que accedió al Aeropuerto Logan utilizó modos de viaje HOV.

- El número total de pasajeros aéreos aumentó un 5,7 por ciento, llegando a 33,4 millones en el 2015, en comparación con los 31,6 millones en el 2014. Durante el mismo período, las VMT en el Aeropuerto aumentaron un 6,5 por ciento. Es probable que existan muchos factores que contribuyen al cambio en las VMT. Estos factores se investigarán más adelante en el informe *2016 ESPR*.
- Massport siguió cumpliendo cabalmente con las regulaciones de Congelamiento del Estacionamiento del Aeropuerto Logan en el 2015. La demanda diaria de estacionamientos en 2015 se acercó con mayor frecuencia al límite por el Congelamiento del Estacionamiento, en comparación con el 2014, pese a que se aumentaron las tarifas de estacionamiento en el área de la terminal el 1 de Julio de 2014. Como uno de los elementos de su estrategia de transporte integral, Massport propone la incorporación de un máximo de 5.000 nuevos espacios de estacionamientos comerciales en el Aeropuerto Logan. La meta del Proyecto de Estacionamiento del Aeropuerto Logan es disminuir el número de pasajeros que optan por modos ambientalmente perjudiciales de recoger y depositar pasajeros, los que generan hasta cuatro viajes en vehículo en lugar de dos. La construcción de espacios de estacionamientos comerciales adicionales en el Aeropuerto Logan depende de un cambio regulatorio,[15] por parte del MassDEP, mediante el cual MassDEP modificaría el Congelamiento del Estacionamiento del Aeropuerto Logan para permitir la creación de algunos espacios de estacionamientos comerciales más en el Aeropuerto Logan. MassDEP ha realizado una consulta entre las partes interesadas, la que proseguirá con el inicio del proceso para modificar la regulación del Congelamiento del Estacionamiento. Massport espera iniciar a comienzos de 2017 un proceso paralelo con la EEA mediante la presentación de un ENF para las nuevas instalaciones de estacionamiento.
- El informe *2014 EDR* informó sobre una disminución del 10,5 por ciento en VMT en el Aeropuerto. Esto refleja los esfuerzos que ha hecho Massport por reducir las VMT mediante la inauguración del RCC, el que: (1) consolidó las operaciones de alquiler de automóviles en un solo lugar; (2) ofrece un servicio unificado de autobuses expresos de ida y vuelta para todas las compañías de alquiler de autos; (3) reubicó a las paradas de taxis y de limusinas/autobuses en un lugar más cercano a las calles del área de la terminal; y (4) agregó mejoras a los sistemas de transporte alternativos.
- Massport está ofreciendo en la actualidad un programa piloto, Logan Express de Back Bay, para determinar si un servicio de autobuses expreso, directo y frecuente aumenta el servicio de HOV desde la Ciudad de Boston. Este servicio en particular ha sido muy valioso al ofrecer alternativas a los pasajeros y empleados que recibieron el impacto de la clausura temporal de dos años de la estación de metro Government Center (una conexión esencial para la Línea Azul del metro y el Aeropuerto Logan), y al ofrecer un nuevo medio de transporte alternativo en el Aeropuerto. Después de reinaugurar la estación de metro Government Center en Marzo de 2016, este programa piloto prosigue. El número de pasajeros en 2015 para la línea Logan Express de Back Bay fue de 290.796, lo que representa un promedio de 805 pasajeros diarios. En 2014, el servicio promedió 624 pasajeros diarios, llegando a un total de 152.892 pasajeros entre el 28 de Abril y el 31 de Diciembre de 2014.

En el Capítulo 5, *Acceso terrestre hacia y desde el Aeropuerto Logan,* se incluye información adicional.

15 Regulaciones 7.30 del Código 310 de Massachusetts.

"Aviation Environmental Design Tool" (Herramienta de Diseño Ambiental de la Aviación) (AEDT)

En el 2015, la FAA introdujo una nueva herramienta combinada de modelación del ruido y calidad del aire, la "Aviation Environmental Design Tool" (Herramienta de Diseño Ambiental de la Aviación) (AEDT). Esta nueva herramienta es un sistema de software que modela de manera dinámica el rendimiento de un avión en el espacio y el tiempo con el fin de generar información sobre la combustión de combustibles, emisiones y ruidos. A partir de 2015, la FAA exige a los aeropuertos que usen la AEDT para la elegibilidad de proyectos de la "National Environmental Policy Act" (Ley de Política Ambiental Nacional) (NEPA) y aislamiento acústico. Massport inició una modelación del ruido y aire inicial usando la AEDT; sin embargo, a Massport les surgieron preocupaciones en relación con los resultados iniciales en el Aeropuerto Logan. Siguiendo las instrucciones de la FAA, se decidió que los resultados iniciales de la AEDT no se publiquen en el informe *2015 EDR* (quedaron pendientes nuevos análisis técnicos adicionales con la Oficina del Medioambiente y Energía de la FAA). Por lo tanto, la modelación del ruido se llevó a cabo con el Integrated Noise Model (Modelo de Ruido Integrado) (INM) de la FAA y el Emissions and Dispersion Modeling System (Sistema de Modelación de Emisiones y Dispersión) (EDMS) para las emisiones de aire.

Massport está evaluando activamente el nuevo modelo y trabajando con la FAA para desarrollar los tipos de ajustes específicos al Aeropuerto Logan para el modelo de AEDT que se ha estado usando durante muchos años en el INM. Una vez que lo apruebe la FAA, los ajustes permitirán que el modelo refleje de manera más precisa el ruido ambiente en el Aeropuerto Logan. Todavía no es posible implementar varios de estos ajustes específicos directamente en la AEDT y deberán ser evaluados por Massport y aprobados por la FAA. Massport ha recurrido a la FAA para que evalúe y apruebe estos ajustes y, si se completan oportunamente, se espera que AEDT sea el modelo oficial para el informe *2016 ESPR* del próximo año. La información adicional sobre el AEDT se entrega en el Capítulo 6, *Reducción del Ruido,* y en el Capítulo 7, *Calidad del Aire/Reducción de Emisiones.*

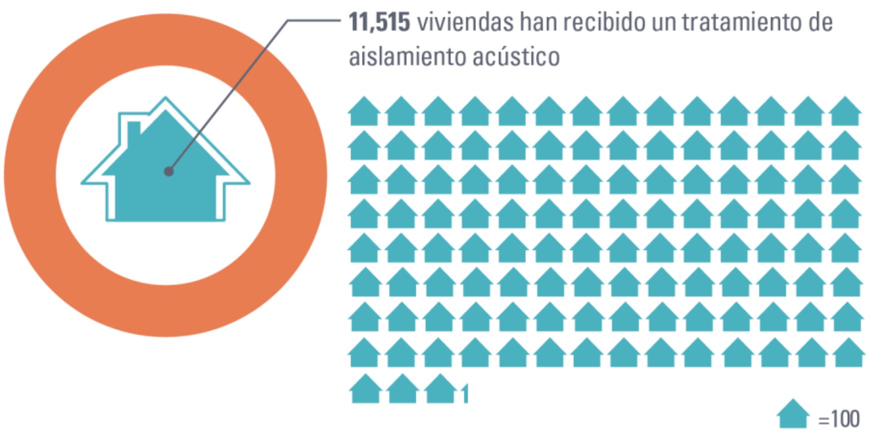
El Certificado de la Secretaría sobre el informe *2014 EDR* establece que los límites de ruido y emisiones contaminantes expulsados al aire del año 2015 deben modelarse mediante la AEDT y compararse con la última versión del INM y EDMS. Debido a los motivos que se explican anteriormente, este informe *2015 EDR* no incluye los resultados de la AEDT. Massport está trabajando activamente con la FAA para revisar los resultados preliminares y para desarrollar, según el criterio de la FAA, ajustes de modelo específicos al Aeropuerto Logan.

Reducción del ruido

Massport está en una lucha por reducir al máximo los impactos de ruido que traen consigo las operaciones del Aeropuerto Logan en sus vecinos a través de una variedad de programas, procedimientos y otras herramientas de reducción del ruido. En el Aeropuerto Logan, Massport implementa uno de los programas más amplios en la reducción del ruido en comparación con cualquier aeropuerto de la nación. El programa integral de reducción del ruido de Massport incluye una Oficina de Reducción del Ruido exclusiva, un sistema de última generación para el Monitoreo del Ruido y las Operaciones; programas de aislamiento acústico para viviendas y colegios; restricciones de horarios y de uso de pistas para los aviones más ruidosos; procedimientos de control previos al despegue; y seguimientos de vuelos diseñados para optimizar las operaciones de sobre la superficie del mar (especialmente durante los horarios nocturnos[16]).

Massport es una empresa líder nacional en la mitigación y aislamiento acústico (insonorización). Hasta la fecha, Massport ha suministrado aislamiento acústico a un total de 11.515 viviendas y seguirá buscando financiamiento para las propiedades que reúnan las condiciones y cuyos propietarios decidan participar (**Figura 1-7**). A partir de 2015, la FAA exige a los aeropuertos que usen el modelo AEDT para determinar la elegibilidad. Massport está trabajando con la FAA sobre el modelo AEDT, del modo como se aplica a las operaciones del Aeropuerto Logan.

Figura 1-7 Viviendas Tratadas a través del Residential Sound Insulation Program (Programa de Aislamiento Acústico Residencial de Massport) (RSIP)



Desde el año 2000, el número de operaciones aéreas diarias en el Aeropuerto Logan ha disminuido en casi un 25 por ciento (de 1.355 operaciones diarias en 2000 a 1.022 operaciones diarias en el 2015), mientras que los aviones han experimentado cargas de pasajeros cada vez más grandes. Los volúmenes de pasajeros siguen aumentando a una tasa mayor que las operaciones aéreas. En el 2015, el número total de pasajeros fue un 20,6 por ciento mayor que en el 2000. Esta tendencia refleja un aumento en el uso de aviones más grandes en la flota, una consolidación de las líneas aéreas y un aumento en los factores de carga por parte de las aerolíneas. En comparación con el 2000, en 2015:

- Las operaciones de Jets representaron un 86 por ciento, contra un 66 por ciento en el 2000;
- Las operaciones totales disminuyeron un 23,6 por ciento, mientras que el total de pasajeros aumentó un 20,6 por ciento en comparación con el 2000; y
- El número de personas expuestas al "Day-Night Average Sound Level" (Nivel de Ruido Promedio durante el Día y la Noche) (DNL) de 65 decibeles (dB) ha disminuido en un 20,6 por ciento desde el 2000.

Para el 2014 y 2015, las diferencias entre los valores de ruido medidos y modelados se han estrechado incluso más de lo que se informaba en los EDR y ESPR anteriores.[17] Esta precisión mejorada en los resultados modelados

16 Los horarios nocturnos son entre las 10:00 pm y las 7:00 am

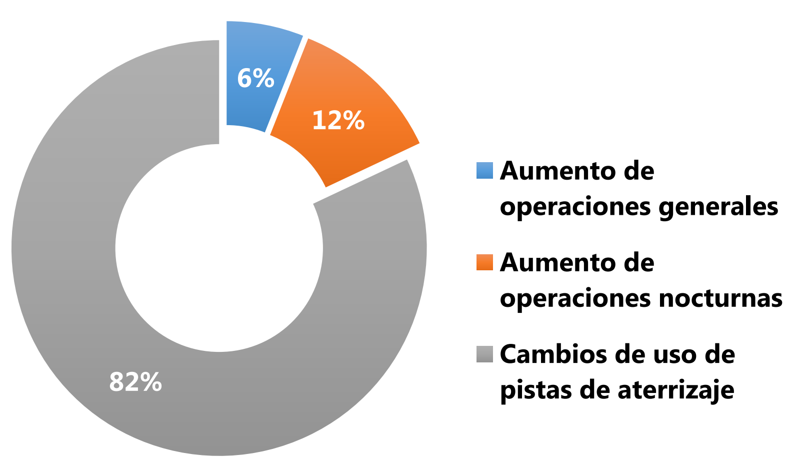
17 Diversos factores han generado una mayor concordancia entre los niveles medidos versus los modelados. Empezando por el informe *2009 EDR*, los datos de seguimiento de vuelos y los datos de medición provienen del nuevo sistema de monitoreo. Los datos de seguimiento de vuelos más precisos se utilizan para las informaciones de modelación y para la correlación de eventos de aviones medidos.

se debe a los equipos de medición y al sistema de monitoreo de ruidos del Aeropuerto y su capacidad para correlacionar eventos de ruido medidos con seguimientos de vuelos individuales, junto con las mejoras en la base de datos de INM.

En comparación con el 2014, los límites de ruido de 65 dB del DNL de 2015 fueron mayores en la mayoría de las áreas que circundan el Aeropuerto debido a los cambios en: (1) uso de pistas, principalmente debido a las condiciones de viento y clima, (2) un aumento en el número de operaciones nocturnas, y (3) un aumento en el número de operaciones en general. El número total de personas expuestas a valores de DNL mayores o iguales que 65 dB aumentó en un 58,0 por ciento, pasando de 8.922 personas en el 2014 a 14.097 personas en el 2015.[18] Los cambios de límites de ruido específicos al año 2015 comparados con el 2014 se analizan a continuación.

1. Los cambios en el uso de pistas del 2014 a 2015 fue el factor más importante en el aumento del número de personas expuestas a valores de DNL mayores o iguales que 65 dB en el 2015.
   - El límite de DNL aumentó en East Boston y levemente en el sector South Boston debido a un aumento en los despegues de la Pista 22R en el 2015. El mayor número de despegues desde la Pista 22R también produjo aumentos en Winthrop.
   - El mayor número de aterrizajes en las Pistas 22L y 25 durante la noche contribuyó a los aumentos en Revere y Withrop.
   - A diferencia del 2014, el 2015 refleja casi un año completo de procedimientos de reducción del ruido nocturno en la Pista 15R-33L. Si bien esta medida reduce la exposición al ruido en general, al concentrar las operaciones sobre la superficie del mar en lugar de las áreas pobladas, aumentó el ruido del inicio del despegue en East Boston, al norte y al oeste del final de la Pista 15R.
   - El menor uso de la Pista 4R para las llegadas en el 2015 produjo una reducción del ruido en límite sur del Aeropuerto.
2. Uno de los factores que influyó en los cambios del límite de ruido en el 2015 fue el aumento de un 5,7 por ciento en las operaciones nocturnas (pasando de 48.056 operaciones nocturnas en el 2014 a 50.786 operaciones nocturnas en el 2015). Este aumento en las operaciones en general y operaciones nocturnas sigue estando muy por debajo del récord de 54.038 operaciones nocturnas alcanzadas en 1999. A medida que las aerolíneas se han expandido a nuevos destinos, el número de operaciones

Figura 1-8 Motivos del Aumento del Número de Personas Expuestas a Valores de DNL Mayores o Iguales que 65



18 Los datos de población se extrajeron de los últimos registros de datos del Censo de los Estados Unidos de 2010.

comerciales y, a su vez, el número de operaciones nocturnas ha aumentado. En el 2015 se produjo un aumento de un 7,5 por ciento en las operaciones nocturnas diarias en comparación con el 2014.[19]

3. El aumento general de las operaciones fue menor que el aumento de las operaciones nocturnas (2,5 por ciento total versus 5,7 por ciento nocturno), pero contribuyó a la expansión de los límites de ruido.

El DNL y los niveles de población en el 2015 siguen estando muy por debajo de los niveles récord alcanzados en 1990 y son menores que el año 2000, cuando 17.745 personas quedaron expuestas a niveles de DNL mayores o iguales que 65 dB de DNL.

Como se muestra en la **Figura 1-9**, el contorno de 65 dB de DNL del 2015 es algo mayor que el contorno de 65 dB de DNL del 2014. La mayor parte de todas las viviendas expuestas a niveles mayores o iguales que 65 dB de DNL en el 2015 han reunido las condiciones en el pasado para participar en el "Residential Sound Insulation Program" (programa de aislación acústica de viviendas) (RSIP) de Massport.

En el Capítulo 6, *Reducción del Ruido,* se incluye información adicional.

19 El DNL trata al ruido nocturno de manera distinta al ruido del día; para los niveles de presión acústica ponderados A que se producen en la noche (entre las 10:00 pm y las 7:00 am), se aplica una multa de 10 dB al evento nocturno.

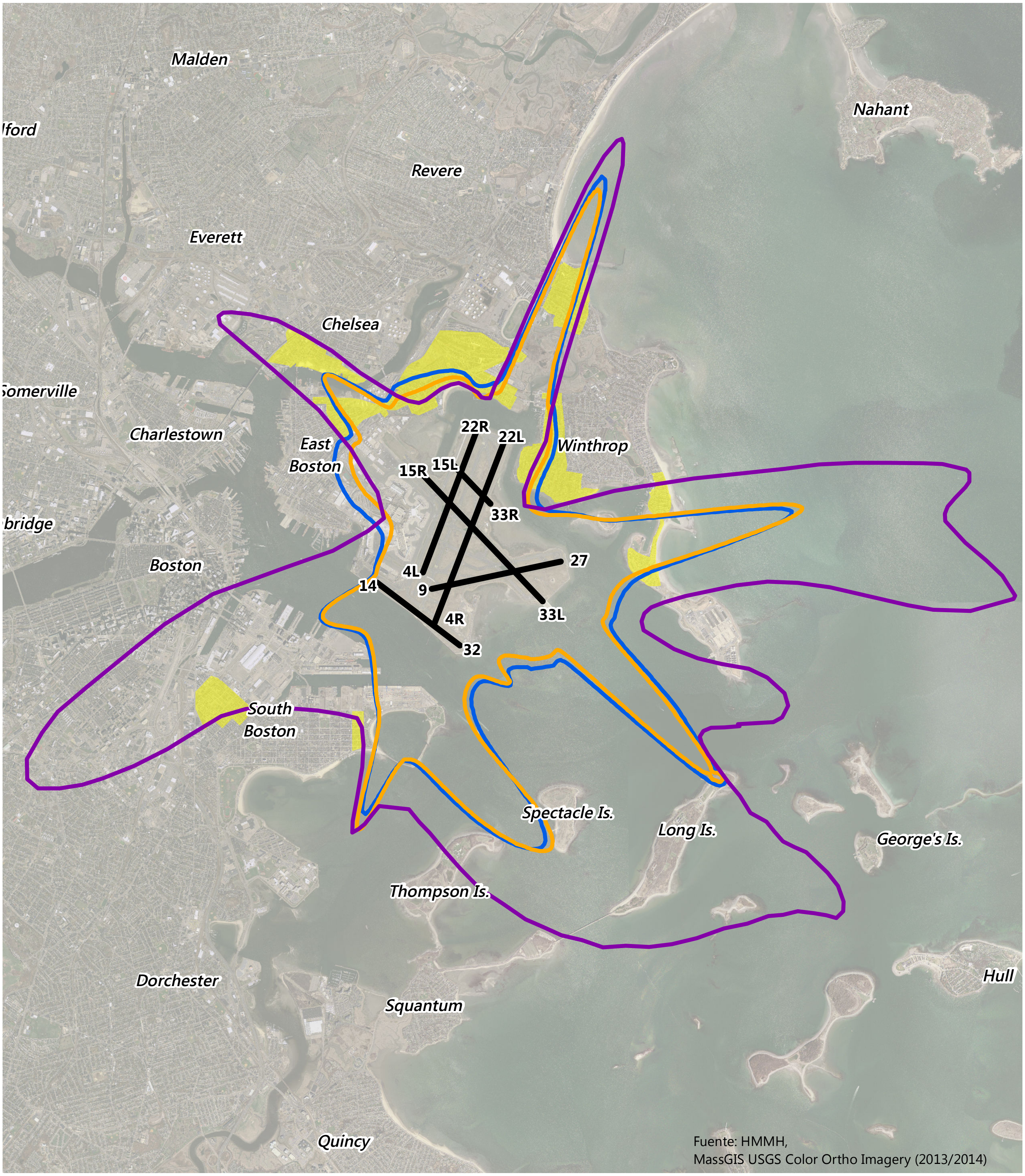


FIGURA 1-9 DNL Comparación del Límite de 65 dB con el Límite Histórico

2015 Environmental Data Report

Límite DNL de 1990
Límite DNL del 2014 (INM 7.0d)
Límite DNL del 2015 (INM 7.0d)
Áreas de aislamiento acústico

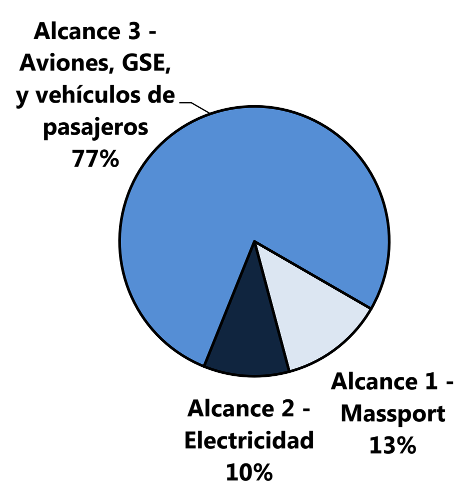
0 1750 3500 7000 Pies

Calidad del Aire/Reducción de Emisiones Contaminantes

El total de las emisiones contaminantes expulsadas al aire que provienen de todas las fuentes asociadas con el Aeropuerto Logan en 2015, son considerablemente menores que lo que eran hace una década atrás. Esta tendencia a la baja de largo plazo es coherente con el objetivo permanente de Massport de adaptar las demandas del creciente número de pasajeros y niveles de actividad de carga con menos operaciones de aviones y menos emisiones. En el 2015, las emisiones calculadas de compuestos orgánicos volátiles (VOC), óxidos de nitrógeno (NO_x), monóxido de carbono (CO), y material particulado (PM) subieron levemente en comparación con el 2014. El aumento en las emisiones de VOC, NO_X, CO y PM se debe principalmente al aumento correspondiente en el "aircraft landing and take offs" (aterrizaje y despegue de aviones) (LTOs) y tiempos de rodaje en el aeropuerto.

- Las emisiones totales de VOC aumentaron un 1 por ciento en el 2015, a 1.188 kilogramos (kg)/día, en comparación con los 1.177 kg/día en el 2014, el que sigue estando muy por debajo de los niveles de los años 1990 y 2000.
- Las emisiones totales del NO_x aumentaron aproximadamente un 5 por ciento en el 2015, a 4.262 kg/día, en comparación con los niveles del 2014 de 4.040 kg/día. En menor medida, este aumento también se puede atribuir al aumento del uso de gas natural por parte de las fuentes fijas. El aumento en el 2015 sigue estando muy por debajo de los niveles de 1990 y 2000.
- Las emisiones totales de CO aumentaron aproximadamente un 3,5 por ciento en el 2015, a 7.243 kg/día, de 6.987 kg/día en el 2014; las emisiones en 2015 siguieron estando muy por debajo de los niveles de 1990 y 2000.
- Las emisiones totales de $PM_{10}/PM_{2.5}$ también aumentaron en aproximadamente un 3 por ciento en el 2015, pasando a 98 kg/día, de 95 kg/día en el 2014.
- Durante nueve años consecutivos, Massport ha preparado de manera voluntaria un inventario de "greenhouse gas emissions" (emisiones con efecto invernadero) (GHG) para el informe EDR del Aeropuerto Logan. En el 2015, las emisiones totales de GHG crecieron un 6 por ciento. Tal como se informó en los informes EDR del año pasado, las emisiones de GHG relacionadas con el Aeropuerto Logan en el 2015 incluían menos del 1 por ciento de los totales de todo el estado.

Figura 1-10 Fuentes de Emisiones de GHG, 2015



Nota: Las emisiones del Alcance 1 provienen de fuentes que pertenecen o que están controladas por Massport, las emisiones del Alcance 2 provienen del consumo eléctrico, el que se genera fuera del Aeropuerto en plantas de generación eléctrica, y las emisiones del Alcance 3 provienen de los aviones, GSE y transporte terrestre hacia y desde el Aeropuerto.

- Con la "Air Quality Initiative" (Iniciativa de Calidad del Aire) (AQI) voluntaria de Massport [20] se ha hecho un seguimiento de las emisiones de NO_x desde el año de referencia de 1999. En el último año de este programa (2015), las emisiones totales de NO_x fueron 632 toneladas anuales (tpy) menos que el año de referencia de 1999. Esto representa una disminución general de un 27 por ciento en emisiones de NO_x durante los últimos 15 años. Entre 1999 y 2015, las mayores reducciones de NO_X estuvieron asociadas con los aviones, "ground service equipment" (equipos de servicio terrestre) (GSE) y vehículos motorizados en el Aeropuerto, con reducciones de un 17 por ciento, 71 por ciento y 87 por ciento, respectivamente. Massport seguirá informando sobre las emisiones de NO_x como parte del inventario de emisiones del Aeropuerto Logan en los futuros informes EDR/ESPR.

El Capítulo 7, *Calidad del Aire/Reducción de Emisiones Contaminantes* incluye información adicional.

Calidad del Agua/Cumplimiento y Manejo del Medioambiente

El enfoque de Massport para el cumplimiento y manejo del medioambiente es un componente esencial de su compromiso con la sostenibilidad y administración responsable en el Aeropuerto Logan (consulte la siguiente sección de este capítulo para conocer los detalles). A través del monitoreo y de la documentación, se evalúa el comportamiento ambiental, lo que permite el desarrollo, puesta en práctica, evaluación y mejoramiento continuo de políticas y programas.

Massport tiene la responsabilidad de asegurar el cumplimiento de las leyes y regulaciones ambientales estatales y federales vigentes. Massport fomenta las prácticas ambientales adecuadas a través de la prevención de la contaminación y medidas de saneamiento. Massport también trabaja en estrecho contacto con los arrendatarios del Aeropuerto y con el personal de operaciones del Aeropuerto en un esfuerzo por mejorar el cumplimiento. A continuación, se presenta un resumen de los hallazgos importantes de la calidad del agua y su cumplimiento para 2015.

- La última auditoría de certificación del Sistema de Manejo Ambiental de la "International Organization for Standardization" (Organización Internacional para la Normalización) (ISO) 14001 se realizó en Junio de 2014, y se emitió un certificado en Julio de 2014; el cual está vigente hasta Julio de 2017. Massport sostiene reuniones regulares para cumplir con los requerimientos regulatorios y mejorar el comportamiento ambiental más allá del cumplimiento.
- El "Stormwater Pollution Prevention Plan" (Plan de Prevención de la Contaminación por Aguas Pluviales) (SWPPP) de Massport aborda los contaminantes de las aguas pluviales en general y también aborda los productos químicos descongelantes y anticongelantes, las posibles bacterias, combustible y aceite y otras fuentes contaminantes posibles, producto de los contaminantes de aguas pluviales.[21]
- En 2015, aproximadamente un 99 por ciento de las muestras cumplían con los estándares (Tabla J-15). Debido al gran tamaño de las áreas de drenaje y a la concentración de contaminantes relativamente baja, no siempre fue posible hacer el seguimiento de rebases (excesos) en eventos específicos. Cuando se informa de un evento conocido, como por ejemplo un derrame, Massport revisa diariamente el

20 Massport adoptó el AQI como un programa voluntario de 15 años con el objetivo general de mantener las emisiones de NO_X asociadas con el Aeropuerto Logan en los niveles de 1999 o por debajo de ellos. Este año 2015 es el último año de la operación del programa. Sin embargo, se seguirá informando sobre las emisiones de NO_x en los futuros informes EDR/ESPR como parte del inventario de emisiones del Aeropuerto Logan.

21 Los Certificados de Cumplimiento Anual de 2015 fueron presentados al Organismo de Protección Ambiental (EPA) y a MassDEP el 17 de Diciembre de 2015, para Massport y cada uno de los co-titulares.

sistema de drenaje para determinar si hay impactos producto del evento y tomar las medidas correctivas pertinentes.

- De las 160 muestras (incluso de aceite y grasa, sólidos totales suspendidos, y PH en los Desagües del Norte, Oeste, Calle Porter y Calle Maverick), 158 estaban dentro o por debajo de los límites permitidos del “National Pollutant Discharge Elimination System” (Sistema de Eliminación de Descargas Contaminantes Nacional) (NPDES).
    - Una muestra de desagüe de un total de 20 muestras en el Desagüe Norte y una muestra de desagüe de un total de 19 muestras en el Desagüe Oeste superaron los límites regulatorios del permiso del NPDES para el aceite y la grasa y los “total suspended solids” (sólidos suspendidos totales) (TSS), respectivamente. El exceso de aceite y grasa en el Desagüe Norte se informó en Febrero de 2015 y el exceso de TSS en el Desagüe Oeste se informó en Septiembre de 2015, conforme a las exigencias.
- En el 2015, se produjeron 16 derrames de aceite y material peligroso, lo cual requirió ser informado a MassDEP, siete de los cuales involucraron un sistema de drenaje de los desagües.[22] Todos los derrames fueron tratados de manera correcta sin provocar impactos nocivos para la calidad del agua.
- De acuerdo con el “Massachusetts Contingency Plan” (Plan de Contingencia de Massachusetts) (MCP), Massport sigue evaluando, saneando y provocando la clausura legal de áreas con contaminación del subsuelo. Massport está tratando de lograr la clausura legal de los sitios MCP que quedan en el Aeropuerto Logan asociados con derrames conocidos, así como también intenta tratar sitios encontrados durante la construcción.

El Capítulo 8, *Calidad del Agua/Cumplimiento y Manejo Ambiental* incluye información adicional.

Sostenibilidad en el Aeropuerto Logan

Figura 1-11 Enfoque de EONS hacia la Sostenibilidad

Massport se ha comprometido con un programa de sostenibilidad vigoroso. Con la sostenibilidad se han redefinido los valores y criterios para medir el éxito organizacional al usar un enfoque de "triple resultado" que considera el bienestar económico, ecológico y social. La aplicación de este enfoque para la toma de decisiones es una manera práctica de optimizar el capital económico, ambiental y social. Massport está tiene una visión amplia de la sostenibilidad, la que se basa en el concepto de triple resultado y considera el contexto específico al aeropuerto. En coherencia con la definición del “Airports Council

22 Las regulaciones ambientales estatales exigen que los derrames de aceite de un volumen de 10 galones (38 litros) o más sean informados a MassDEP.

International – North America" (Consejo Internacional de Aeropuertos - América del Norte) (ACI-NA) de Sostenibilidad de Aeropuertos[23] (**Figura 1-11**), Massport se ha concentrado en un enfoque holístico para administrar el Aeropuerto Logan con el objeto de asegurar la viabilidad Económica, eficiencia Operacional, conservación de recursos Naturales y responsabilidad Social (EONS). Massport tiene el compromiso de establecer prácticas ambientalmente sustentables en todo el Aeropuerto y a nivel de todas la Autoridades y sigue avanzando en una amplia gama de iniciativas. En las siguientes secciones se entrega un resumen de muchas de las iniciativas de sostenibilidad de largo plazo y multifacéticas que ha impulsado Massport, cuyos capítulos individuales de este informe *2015 EDR* los explican de manera más completa, cuando corresponde.

"Sustainability Management Plan" (Plan Gerencial para la Sostenibilidad (SMP) del Aeropuerto Logan

Massport se ha comprometido con reducir los impactos ambientales locales sin sacrificar el nivel de servicio; el vigoroso programa de sostenibilidad de Massport es un indicativo de este compromiso. En 2013, Massport recibió una subvención de la FAA para preparar un SMP para el Aeropuerto Logan. El esfuerzo de planificación del SMP del Aeropuerto Logan empezó en Mayo de 2013 y terminó en Abril de 2015. El SMP del Aeropuerto Logan tiene una visión amplia de la sostenibilidad que incluye consideraciones tales como el dinamismo económico, responsabilidad social, eficiencia operacional y conservación de los recursos naturales. El SMP del Aeropuerto Logan tiene el propósito de fomentar e integrar la sostenibilidad en todo el Aeropuerto y coordinar los esfuerzos de una sostenibilidad permanente con todas la Autoridades. El SMP del Aeropuerto Logan desarrolló un esquema y plan de implementación, con métricas y objetivos, el que se ha diseñado para hacer un seguimiento de los avances a lo largo del tiempo. En la actualidad, Massport está avanzando en una serie de iniciativas de corto plazo para ayudar a lograr las metas (**Tabla 1-1**) en las áreas de energía y emisiones de gases con efecto invernadero; bienestar de la comunidad, empleados y pasajeros; resiliencia; manejo y reciclado de materiales y desechos y conservación del agua. El SMP del Aeropuerto Logan está disponible en línea en https://www.massport.com/environment/sustainability-management-plan.

Metas de Sostenibilidad del Aeropuerto Logan

Como parte del SMP del Aeropuerto Logan, Massport fijó metas para mejorar el desempeño del Aeropuerto Logan en diez categorías de sostenibilidad: energía y emisiones de GHG; conservación del agua, bienestar de la comunidad, empleados y pasajeros; manejo y reciclado de materiales y desechos; resiliencia; reducción del ruido; mejoramiento de la calidad del aire; acceso terrestre y conectividad; calidad del agua/aguas pluviales y recursos naturales. La **Tabla 1-1** describe cada una de las metas a medida que el SMP del Aeropuerto Logan las va definiendo. Massport entrega información sobre su avance en el logro de cada meta, incluidos los cambios en el desempeño relacionado, en los informes de sostenibilidad. Massport publicó su primer informe de sostenibilidad anual en 2016, el que está disponible

23 Airports Council International (Consejo Nacional de Aeropuertos) (ACI). sostenibilidad del Aeropuerto: A Holistic Approach to Effective Airport Management (Un Enfoque Holístico para una Administración Eficaz del Aeropuerto). Sin fecha. http://www.aci-na.org/static/entransit/Sustainability%20White%20Paper.pdf. En línea desde el 17 de Julio de 2013.

en el sitio en línea https://www.massport.com/environment/sustainability-management-plan/2016-logan-airport-annual-sustainability-report/.

Tabla 1-1 Metas y Descripciones de Sostenibilidad del Aeropuerto Logan

Categoría de Sostenibilidad	**Meta**	**Categoría de Sostenibilidad**	**Meta**
Energía y Emisiones de Gases con Efecto Invernadero (GHG)	Reducir la intensidad de energía y las emisiones de GHG mientras aumenta la parte de energía del Aeropuerto Logan que se produce a partir de fuentes renovables.	Conservación del agua	Conservar los recursos de agua regionales mediante un consumo reducido de agua potable.
Bienestar de la comunidad, empleados y pasajeros	Fomentar el bienestar de comunidades, pasajeros y empleados económicamente prósperos y sanos.	Manejo y reciclaje de materiales y desechos	Reducir la generación de desechos, aumentar la tasa de reciclaje y utilizar materiales ambientalmente sanos.
Resiliencia	Convertirse en un modelo innovador para la planificación de resiliencia e implementación entre las autoridades portuarias.	Reducción del ruido	Reducir al máximo los impactos del ruido que provienen de las operaciones del Aeropuerto Logan.
Mejoramiento de la calidad del aire	Disminuir las emisiones de contaminantes expulsados al aire de las fuentes del Aeropuerto Logan	Acceso terrestre y conectividad	Ofrecer un acceso terrestre de alta calidad al Aeropuerto Logan a través de modos de viajes alternativos y HOV.
Calidad del agua/aguas pluviales	Proteger la calidad del agua y reducir al máximo las descargas de contaminantes.	Recursos naturales	Proteger y restaurar los recursos naturales cerca del Aeropuerto Logan.

La Sostenibilidad en la Planificación, Diseño y Construcción

En las siguientes secciones se presentan los logros de sostenibilidad de Massport en la planificación, diseño y construcción de sus proyectos.

"Leadership in Energy and Environmental Design" (Liderazgo en Energía y Diseño Ambiental) (LEED®)-Instalaciones con Certificación en el Aeropuerto Logan

El sistema de clasificación de LEED del "United States Green Building Council" (Consejo de Construcción Ecológica de los Estados Unidos) (USGBC) es el sistema de certificación de construcciones ecológicas más ampliamente reconocido en América del Norte. Massport está luchando por lograr la certificación de LEED para todos los proyectos de construcción nuevos y de renovación importantes de más de 20.000 pies cuadrados (1.850 m^2). Algunos de los ejemplos recientes de edificios con certificación LEED en el Aeropuerto Logan son el nuevo RCC y el Patio de Mantenimiento de Autobuses Ecológicos (**Figura 1-12** y **Tabla 1-2**). El nuevo RCC en el SWSA empezó a construirse en el 2010 y se terminó en el 2013. Massport se siente muy orgulloso porque RCC obtuvo en el 2015 la primera Certificación de Oro de LEED del Aeropuerto Logan. El Patio de Mantenimiento de Autobuses Ecológicos obtuvo una Certificación de Plata de LEED porque cambió las operaciones de mantenimiento en el Aeropuerto desde un lugar alejado del Aeropuerto, lo que redujo los viajes de los autobuses y emisiones innecesarias en las congestionadas calles de las comunidades vecinas. Los detalles adicionales están disponibles en el Capítulo 3, *Planificación del Aeropuerto*.

Figura 1-12 Instalaciones con Certificación LEED en el Aeropuerto Logan

LEED GOLD	LEED SILVER	LEED CERTIFIED	LEED CERTIFIED
Centro de alquiler de automóviles, Certificación de Oro de LEED (2015)	**Patio de Matenimiento de Autobuses Ecológicos, Certificación de Plata de LEED (2015)**	**Instalación de Aviación Civil de Soporte de Vuelos Característicos, con Certificación LEED (2008)**	**Terminal A, con Certificación LEED (2006)**

"Sustainable Design Standards and Guidelines" (Regulaciones y Directrices de Diseño Sustentable) (SDSG) y Certificación LEED

Para proyectos de construcción más pequeños o proyectos no relacionados con la construcción, Massport utiliza sus "*Sustainable Design Standards and Guidelines" (Regulaciones y Directrices de Diseño Sustentable)* (SDSG) para incorporar la sostenibilidad. El SDSG, que fue revisado y reeditado en Marzo de 2011, ofrece un marco de diseño y construcción sustentable tanto para proyectos de construcción nuevos como de renovación. El SDSG se aplica a una amplia variedad de criterios específicos a un proyecto, tales como diseño del sitio, materiales del proyecto, manejo y eficiencia de la energía, calidad y eficiencia del manejo del aire, emisiones y agua, calidad del aire interior y comodidad del ocupante. Massport ha utilizado las nuevas regulaciones para destinar más de $200 millones a proyectos importantes de Massport entre los años fiscales 2010 a 2013, incluyendo más de $30 millones para proyectos marítimos. Además del SDSG, Massport lucha por obtener la Certificación LEED para los proyectos elegibles. En el 2014, El Patio de Mantenimiento de Autobuses Ecológicos obtuvo la certificación de Plata de LEED y en el 2015 el RCC obtuvo la certificación de Oro de LEED.

Tabla 1-2 Instalaciones con Certificación LEED en el Aeropuerto Logan

Terminal A (con Certificación LEED) Finalizado en 2005/2006

- Lugares prioritarios exclusivos para vehículos de alta ocupación (HOV) y bicicletas
- Actualización del diseño de paneles solares en el techo de la Terminal A
- Filtración de aguas pluviales
- Techo reflectante
- Características de reducción del uso de agua
- Luz del día natural asociada a tecnologías de iluminación avanzada para la eficiencia de energía
- Uso de materiales reciclados y de fuentes regionales
- Medidas para mejorar la calidad del aire interno

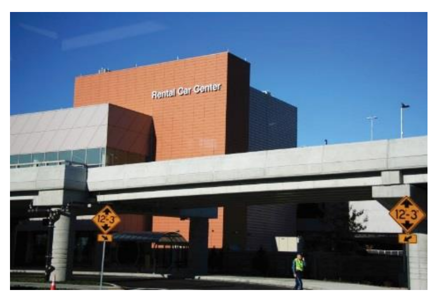
Instalación de Aviación Civil de Soporte de Vuelos Característicos (con Certificación LEED) Finalizado en 2007/2008

- Mecanismos para reducir el uso de agua
- Luz del día natural asociada a tecnologías de iluminación avanzada para la eficiencia de energía
- Cristales para ventanas y sombrillas para aumentar al máximo la luz del día y disminuir al máximo la acumulación de calor
- Materiales reciclados y de fuentes regionales
- Medidas para mejorar la calidad del aire interno

Patio de Mantenimiento de Autobuses Ecológicos (Certificación de Plata de LEED) Finalizado en 2012

- Paneles solares en la cima del techo
- Características de ahorro de agua y energía
- Reducción de millas recorridas por los vehículos (VMT)
- Nueva flota de transporte que incluye 50 autobuses híbridos con energía menos contaminante a diésel/electricidad y autobuses a gas licuado (CNG)
- Materiales cultivados, cosechados, producidos transportados de manera sustentable.

Centro de Alquiler de Automóviles (RCC) (Certificación de Oro de LEED) Finalizado en 2013



- Materiales de construcción ecológicos
- Paneles solares en la cima del techo
- Acceso y conexiones para bicicletas y peatones
- Luz del día natural asociada a tecnologías de iluminación avanzada para la eficiencia de energía
- Uso de materiales reciclados y de fuentes regionales
- Medidas para mejorar la calidad del aire interno
- Estaciones de conexión para vehículos eléctricos y otras fuentes de combustible alternativas, tales como E-85 (etanol)
- Flotas de alquiler de automóviles que incluyen vehículos híbridos/combustibles alternativos/de bajas emisiones
- Conexiones para peatones
- Instalaciones para bicicletas y duchas/vestuario de empleados
- La recuperación de agua para el agua de lavado de vehículos y uso de aguas pluviales para usos de agua no potable, tales como el lavado de vehículos y riego de jardines
- Reducción de VMT

Proceso de Revisión Ambiental del Aeropuerto Logan

Este informe *2015 EDR* forma parte del proceso de revisión ambiental consolidado a nivel estatal, en el que se evalúan los impactos ambientales acumulados del Aeropuerto Logan. El proceso ofrece un contexto contra el cual los proyectos individuales del Aeropuerto Logan cumplen con los límites de revisión ambiental estatales y federales y son evaluados sobre una base específica al proyecto. Los procesos de revisión ambiental específicos a todo Aeropuerto y al proyecto se describen a continuación.

Contexto Histórico del Informe EDR/ESPR del Aeropuerto Logan

En 1979, el Secretario de la "Executive Office of Energy and Environmental Affairs" (Oficina Ejecutiva de Asuntos Ambientales) (EEA) emitió un Certificado que exige a Massport que defina, evalúe y divulgue, cada tres años, el impacto del crecimiento de largo plazo en el Aeropuerto a través de un "Generic Environmental Impact Report" (Informe de Impacto Ambiental Genérico) (GEIR). El Certificado también exigía Actualizaciones Anuales provisorias para entregar los datos sobre las condiciones para los años entre los GEIR. El GEIR evolucionó hacia una herramienta de planificación eficaz para Massport y entregó proyecciones de las condiciones ambientales, de modo que los impactos acumulados de proyectos individuales podían ser evaluados dentro de un contexto más amplio.

La EEA eliminó los GEIR según las revisiones de 1998 a sus Regulaciones de MEPA. Sin embargo, el Certificado sobre la Actualización Anual de 1997[24] propuso revisar el proceso de revisión para el Aeropuerto Logan, lo que resultó en la preparación de nuevos EDR/ESPR por parte de Massport. Los informes ESPR más completos ofrecen un análisis de largo alcance de las operaciones y pasajeros proyectados y de los impactos acumulados, mientras que los informes EDR se preparan anualmente para entregar una revisión de las condiciones ambientales para el año que se informa en comparación con el año anterior. El proceso de los informes EDR/ESPR se desarrolló para permitir proyectos individuales en el Aeropuerto Logan para que estos sean considerados y analizados dentro del contexto más amplio en todo el Aeropuerto. Tal como se establece en la introducción del informe *1999 ESPR*, "si bien los informes ESPR y EDR de Logan ofrecen un contexto de planificación amplio para los proyectos propuestos para el Aeropuerto Logan y futuros conceptos de planificación que Massport considera, no se puede construir ningún proyecto específico únicamente sobre la base de la inclusión y el análisis del informe *1999 ESPR*". Además, establece que los proyectos que cumplen con los umbrales de revisión de MEPA o NEPA deben someterse a esos procesos, según sea necesario. En suma, los informes EDR/ESPR ofrecen un contexto de planificación que complementa las presentaciones individuales específicas a un proyecto.

En los últimos años, las operaciones de aviones y los niveles de actividad de pasajeros e impactos ambientales asociados se han mantenido muy por debajo de los niveles previamente analizados para el Aeropuerto Logan. Por lo tanto, el crecimiento de la aviación pronosticado en el informe *2004 ESPR*, sobre cuya base se estableció inicialmente el cronograma de ESPR, no se ha producido. En consecuencia, con la aprobación del Secretario, Massport preparó los *2009 y 2010 EDR* en lugar del informe ESPR originalmente planificado para el 2009. El informe *2011 ESPR*, registrado a comienzos del 2013, informó sobre el año calendario 2011 y actualizó el nivel de actividad de pasajeros y proyecciones de operaciones

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24 **Certificado del Secretario de la Oficina Ejecutiva de Asuntos Ambientales sobre la Actualización Anual de 1997 del Aeropuerto Logan, emitido el 16 de Octubre de 1998.**

de aeronáuticas. El informe *2012/2013 EDR* presentó las condiciones para los años calendario 2012 y 2013. El informe *2014 EDR* presentó las condiciones para el año calendario 2014.

Este informe *2015 EDR* ofrece un análisis completo y acumulado de los impactos de todas las actividades del Aeropuerto Logan basado en la actividad real de pasajeros y en los niveles de operaciones aeronáuticas en el 2015, y presenta planes de manejo ambiental para tratar las áreas con problemas ambientales. Massport propone preparar un informe *2016 ESPR* para entregar información sobre los niveles de actividad y condiciones ambientales para ese año y proyecciones hasta el año 2034, y prevé que este informe se publicará a inicios del 2018. Massport seguirá identificando y abordando las tendencias de aviación y ambientales de largo plazo tanto en los informes EDR como ESPR cuando le corresponda hacerlo. Como se indica en el Certificado del Secretario en el ENF del Proyecto de Modernización de la Terminal E, los informes EDR/ESPR continuarán siendo la instancia para abordar los impactos acumulados de todo el aeropuerto.

Revisión específica al proyecto

Si bien esta revisión, que abarca todo el Aeropuerto, ofrece un amplio contexto de planificación para los proyectos propuestos y conceptos de planificación futuros, algunos proyectos específicos del Aeropuerto también quedan sujetos a un proceso de revisión ambiental público siempre y cuando se ubiquen dentro de los límites mínimos de revisión ambiental estatal. Si se requiere, Massport y los arrendatarios del Aeropuerto presentarán los ENF y EIR conforme a MEPA. Del mismo modo, cuando se inicia la revisión ambiental de NEPA[25], los proyectos se revisarán según el proceso de revisión ambiental de NEPA.

Organización del informe *2015 EDR*

El resto de este informe *2015 EDR* incluye:

- **Capítulo 2, *Niveles de Actividad***, presenta las estadísticas de actividad de la aviación del Aeropuerto Logan en 2015 y compara los niveles de actividad con el año anterior. Las medidas de actividad específicas analizadas incluyen a los pasajeros, operaciones aeronáuticas, combinación de flota y volúmenes de carga/correo postal.
- **Capítulo 3, *Planificación del Aeropuerto***, en él se presenta un resumen de las actividades de planificación, construcción y autorización que se hicieron en el Aeropuerto Logan en 2015. En él también se describen las futuras actividades e iniciativas conocidas de planificación, construcción y autorización.
- **Capítulo 4, *Transporte Regional***, en él se describen los niveles de actividad en los aeropuertos regionales de la región de Nueva Inglaterra en el 2015 y se actualizan las últimas actividades de planificación regional.
- **Capítulo 5*, Acceso Terrestre hacia y desde el Aeropuerto Logan***, en él se incluye información sobre el transporte de pasajeros, vías, volúmenes de tráfico y estacionamientos para el 2015.
- **Capítulo 6, *Reducción del Ruido***, en él se actualiza el estado del ruido ambiental en el Aeropuerto Logan en el 2015 y se explican los esfuerzos de Massport por reducir los niveles de ruido.

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25 Sección 4321 y sig. del código 42 de USC. La "Federal Aviation Administration" (Administración Federal de Aviación) (FAA) implementa NEPA a través del Decreto 1050 de la FAA.1E, "Environmental Impacts: Policies and Procedures" (Impactos Ambientales: Políticas y Procedimientos), Administración Federal de Aviación, "United States Department of Transportation" (Departamento de Transporte de los Estados Unidos), Fecha de vigencia: 20 de Marzo de 2006.

- **Capítulo 7, *Calidad del Aire/Reducción de Emisiones***, en él se presenta un resumen de la calidad del aire relacionada con el Aeropuerto en el 2015 y los esfuerzos para reducir las emisiones.
- **Capítulo 8, *Calidad del Agua/Cumplimiento y Manejo Ambiental***, en él se describen las actividades de manejo ambiental permanentes de Massport que incluyen las actividades de cumplimiento del "National Pollutant Discharge Elimination System" (Sistema de Eliminación de Descargas Contaminantes Nacional) (NPDES), aguas pluviales, derrames de combustible de acuerdo con el "Massachusetts Contingency Plan" (Plan de Contingencia de Massachusetts) (MCP) y el manejo de estanques.
- **Capítulo 9, *Seguimiento de la Mitigación Ambiental del Proyecto***, incluye información sobre los avances de Massport para cumplir los compromisos de mitigación ambiental de la Sección 61 de MEPA[26] para proyectos específicos del Aeropuerto.

Los apéndices de referencia incluyen:

Apéndices de MEPA: Estos incluyen el Certificado del Secretario de EEA sobre el informe *2014 EDR*, comentarios escritos que se recibieron sobre el informe *2014 EDR* y respuestas a dichos comentarios, Certificados del Secretario sobre los informes anuales emitidos para los años de referencia del 2011 al 2014, una lista de los revisores a los que se les distribuyó este *2015 EDR* y un alcance propuesto para *2016 ESPR*. También se incluyen en esta sección los Certificados del Secretario relacionados con el ENF, EA/EIR Preliminar, y EA/EIR Definitivo del Proyecto de Modernización de la Terminal E.

Apéndice A – Certificados y Respuestas de MEPA a los Comentarios[27]

Apéndice B – Comentarios Escritos y Respuestas

Apéndice C – Alcance Propuesto para el informe 2016 ESPR

Apéndice D – Lista de Distribución

Apéndices Técnicos:[28] Estos incluyen datos analíticos detallados y documentación metodológica para los diferentes análisis ambientales presentados y realizados para este informe *2015 EDR*.

Apéndice E – Niveles de Actividad

Apéndice F – Transporte Regional

Apéndice G – Acceso Terrestre

Apéndice H – Reducción del Ruido

Apéndice I – Calidad del Aire/Reducción de Emisiones Contaminantes

Apéndice J – Calidad del Agua/Cumplimiento y Manejo Ambiental

Apéndice K – Informe de Monitoreo de Tarificaciones en Períodos Picos en los años 2015 y 2016

Apéndice L – Memorando sobre Rodaje de Motores Reducido/Individual en el Aeropuerto Logan

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26 En el Capítulo 30, Sección 61 (M.G.L. c. 30, § 61) de la "Massachusetts General Law" (Ley General de Massachusetts), se estipula que todos los organismos deben revisar, evaluar y determinar los impactos ambientales de todos los proyectos o actividades y que deberán usar todos los medios y medidas que estén a su alcance para disminuir al máximo los daños al medioambiente. Para los proyectos que requieren un Informe de Impacto Ambiental, en los Hallazgos de la Sección 61 se especificarán las medidas factibles que se puede tomar para evitar o mitigar los impactos ambientales, la parte responsable para financiar las medidas de mitigación ambiental y el programa de implementación previsto para las medidas de mitigación ambiental.

27 Los Certificados del Secretario sobre el Formulario de Notificación, el Informe Preliminar de Evaluación Ambiental/Impacto Ambiental, y el Informe Definitivo de Evaluación Ambiental/Impacto Ambiental del Proyecto de Modernización de la Terminal E se incluyen en el Apéndice A. Para mayor comodidad, Massport ha respondido a los comentarios que se relacionan con el informe EDR y ESPR.

28 Los apéndices técnicos se incluyen en el CD adjunto.

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Activity Levels

Introduction

Boston-Logan International Airport (Logan Airport or Airport) serves as New England's primary domestic and international airport, and plays a key role in the metropolitan Boston and New England passenger and freight transportation networks. Logan Airport plays a number of roles in the local, New England, and national air transportation system. It is the primary airport serving the Boston metropolitan area, the principal New England airport for long-haul services, and is a major U.S. international gateway airport for transatlantic services.

This chapter reports on annual air traffic activity at Logan Airport in 2015, including air passengers, aircraft operations, aircraft fleet mix, and cargo volumes. Air traffic activity levels at Logan Airport are the basis for the evaluation of noise, air quality effects, and ground access conditions 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]

2015 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 (arrivals)

13th Largest U.S. passenger gateway to the world (scheduled passenger service)

Source: ACI, 2015; USDOT, 2015

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 2015, passenger activity levels reached an all-time high of 33.4 million passengers and aircraft operations totaled 372,930. From 2000 to 2015, the annual number of passengers at Logan Airport increased by 20.6 percent, while the annual number of aircraft operations[4] decreased by 23.6 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 achieved 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 2010 and 2015, 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 An aircraft operation is defined as one arrival or one departure.

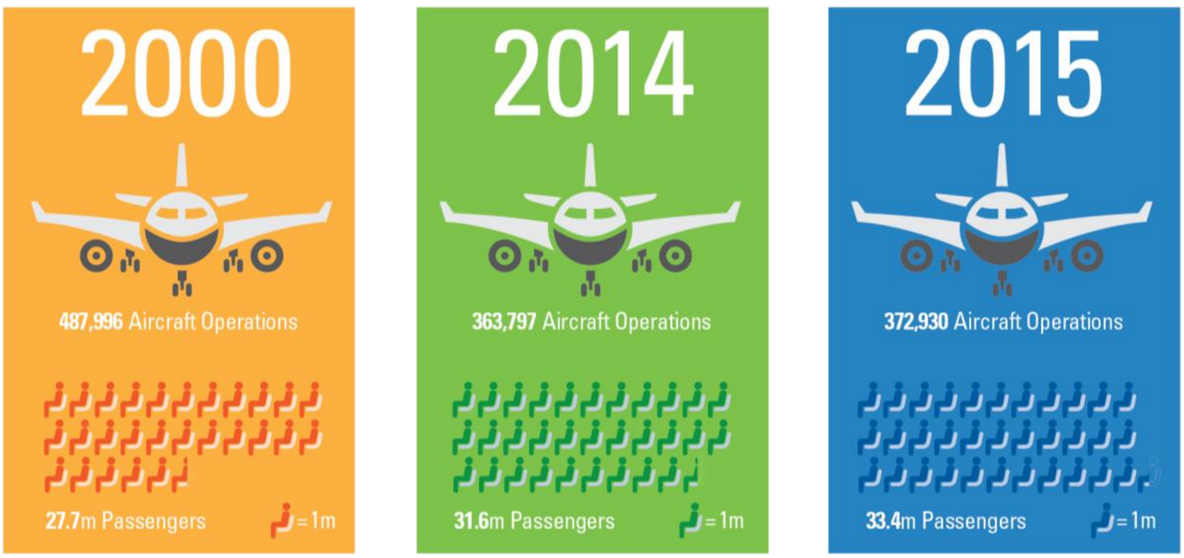
important national and international destination, a robust regional economy, and regional demographics favorable to air travel.

This chapter specifically describes 2015 activity levels compared to 2014 and historical trends for:

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

2015 Activity Levels Highlights and Key Findings

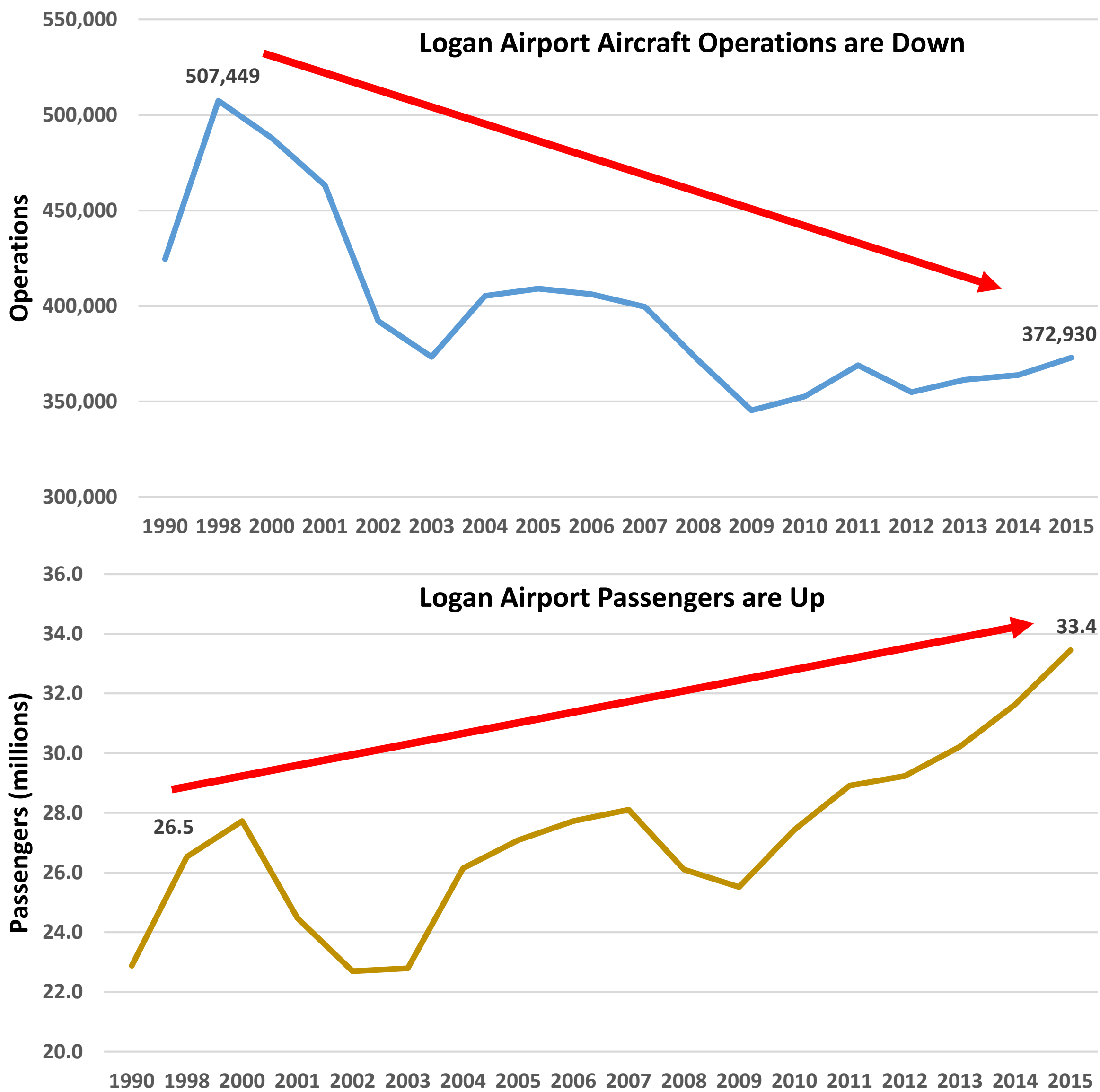
Notable changes in passenger, operations, and cargo activity at Logan Airport in 2015 are described below.



- In 2015, Logan Airport was ranked the 17th busiest airport in the U.S. in terms of passengers and the 18th busiest in terms of operations.[5] In 2014, the Airport was ranked 18th busiest airport in the U.S. for passengers and 17th busiest for operations.[6]
- From 2000 to 2015, the annual number of passengers at Logan Airport increased by 20.6 percent, while the annual number of aircraft operations[7] decreased by 23.6 percent.
- The total number of air passengers increased by 5.7 percent to 33.4 million in 2015, compared to 31.6 million in 2014 (**Figure 2-1**). The 2015 passenger level represents a new record high for Logan Airport.

5 Airports Council International, Worldwide Airport Traffic Report, December 2015
6 ACI-NA. 2014. *Airport Traffic Reports*. www.aci-na.org. Accessed February 2016.
7 An aircraft operation is defined as one arrival or one departure.

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



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

- 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 5.0 million in 2014 to 5.5 million in 2015, a 10.9-percent increase. Annual domestic passengers' activity levels increased from 26.5 million in 2014 to 27.8 million in 2015,[8] a 4.8-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.

8 Excluding general aviation (GA) passengers.

- To accommodate regional demand, new non-stop services were introduced by a number of foreign airlines including Aeromexico, Cathay Pacific, El Al, Hainan Airlines, and WOW Air. New international destinations from Logan Airport in 2015 included Mexico City, Hong Kong, Tel Aviv, and Shanghai.
- The total number of aircraft operations at Logan Airport increased from 363,797 in 2014 to 372,930 in 2015, a 2.5-percent increase. This was preceded by a 0.7-percent increase from 2013 to 2014. 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 33.4 million air passengers in 2015, which saw 134,519 fewer operations.
- Passenger aircraft operations accounted for 91 percent of total aircraft operations in 2015. While domestic operations remain the largest share of commercial operations,[9] international operations have grown steadily at Logan Airport. In 2015, scheduled domestic operations increased by 1.5 percent while scheduled international operations increased by 6.5 percent.
- International passengers made up approximately 16.1 percent of total Airport passengers in 2015, and this is projected to increase steadily to nearly 20 percent of the total by 2030 or sooner.
- A series of factors, including the key factor of continued local and regional economic growth, have combined to produce this exceptional passenger growth.
- JetBlue Airways continued to expand services at Logan Airport, increasing its total operations by 3.9 percent in 2015. As Logan Airport's largest carrier, JetBlue Airways accounted for 25.3 percent of total passenger aircraft operations and 26.6 percent of total passengers in 2015.
- General Aviation (GA) operations, which accounted for 7.6 percent of total operations in 2015, increased by 6.6 percent from 2014.[10] The 28,166 GA operations in 2015 remain well below the 35,233 GA operations that Logan Airport handled in 2000. Hanscom Field, Logan Airport's reliever airport, handled 127,700 GA operations in 2015.[11]
- Air carrier efficiency continued to increase, with the average number of passengers per aircraft operation at Logan Airport increasing from 87.0 in 2014 to 89.7 in 2015. 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 volumes,[12] at Logan Airport totaled 606 million pounds in 2015, compared to 608 million pounds in 2014. Approximately 43 percent of Logan Airport's cargo was carried by passenger airlines as belly cargo, while 37 percent was carried by all-cargo carriers such as FedEx and UPS. Dedicated air cargo operations increased from 5,711 to 6,059, a 6.1-percent increase.
- The *2016 ESPR* will update operations and passenger activity levels through 2035.

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

Air Passenger Levels in 2015

The following section provides an overview of air passenger levels in 2015 for Logan Airport.

Logan Airport Passengers

Logan Airport is the principal airport for the greater Boston metropolitan area and is 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 2015.[13] Logan Airport served 33.4 million passengers in 2015, an increase of 5.7 percent over 2014. This represented a historic high for Logan Airport, exceeding the previous record of 31.6 million in 2014. Logan Airport is one of the fastest growing airports in the U.S., with passenger growth continuing to outpace overall U.S. passenger growth. Total scheduled passenger traffic in the U.S. increased by 5.0 percent[14] in 2015 compared to the passenger growth of 5.7 percent at Logan Airport. Factors that contributed to the strong passenger growth at Logan Airport in 2015 included:

- Strengthening economic growth and a recovery in air travel demand across the nation;
- JetBlue Airways' continued expansion at Logan Airport in response to passenger demand; and
- Growing 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 two periods of decline and gradual recovery, Logan Airport's international traffic finally surpassed 2000 levels for the first time in 2013. In 2015, international passengers increased 10.9 percent over 2014 figures or 21.7 percent over 2013 levels. Since 2011, the international passenger segment has averaged a 7.0-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 service in recent years. Boston is currently the 13th largest U.S. gateway for international air travel, as well as the third largest U.S. gateway airport (after Fort Lauderdale and Honolulu) that is not also a connecting U.S. airline hub.[15] The O&D strength of the Boston market makes Logan Airport an attractive gateway for foreign flag 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 95,000 direct and indirect jobs,[16] 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 1.4 million overseas visitors spent more than $1 billion in 2014, or $763, on

13 Airports Council International, Worldwide Airport Traffic Report, December 2015
14 Bureau of Transportation Statistics, March 2016.
15 U.S. DOT, T100 Database, YE 3Q 2015
16 Massachusetts Aeronautics Commission. 2013. Massachusetts Statewide Airport Economic Impact Study. http://www.massdot.state.ma.us/portals/7/docs/mass_exec_summary_cml.pdf.

average, per visit.[17] New international service in the last three years alone has contributed more than $1.4 billion per year to the local economy and $44 million in new incremental tax revenue through income and sales.[18]

As shown in **Table 2-1**, domestic air passengers represent Logan Airport's largest market segment, accounting for 83.1 percent of total passengers in 2015. The domestic passenger market increased by 4.8 percent in 2015. Growth in JetBlue Airways, Delta Air Lines, and Southwest Airlines' domestic networks from Logan Airport were the main contributors to growth in domestic passengers. JetBlue Airways carried 8.1 million domestic passengers at Logan Airport in 2015, compared to 7.6 million in 2014. Delta Air Lines carried 3.6 million domestic passengers in 2015, up 18.1 percent from 3.0 million in 2014. Southwest Airlines carried 2.6 million domestic passengers in 2015, up 17.4 percent from 2.0 million passengers in 2014.

Table 2-1 Air Passengers by Market Segment, 1990, 1998, 2000, and 2011-2015

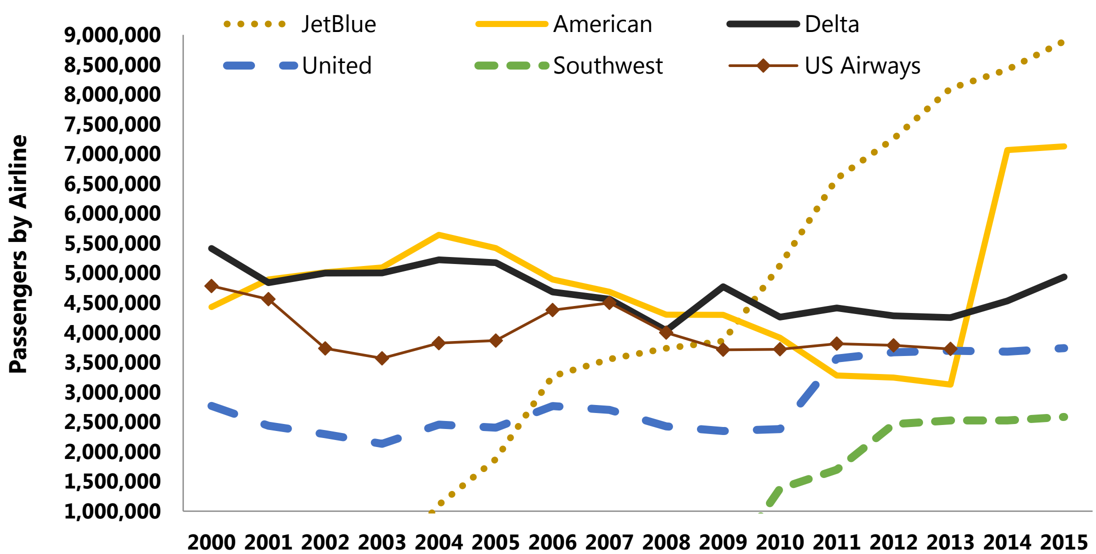
	1990	1998[1]	2000	2011	2012	2013	2014	2015	Percent Change (2014-2015)	Avg. Annual Growth (2011-2015)
Domestic	19,519,247	22,429,639	23,100,645	24,579,780	24,743,008	25,578,080	26,545,978	27,810,256	4.8%	3.1%
International	3,358,944	3,985,954	4,513,192	4,215,071	4,383,945	4,546,018	4,992,225	5,534,176	10.9%	7.0%
Europe/ Middle East	N/A	2,467,585	2,948,542	2,939,226	2,896,002	2,901,529	3,194,109	3,473,579	8.7%	4.3%
Bermuda/ Caribbean[2]	N/A	702,383	693,620	700,267	793,953	863,842	887,301	946,428	6.7%	7.8%
Canada	N/A	790,731	833,669	573,660	614,879	643,987	669,546	688,459	2.8%	4.7%
Asia/Pacific	N/A	25,255	37,451[3]	0	78,484	104,235	170,867	316,621	85.3%	New
Central/ South America	N/A	0	0	1,918	627	32,425	70,402	109,089	55.0%	174.6%
General Aviation	N/A	111,115	112,996	114,416	109,134	94,872	96,242	105,148	9.3%	(2.1%)
Total Passengers	22,878,191	26,526,708	27,726,833	28,909,267	29,236,087	30,218,970	31,634,445	33,449,580	5.7%	3.7%

Source: Massport
N/A Not available
Notes: Numbers in parentheses () indicate negative number.
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 over other U.S. gateways to international destinations.
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.

17 Greater Boston Convention and Visitors Bureau. 2016. *GBCVB, Massport Celebrates Record Number of International Visitors in 2014*. http://www.bostonusa.com/partner/press/press-releases/view/GBCVB-Massport-Celebrate-Record-Number-of-International-Visitors-in-2014-/113/. Accessed December 6, 2016.
18 InterVISTAS. 2015. *Economic Impact of Recent International Routes.*

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.[19] Domestic passenger activity levels have recovered from the recent economic downturn in 2008/2009, when the total number of domestic air passengers fell to 21.8 million. In 2015, domestic passenger activity levels reached a new peak of 27.8 million.

Figure 2-2 Annual Passengers at Logan Airport Served by Top Five Airlines, 2000-2015



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.

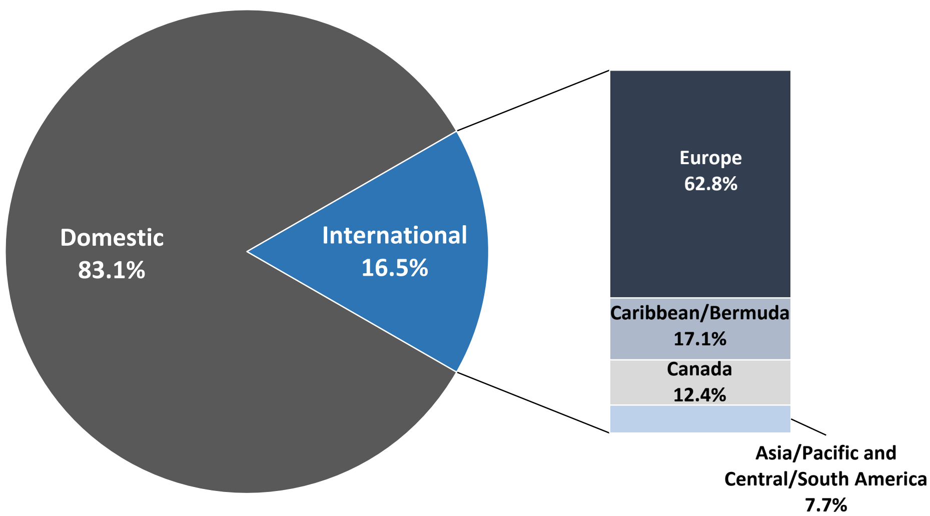
Due to the region's strong economy, Logan Airport experienced substantial growth in international passenger activity levels in both 2014 and 2015. In 2014, international passenger traffic at Logan Airport increased by 9.8 percent over 2013 to reach 5.0 million, exceeding the historical international passenger peak achieved in 2000. International passenger growth accelerated in 2015, growing by 10.9 percent to reach a record 5.5 million. JetBlue Airways and Delta Air Lines have both expanded international services at Logan Airport in recent years, with JetBlue Airways continuing to grow its Caribbean network and Delta Air Lines introducing new non-stop service to Amsterdam, London Heathrow, and Paris De Gaulle. Logan Airport has also attracted a significant

19 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.

amount of foreign carrier service, including new service by Emirates, Hainan Airlines, and Turkish Airlines in 2014, as well as Aeromexico, Cathay Pacific, El Al, and WOW Air in 2015.

Figure 2-3 shows the distribution of Logan Airport passengers by market segment. Europe/Middle East was the dominant international destination market, accounting for 62.8 percent of international traffic and 10.4 percent of total traffic at Logan Airport. Passenger traffic to Europe/Middle East was up 8.7 percent in 2015, driven by new services to the Middle East by Emirates and Turkish Airlines. The Bermuda/Caribbean regions and Canada accounted for 17.1 percent and 12.4 percent of international passengers respectively in 2015, with traffic to Bermuda/Caribbean seeing strong growth of 6.7 percent. Asia/Pacific and Central/South America passenger traffic accounted for 5.7 percent and 2.0 percent of international passengers respectively, following the introduction of new airline service to those regions in 2015.

Figure 2-3 Distribution of Logan Airport Passengers by Market Segment, 2015



Source: Massport
Note: General Aviation accounted for 0.3 percent of Logan Airport Passengers in 2015.

Aircraft Operation Levels in 2015

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

Logan Airport Aircraft Operations

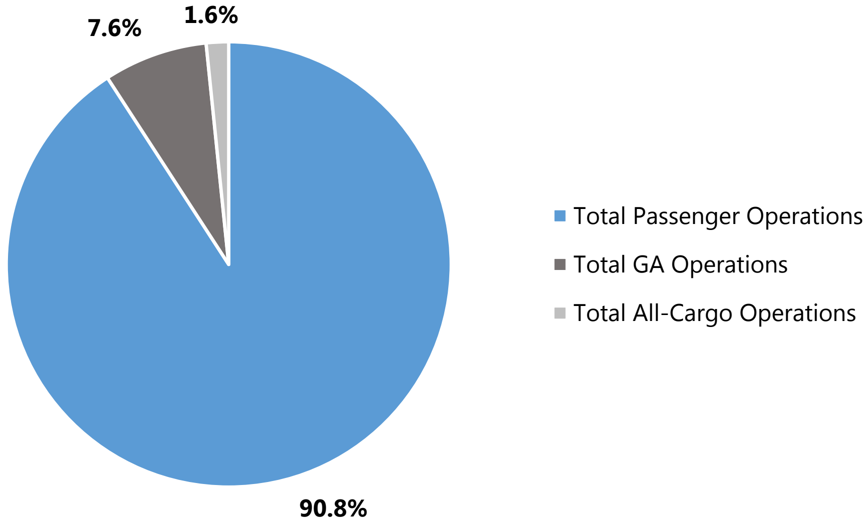
The total number of aircraft operations at Logan Airport increased 2.5 percent from 363,797 operations in 2014 to 372,930 operations in 2015 (**Table 2-2**). Increases were seen in passenger, GA, and all-cargo operations in 2015, driven by faster airline capacity growth and declining fuel prices. As shown in **Figure 2-4**, passenger operations account for 90.8 percent of total aircraft operations at Logan Airport, while GA and all-cargo operations account for 7.6 percent and 1.6 percent, respectively. **Figure 2-5** depicts passengers and aircraft operations since 1990 and shows how passenger levels have grown at Logan Airport while overall aircraft operations have decreased to levels well below the historical peak of approximately 507,000 operations in 1998. From 2000 to 2015, the annual number of passengers at Logan Airport increased by 20.6 percent, while the annual number of aircraft operations decreased by 23.6 percent.

Table 2-2 Logan Airport Aircraft Operations (1990, 1998, 2000, and 2011 – 2015)

Category	1990	1998[1]	2000	2011	2012	2013	2014	2015	Percent change (2014-2015)	Avg. Annual Growth (2011-2015)
Total Aircraft Operations	**424,568**	**507,449**	**487,996**	**368,987**	**354,869**	**361,339**	**363,797**	**372,930**	**2.5%**	**0.3%**
	Operations by Type and Aircraft Class									
Passenger Jet	N/A	244,642	254,968	223,083	225,166	233,072	240,252	254,250	5.8%	3.3%
Passenger Regional Jet	N/A	12,172	37,600	61,704	46,753	47,875	44,079	38,229	(13.3%)	(11.3%)
Passenger Non-Jet	N/A	207,880	147,913	49,700	49,599	48,307	47,339	46,225	(2.4%)	(1.8%)
Total Passenger Operations	**N/A**	**464,694**	**440,481**	**334,487**	**321,518**	**329,254**	**331,670**	**338,705**	**2.1%**	**0.3%**
GA Jet Operations	N/A	13,636	20,595	21,129	21,042	21,237	21,025	20,589	(2.1%)	(0.6%)
GA Non-Jet Operations	N/A	18,076	14,638	7,101	7,072	5,445	5,391	7,577	40.6%	1.6%
Total GA Operations	**24,976**	**31,712**	**35,233**	**28,230**	**28,114**	**26,682**	**26,416**	**28,166**	**6.6%**	**(0.1%)**
Cargo Jet	N/A	10,428	11,788	5,053	4,220	4,647	4,911	5,605	14.1%	2.6%
Cargo Non-Jet	N/A	630	494	1,217	1,017	756	800	454	(43.2%)	(21.8%)
Total All-Cargo Operations	**N/A**	**11,058**	**12,282**	**6,270**	**5,237**	**5,403**	**5,711**	**6,059**	**6.1%**	**(0.9%)**

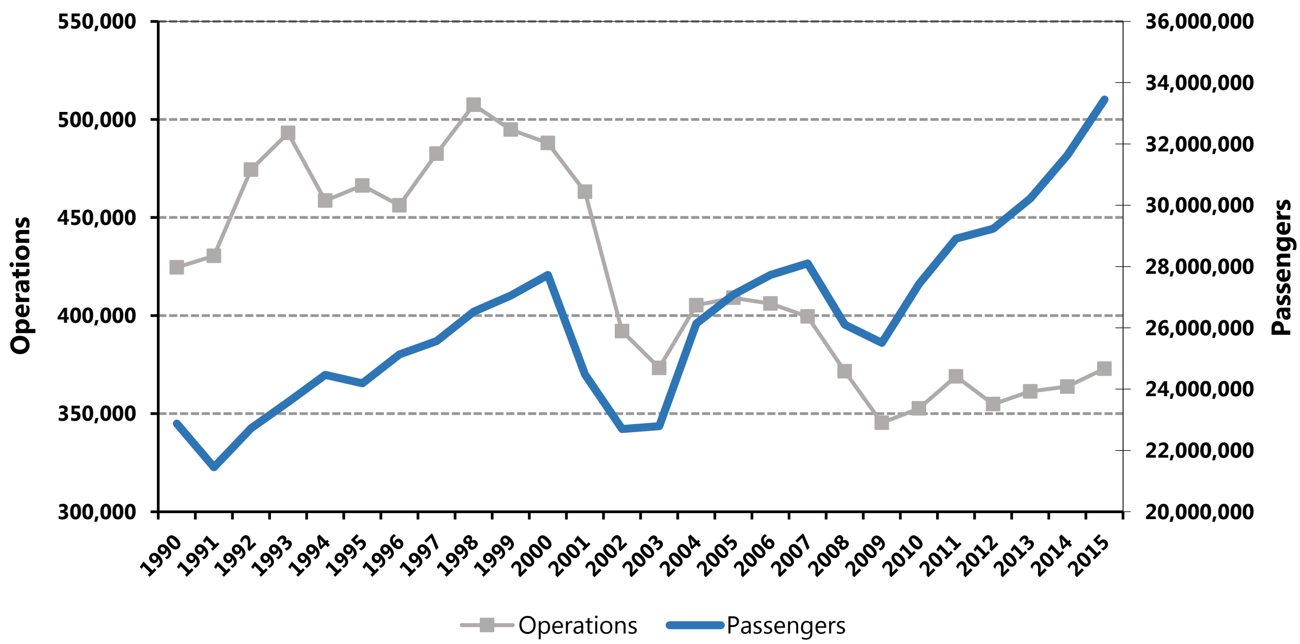
Source: Massport
NA Not Available
1 1998 represents the historic peak in terms of aircraft operations for Logan Airport.
Notes: Jet includes the Embraer E-190, which is a regional jet configured with 88 to 100 seats, but is similar in size to some traditional narrow-body jets.
Numbers in parentheses () indicate negative numbers.

Figure 2-4 Logan Airport 2015 Aircraft Operations by Type



Source: Massport

Figure 2-5 Logan Airport Historical Air Passenger and Aircraft Operations, 1990-2015



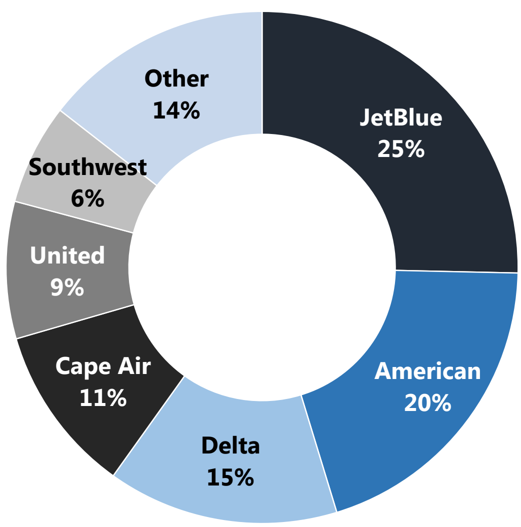
Source: Massport

Passenger Operations

Logan Airport accommodated 338,705 passenger aircraft operations in 2015, a 2.1-percent increase from 2014. Passenger aircraft operations represented 90.8 percent of total aircraft operations at Logan Airport in 2015, while GA operations and all-cargo operations represented 7.6 percent and 1.6 percent respectively (**Figure 2-4**).

The dominant carriers at Logan Airport, based on the number of aircraft operations in 2015, are shown in **Figure 2-6**. JetBlue Airways, the recently merged American Airlines/US Airways, Delta Air Lines, Cape Air, and United Airlines were the top carriers in 2015 based on the number of aircraft operations.[20] In 2015, JetBlue Airways accounted for approximately 85,852 operations, American Airways/US Airways accounted for 67,536 operations, and Delta Air Lines ranked third with 49,413 operations. Cape Air, United Airlines, and Southwest Airlines ranked fourth, fifth, and sixth, respectively, in 2015 with 35,994 operations, 29,343 operations, and 21,542 operations respectively.

Figure 2-6 Dominant Passenger Carriers at Logan Airport by Aircraft Operations, 2015



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.

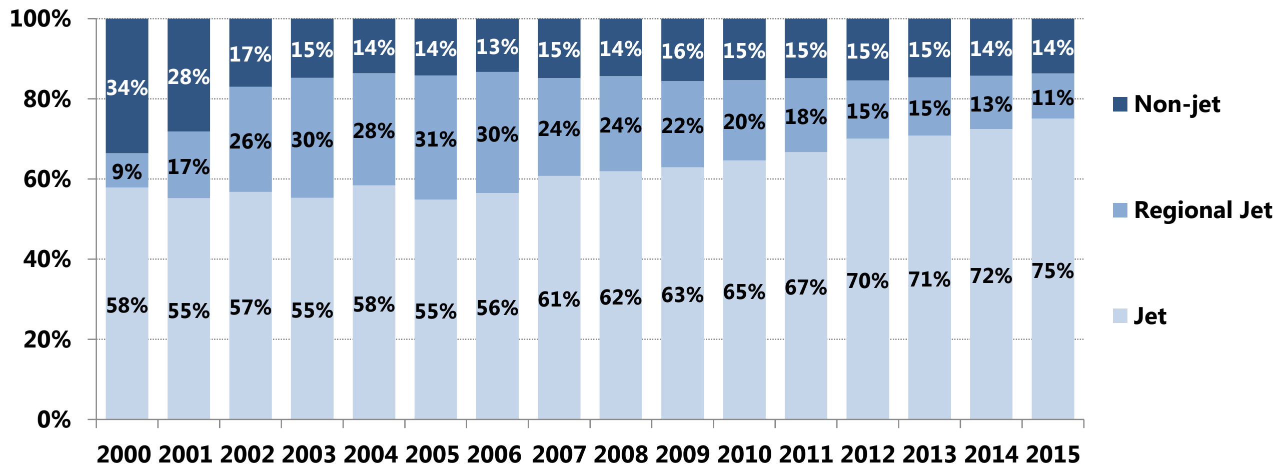
Passenger Regional Jet (RJ) operations (jet aircraft with fewer than 90 seats) and non-jet passenger operations decreased by 13.3 percent and 2.4 percent respectively in 2015, while jet passenger operations increased by 5.8 percent.[21] RJ operations have been declining steadily since 2006, as airlines eliminated unprofitable services to small and medium size markets and consolidated services after a period of airline mergers. The decreases in RJ operations also reflects the retirement of smaller, less fuel-efficient RJs with 30 to 50 seats.

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

21 In this report, the term regional jet refers to small jet aircraft with fewer than 90 seats. The Embraer-190, operated by JetBlue Airways and US Airways at Logan Airport, carries up to 100 and 99 passengers respectively, and is considered a jet.

The change in mix of passenger aircraft operations since 2000 is shown in **Figure 2-7**. RJs accounted for 11 percent of total passenger operations in 2015, compared to 31 percent at the peak level in 2005. Similarly, non-jets have declined from a high of 34 percent in 2000 to 14 percent in 2015.

Figure 2-7 Passenger Aircraft Operations at Logan Airport by Aircraft Type, 2000-2015



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 2015, continuing the trend seen over the past decade. 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). In 2015, Logan Airport operations accommodated an average of 89.7 passengers per flight compared to 87.0 in 2014 (**Table 2-3**). The average number of passengers per flight has risen by 14.5 percent since 2011, when the average number of passengers per flight was 78.3. The trend of more passengers on fewer flights is more efficient; this reflects a shift away from smaller, less fuel-efficient aircraft and rising load factors as airlines carefully monitored and restricted capacity growth. In 2015, Logan Airport's average domestic load factor increased to 82.8 percent from 82.1 percent in 2014. The national average domestic load factor has also been increasing, rising from 81.7 percent in 2014 to 82.6 percent in 2015.[22] Changes in passengers per operation and load factor at Logan Airport are shown in **Figure 2-8**.

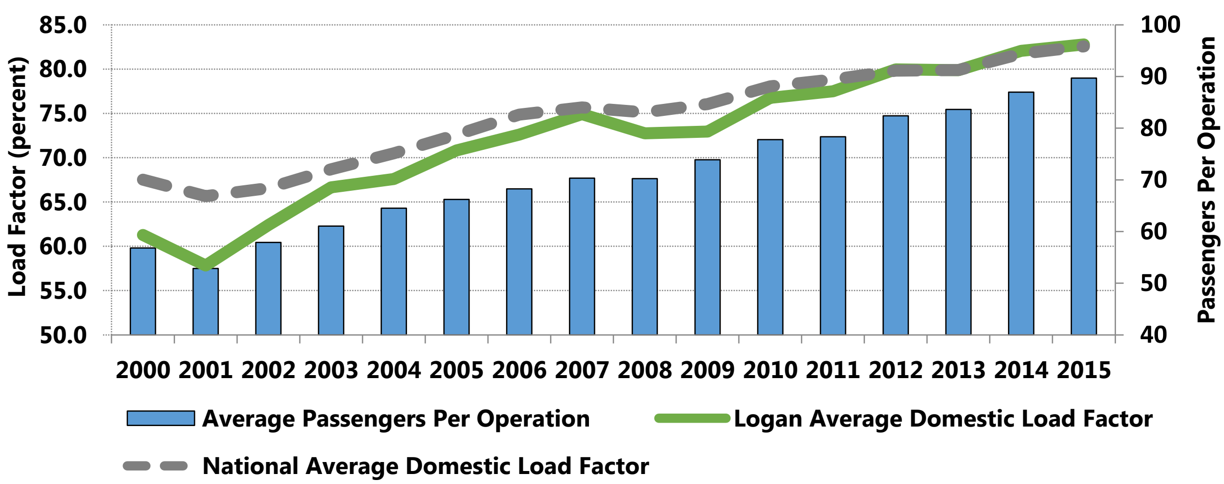
22 U.S. DOT, T100 Database; includes scheduled passenger service only

Table 2-3 Air Passengers and Aircraft Operations, 2011-2015

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)
2011	28,909,267	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

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, 2000-2015



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

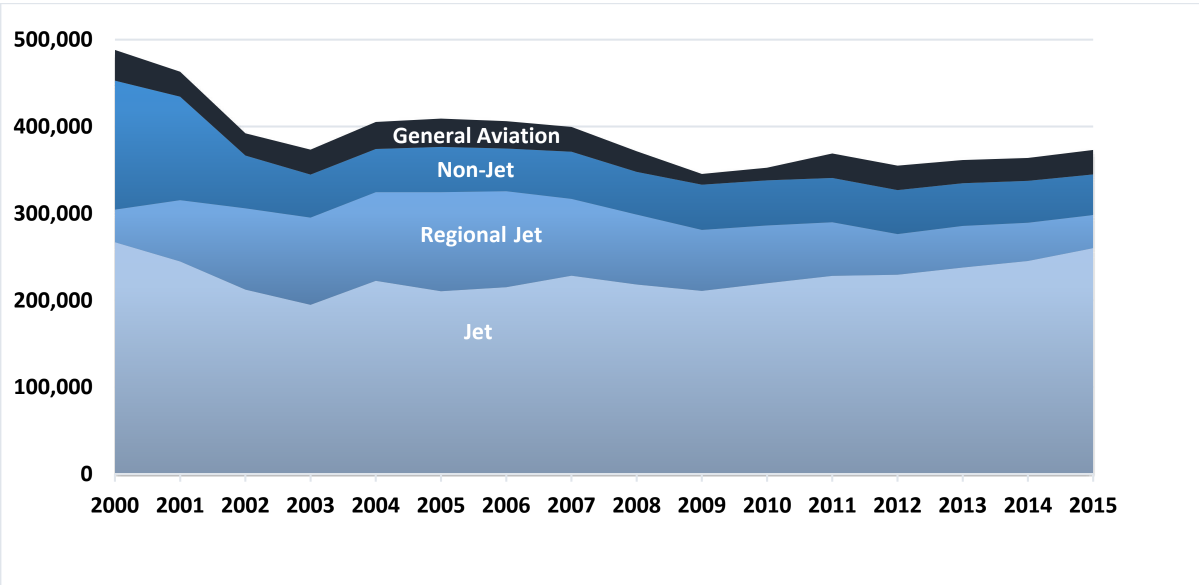
General Aviation Operations

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. A sharp drop in oil prices and fuel expense in 2015 contributed to an increase in GA activity at Logan Airport in 2015. GA operations at Logan Airport totaled 28,166 operations in 2015, up

6.6 percent from the 26,416 operations in 2014, however, GA operation levels in 2015 remain well below the 35,233 GA operations that Logan Airport handled in 2000.

In 2015, GA operations accounted for 7.6 percent (28,166 operations) of aircraft activity at Logan Airport (**Figure 2-4**). In comparison, Hanscom Field accommodated approximately 127,700 GA operations in 2015, with GA representing 99.6 percent of Hanscom Field's aircraft activity. Hanscom Field remains the primary GA airport for the Greater Boston region, accommodating close to five times the number of GA operations at Logan Airport. **Figure 2-9** depicts changes in Logan Airport aircraft operations by category since 2000.

Figure 2-9 Aircraft Operations at Logan Airport by Aircraft Class, 2000-2015



Source: Massport
Notes: Jet, regional jet, and non-jet operations are associated with commercial passenger and all-cargo airlines.
General Aviation 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. In 2015, all-cargo operations at Logan Airport totaled 6,059 operations, an increase of 6.1 percent compared to the prior year. All-cargo carriers at Logan Airport include FedEx, UPS, DHL, and a few other smaller carriers.

Airline Passenger Service in 2015

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.[23] This section examines changes in airline departures and seat capacity at Logan Airport in 2015 and provides an overview of new and discontinued routes.

Service Developments at Logan Airport

In 2015, 36 airlines provided scheduled passenger service from Logan Airport to 123 non-stop destinations.[24] The major changes in Logan Airport's scheduled passenger services in 2015 are described below. The average non-stop stage length (the average length of non-stop flights) of scheduled domestic flights from Logan Airport increased from 807 miles in 2014 to 812 miles in 2015. The average non-stop stage length of scheduled international flights increased from 1,939 miles in 2014 to 2,111 miles in 2015.

Changes in Domestic Passenger Service

As shown in **Table 2-4**, the total number of scheduled domestic flights at Logan Airport in 2015 increased by 1.5 percent compared to 2014. Overall, scheduled jet operations by legacy carriers and low-cost carriers increased by 5.0 percent in 2015, while regional/commuter flights were down by 8.4 percent.

Legacy carrier jet operations increased from 109,470 operations in 2014 to 114,987 operations in 2015. This marked the second consecutive year of growth in legacy carrier jet operations at Logan Airport, following continued reductions since 2008 related to capacity cuts (due to the challenging operating environment) and airline consolidation. Growth in legacy carrier jet operations was driven by Delta Air Lines, who has expanded jet operations significantly at Logan Airport over the past two years. In 2015, Delta Air Lines increased domestic jet operations by 30.0 percent to 30,705 operations, compared to 23,614 operations in 2014. Along with the increases in jet operations, Delta Air Lines also implemented large cuts in regional jet operations, however. Overall, Delta Air Lines saw a 5.2-percent increase in domestic jet and non-jet operations combined in 2015, making it the second fastest growing carrier at Logan Airport after JetBlue Airways in terms of domestic operations.

Total domestic low-cost carrier operations grew by 5.0 percent in 2015, increasing from 105,384 operations in 2014 to 110,642 operations in 2015. Low-cost carriers accounted for 37.3 percent of Logan Airport's total scheduled domestic operations in 2015. JetBlue Airways, the dominant low-cost carrier at Logan Airport, continued to expand, increasing its domestic operations by 4.1 percent from 76,247 operations in 2014 to 79,364 operations in 2015. Ultra-low cost carrier Spirit Airlines also expanded operations at Logan Airport in 2015, increasing domestic operations by 66.2 percent from 2,945 operations to 4,896 operations.

Regional commuter flights were down by 8.4 percent in 2015 due to reductions by PenAir and Delta Air Lines, United Airlines, and US Airways' regional affiliates.

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23 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.

24 Based on OAG Schedules. There are a total of 36 airlines, counting American/US Airways as one airline following their 2013 merger.

Table 2-4 Domestic Air Passenger Operations by Airline Category, 2011-2015

Category	2011	2012	2013	2014	2015	Percent change 2014-2015	Avg. Annual Growth (2011-2015)
Scheduled Jet Carriers	207,369	203,376	211,176	214,854	225,629	5.0%	2.1%
Legacy Carriers[1]	111,761	108,374	107,162	109,470	114,987	5.0%	0.7%
Low-Cost Carriers[2]	95,608	95,002	104,014	105,384	110,642	5.0%	3.7%
Regional/ Commuter	89,586	79,790	79,922	76,682	70,274	(8.4%)	(5.9%)
Total Scheduled Domestic	**296,955**	**283,166**	**291,098**	**291,536**	**295,903**	**1.5%**	**(0.1%)**

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 2015 included JetBlue Airways, Southwest Airlines, Spirit Airlines, Virgin America, and Sun Country Airlines.

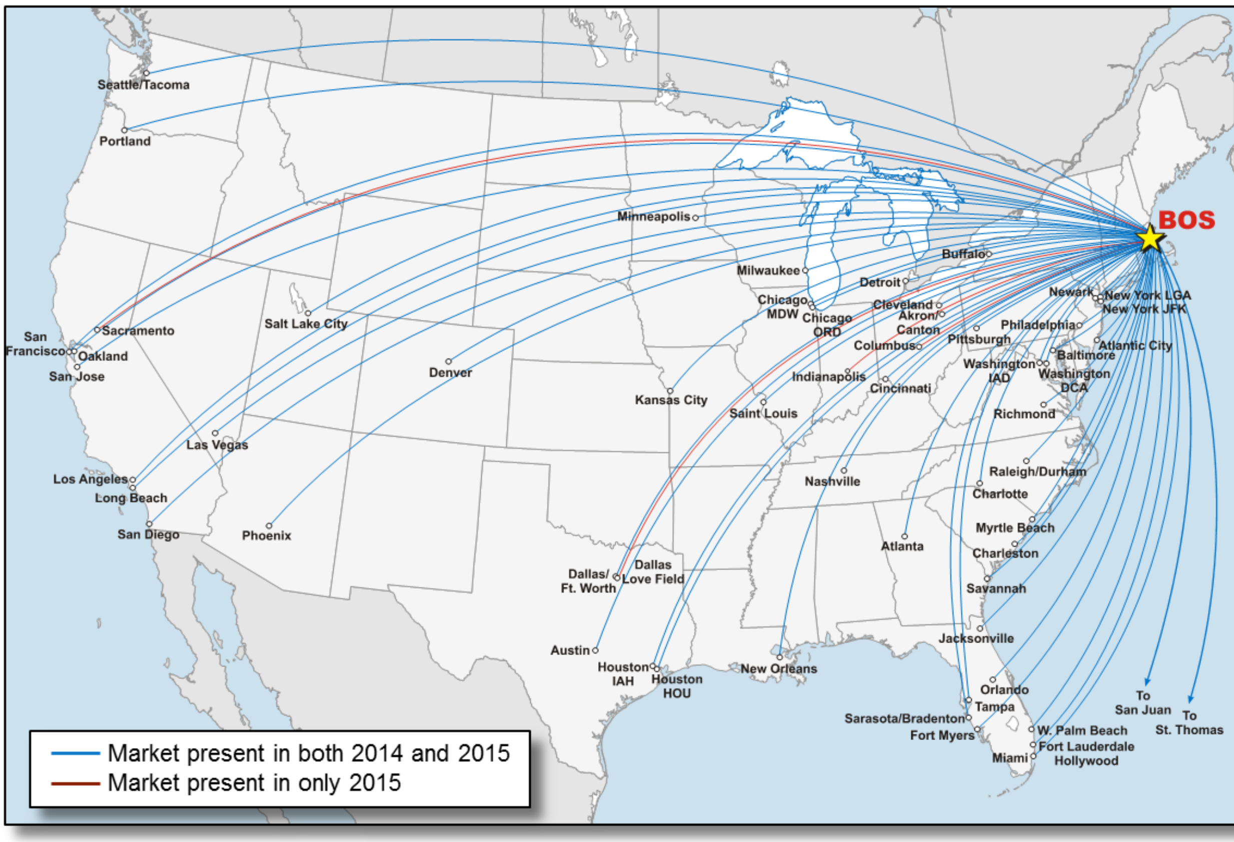
Highlights of key domestic airline service changes at Logan Airport in 2015 include:

- JetBlue Airways continued to grow operations from Logan Airport, progressing steadily. In 2015, JetBlue Airways operated up to 126 daily departures from Logan Airport. New domestic destinations introduced in 2015 included Cleveland, Sacramento, and Martha's Vineyard. JetBlue Airways also added frequencies in markets including Richmond, Detroit, Fort Myers, and West Palm Beach.
- Delta Air Lines added significant domestic seat capacity at Logan Airport in 2015, increasing frequencies in a number of strong markets while also continuing to trim less successful routes. Delta Air Lines' capacity on the Boston-New York LGA Delta Shuttle route increased by almost 30 percent in 2015, due to a switch from 76-seat Embraer E175 regional jet aircraft to 110-seat 717 mainline jet aircraft starting November 2014. Delta Air Lines added frequencies in the Atlanta, Minneapolis, Los Angeles, New York (JFK), and Detroit markets as well. Delta Air Lines also introduced new non-stop service from Logan Airport to Milwaukee in 2015.
- American Airlines reduced domestic operations at Logan Airport in 2015, as part of the ongoing operations integration process with US Airways following the American Airlines/US Airways merger in December 2013. Non-stop service to Richmond discontinued in late 2014. In 2015, American Airlines also reduced frequencies from Logan Airport to Chicago O'Hare, Dallas/Fort Worth, and Philadelphia. Overall, American Airlines reduced domestic seat capacity at Logan Airport by approximately 4 percent in 2015.
- Spirit Airlines significantly expanded its network at Logan Airport in 2015, launching several new routes. New non-stop services included year-round service to Atlanta and Las Vegas, as well as seasonal service to Cleveland and Detroit. Spirit Airlines currently operates 11 routes from Logan Airport, making Boston a new focus city for the carrier.

- Southwest introduced new non-stop services from Logan Airport to Columbus (twice daily), Indianapolis (twice daily), Dallas Love Field (once daily), and Austin (once daily) in 2015.
- In 2015, private charter airline Tradewind Aviation began operating 20 weekly scheduled shuttle services from Logan Airport to Westchester County on eight-seat turboprop aircraft.

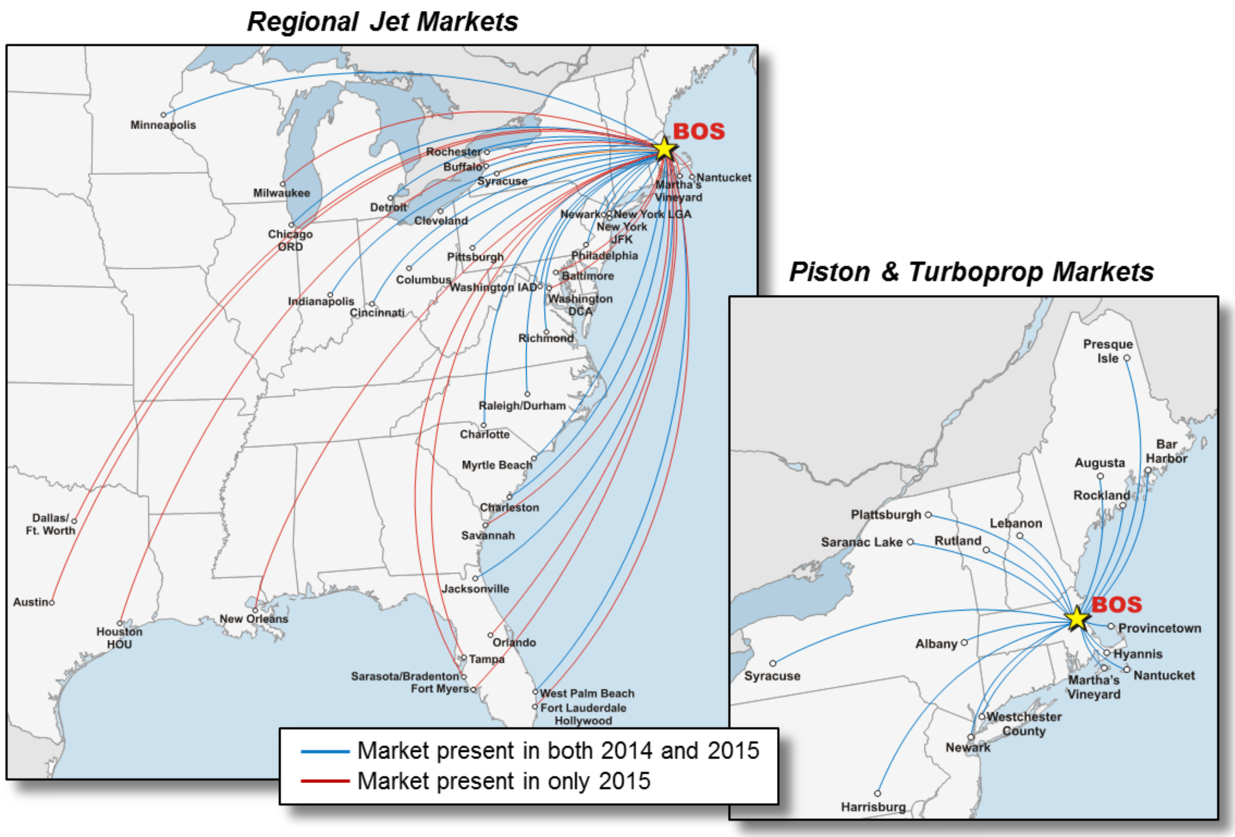
A complete listing of all changes in scheduled departures by domestic destination is in Appendix E, *Activity Levels*. Logan Airport's scheduled domestic large jet and domestic regional services in 2015 are illustrated in **Figure 2-10** and **Figure 2-11**.

Figure 2-10 Domestic Non-stop Large Jet Markets Served from Logan Airport, July 2015



Source: Official Airline Guide Market Files.

Figure 2-11 Domestic Non-stop Regional Jet and Non-Jet Markets Served from Logan Airport, July 2015



Source: Official Airline Guide Market Files.

Changes in International Passenger Service

Total scheduled international passenger operations at Logan Airport increased by 5.8 percent in 2015. There were approximately 42,099 annual international passenger operations at Logan Airport in 2015, up from 39,785 operations in 2014, 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 38 percent of total scheduled international passenger operations in 2015. This is primarily due to the high frequency service offered by Air Canada and Porter Airlines using smaller regional jet and turboprop aircraft in a number of Canadian markets. In 2015, passenger operations to Canada remained largely flat. Passenger operations to Europe, Logan Airport's second largest international market in terms of operations and largest international market in terms of passengers, increased by 4.7 percent in 2015. Operations to the Bermuda/Caribbean market increased by 2.1 percent. Passenger operations to the Middle East, Asia, and Central America increased in 2015 due to new non-stop services introduced by foreign carriers.

Table 2-5 International Passenger Operations by Market Segment, 2011-2015

Category	2011	2012	2013	2014	2015	Percent change 2014-2015	Avg. Annual Growth (2011-2015)
Canada	16,290	16,787	16,125	15,748	15,801	0.3%	(0.8%)
Europe	14,782	13,890	13,530	13,816	14,459	4.7%	(0.6%)
Bermuda/Caribbean[1]	6,054	6,752	7,031	7,428	7,584	2.1%	5.8%
Middle East	0	0	0	1,052	1,792	70.3%	N/A
Asia	0	474	646	1,011	1,751	73.2%	N/A
Central/South America	0	0	347	730	991	35.8%	N/A
Total Scheduled International	**37,126**	**37,903**	**37,679**	**39,785**	**42,378**	**6.5%**	**3.4%**

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

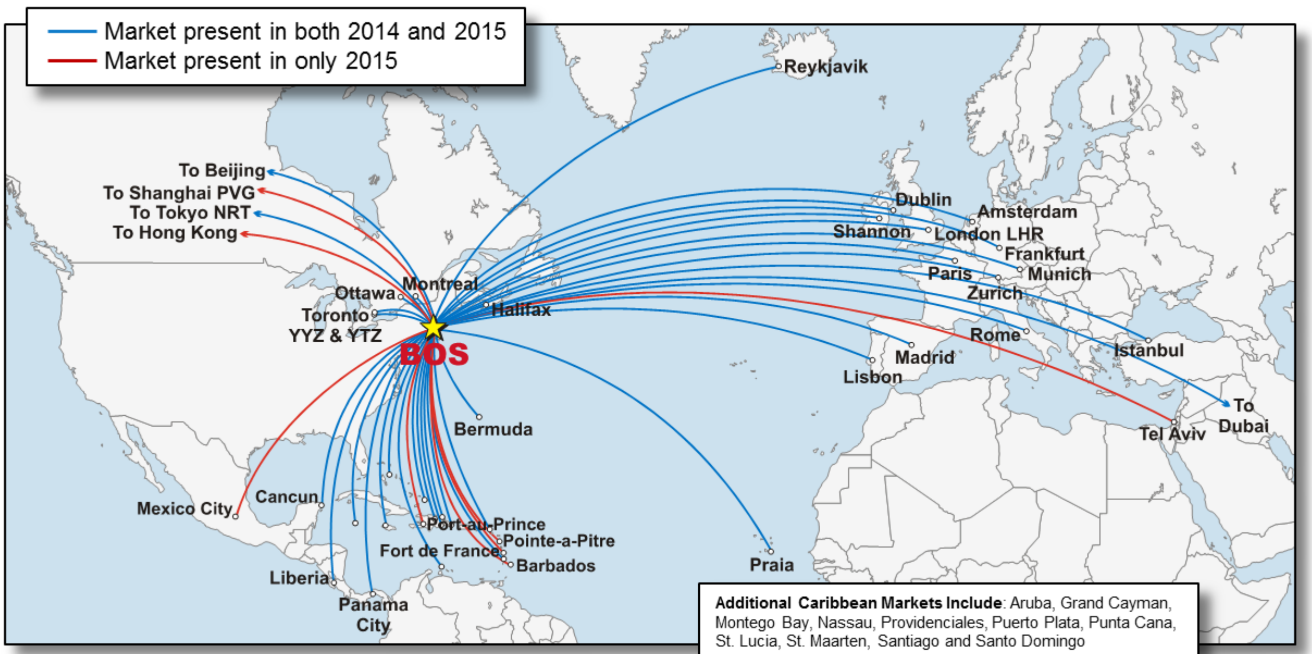
Changes in international service at Logan Airport in 2015 included a continued growth of foreign carrier service. Logan Airport has seen a rapid increase in international service in recent years, with a number of new foreign carriers entering the market. In 2014, three new foreign carriers started service at Logan Airport: Emirates, Turkish Airways, and Hainan Airlines. In 2015, Logan Airport saw the launch of service by five new foreign carriers, as well as additional service to China by Hainan Airlines. New and expanded international passenger service at Logan Airport in 2015 included the following:

- Icelandic low-cost carrier WOW Air launched service at Logan Airport in March 2015, providing five to six weekly non-stop services to Reykjavik.
- Cathay Pacific Airways launched service at Logan Airport in May 2015, providing four weekly non-stop services to Hong Kong. This represents Logan Airport's third non-stop service to Asia, after Japan Airlines introduced Tokyo Narita service in 2012 and Hainan Airlines introduced Beijing service in 2014.
- In May 2015, Hainan Airlines started three weekly non-stop services to Shanghai Pu Dong, its second non-stop service from Logan Airport. Shanghai represents Logan Airport's fourth non-stop destination in Asia, in addition to Tokyo, Beijing, and Hong Kong.
- Aeromexico also launched service at Logan Airport in June 2015, providing five to six weekly non-stop services to Mexico City.
- El Al Israel Airlines launched service at Logan Airport in July 2015, providing twice weekly non-stop service to Tel Aviv.
- In addition, European low-cost carrier Norwegian Air Shuttle launched twice weekly seasonal service to two Caribbean destinations, Pointe-a-Pitre (Guadeloupe) and Fort de France (Martinique), in December 2015.
- In 2015, JetBlue Airways continued to expand its service offerings to the Caribbean, adding new non-stop seasonal service to Barbados and Port Au Prince (Haiti).

- Delta Air Lines extended its seasonal daily non-stop service between Logan Airport and Paris Charles de Gaulle to a year-round operation, beginning in October 2015. The service is operated by Delta Air Lines in conjunction with joint venture partner Air France.[25]
- The only notable international service cutback in 2015 was the discontinuation of TACV Cabo Verde Airlines service to Praia (Cape Verde). TACV has operated year-round once to twice weekly non-stop services between Logan Airport and Praia since 2005, but adjusted the service to fly out of T. F. Green Airport (Providence, RI) instead of Logan Airport starting in 2015.

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 2015



Source: Official Airline Guide Market Files.

25 Air France already operates daily non-stop service from Logan Airport to Paris Charles de Gaulle, with twice daily service during the peak summer season.

Cargo Activity Levels in 2015

In 2015, Logan Airport ranked 20th among U.S. airports in total cargo volume.[26] 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 58.4 percent of the total non-mail cargo volume in 2015. **Table 2-6** shows all-cargo aircraft operations and cargo volumes at Logan Airport for 1990, 2000, and 2011 to 2015.

In 2015, the number of all-cargo aircraft operations at Logan Airport increased by 6.1 percent while total cargo volume, including mail, was largely flat (**Table 2-6**). Compared to 2000, all-cargo operations at Logan Airport have declined by approximately 51 percent, while total cargo volume has declined by approximately 42 percent. A number of factors are responsible for the decline 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.

Table 2-6 Cargo and Mail Operations and Volume (1990, 2000, and 2011–2015)

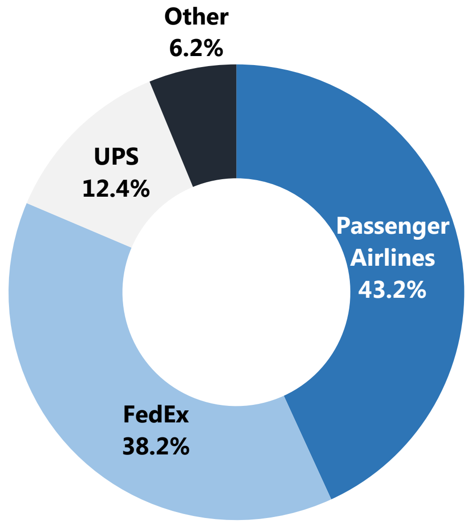
	1990	2000	2011	2012	2013	2014	2015	Percent change (2014-2015)	Avg. Annual Growth (2011-2015)
All-Cargo Aircraft Operations	n/a	12,282	6,270	5,237	5,403	5,711	6,059	6.1%	(0.9%)
Volume (lbs.)									
Express/Small Packages	n/a	484,490,143	332,896,322	327,234,464	334,315,119	356,743,626	336,013,472	(5.8%)	0.2%
Freight	n/a	367,857,011	204,055,228	204,596,956	203,877,671	228,716,329	239,768,129	4.8%	4.1%
Mail	119,818,113	194,902,513	24,566,806	21,546,316	19,407,316	22,087,150	30,556,356	38.3%	5.6%
Total	**753,253,075**	**1,047,259,667**	**561,518,356**	**553,377,736**	**557,600,528**	**607,547,105**	**606,337,957**	**(0.2%)**	**1.9%**

Source: Massport.
Note: Numbers in parentheses () indicate negative numbers.

FedEx carried 38.2 percent of the total cargo volume through Logan Airport in 2015 and was the 13th largest air carrier at the Airport in terms of total flights. UPS was the next largest cargo operator and accounted for 12.4 percent of Logan Airport's cargo volume in 2015. Passenger airlines carried 43.2 percent, or 262 million pounds, of Logan Airport's cargo as belly cargo in 2015, compared to 345 million pounds that were shipped on all-cargo carriers. These numbers are presented in **Figure 2-13**.

26 U.S. DOT, T100 Database, YE 3Q 2015. Total cargo volume includes mail.

Figure 2-13 Cargo Carriers – Share of Logan Airport Cargo Volume, 2015



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

3

Airport Planning

Introduction

This chapter describes the status of projects underway or completed at Logan Airport by the end of 2015 and provides updates for projects in progress 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 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, Massport has identified priority planning projects and initiatives to accommodate the increased demand in international 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 *2015 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.

2015 Planning Highlights and Key Findings

Recent progress on planning initiatives and individual projects at Logan Airport during 2015 are described below.

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 includes interior and exterior improvements. The project does not include any new gates, but is reconfiguring three existing gates to accommodate Group VI aircraft (including the Airbus A380 and Boeing 747-8 primarily used by international air carriers). An addition to the west side of Terminal E will allow passenger holdrooms to be reconfigured to accommodate the larger passenger loads associated with larger aircraft. The project also includes modifications to the airfield to meet required Federal Aviation Administration (FAA) safety and design standards to accommodate the larger aircraft. An Environmental Assessment (EA) was filed, and FAA issued a Finding of No Significant Impact (FONSI) on July 29, 2015. Construction is underway with a planned 2017 completion.

- **Terminal E Modernization Project.** To accommodate existing and long-range forecasted demand for international service in an efficient, environmentally sound manner that also improves customer service, Massport is planning to modernize the existing international Terminal E. Modernizing Terminal E 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. 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. Previously, a satellite FIS facility was planned and permitted in 2001 for Terminal B, but never constructed (EEA # 9791). As part of Phase 2, the Terminal E Modernization Project will construct a weather-protected direct connection between Terminal E and the Massachusetts Bay Transportation Authority (MBTA) Blue Line Airport Station, which will improve the passenger experience and convenience. As part of this project, the existing on-Airport gas station will be relocated to the Southwest Service Area. Massport filed an Environmental Notification Form (ENF) in October 2015 and a joint federal Draft Environmental Assessment/state Draft Environmental Impact Report (Draft EA/EIR) in July 2016. On September 16, 2016, the Secretary of the Executive Office of Energy and Environmental Affairs (EEA) issued a Certificate on the Draft EIR finding that the project adequately and properly complies with MEPA. (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 *2015 EDR*.) Massport filed the Final EA/EIR on September 30, 2016. On November 10, 2016, the FAA issued a FONSI and 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. The project, including the MBTA connection, is in the conceptual design phase and initial construction will likely begin in 2018. Future EDRs and Environmental Status and Planning Reports (ESPRs) will provide updates as final design and construction proceed.
- **Terminal C to E Connector.** The Terminal C to E Connector provides a new post-security connection between Terminals C and E on the Departures Level. Approximately 18,900 square feet of interior renovations were made to the existing building, with limited (approximately 3,500 square feet) new exterior construction. The connector provides passengers with a new access point to Terminal E. 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 Airline 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 (now 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.
- **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 new 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 2015.

Ground Access and Parking Projects

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. In 2010, construction began on the new RCC, and 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. In keeping with Massport's commitment to sustainability, the Authority is proud that the RCC was awarded Logan Airport's first Gold Certification in Leadership in Energy and Environmental Design (LEED®) in 2015. The status of mitigation efforts for the RCC is provided in Chapter 9, *Project Mitigation Tracking*.
- **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. Three additional new CNG buses were put into service in the summer of 2015, increasing the total from 18 to 21 buses. The new 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

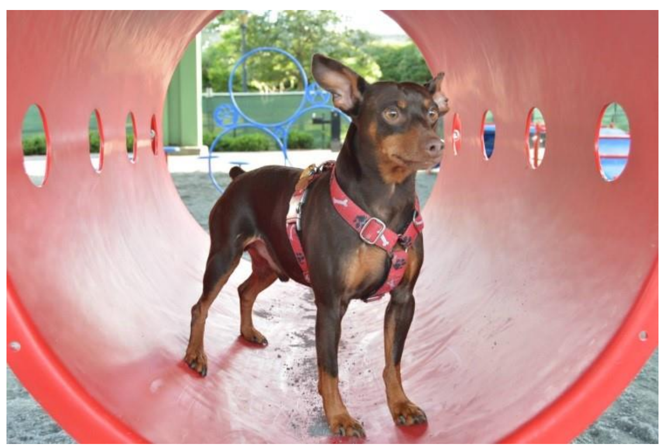
West Garage addition.
Source: Massport

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.[1] The project commenced in the spring of 2015 and was completed in late 2015.

- **Logan Airport Parking Project.** As one element of its comprehensive ground transportation strategy, Massport proposes to build up to 5,000 new 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 (see below for a detailed description). The construction of additional commercial parking spaces at Logan Airport is predicated on a regulatory change,[2] by the Massachusetts Department of Environmental Protection (MassDEP), whereby MassDEP would amend the existing Logan Airport Parking Freeze to allow for some additional commercial parking spaces at Logan Airport. MassDEP has conducted a stakeholder process, which will be followed by initiating the process to amend the Parking Freeze regulation. Massport expects to initiate a parallel process with EEA by filing an ENF for new parking facilities sometime in early 2017.

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. 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.



A dog plays at the recently completed Bremen Street Dog Park.
Source: Massport

- **Bremen Street Dog Park.** In September 2015, Massport officially opened the Bremen Street Dog Park. This recreational area allows for all types and sizes of dogs to utilize 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 Boston Harbor, through Bremen Street Park and the new East Boston Library, to Wood Island Marsh, and finally to Constitution Beach with only two roadway

1 310 Code of Massachusetts Regulations 7.30 and 40 CFR 52.1120.
2 310 Code of Massachusetts Regulations 7.30.

crossings. There are pedestrian and bike counters along the Greenway Connector. In 2015, there were 11,545 East Boston Greenway users that were recorded by the counters.

Planning Initiatives

- **Strategic Planning.** In 2013, Massport began a strategic planning effort to position the Authority's aviation, maritime, and real estate lines of business, and its administrative support structures and workforce to meet the region's 21st century transportation and economic development challenges. The strategic planning initiative's primary goal was to formulate a vision for Massport as a transportation and economic development engine for the Commonwealth of Massachusetts in the 21st century.
- **Resiliency Planning.** At the end of 2013, Massport initiated the Disaster and Infrastructure Resiliency Planning (DIRP) Study for Logan Airport, the Port of Boston, and Massport's waterfront assets in South and East Boston. 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 will make recommendations regarding short-term adaptation strategies to make Massport's facilities more resilient to the likely effects of climate change. Massport published *Flood Proofing Design Guidelines* in November 2014, with a revision in April 2015.
- **Runway Incursion Mitigation and Comprehensive Airfield Geometry Analysis.** As FAA began to close out their comprehensive nationwide runway safety area improvements program in 2015, their safety focus shifted to analysis of the airfield geometry. The new comprehensive multi-year Runway Incursion Mitigation (RIM) program will identify, prioritize, and develop strategies to help airports across the U.S. enhance airfield safety. In January 2016, Massport issued a Request for Proposals to study airfield geometry issues at Logan Airport. Future EDRs and ESPRs will provide updates on this initiative and those efforts are likely to require permitting under state or federal regulations.
- **Logan Airport Sustainability Management Plan (SMP).** In 2013, Massport was awarded a grant by the 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 broad view of sustainability including economic vitality, operational efficiency, natural resource conservation, and social responsibility considerations, and is intended to promote and integrate sustainability Airport-wide, and to coordinate on-going sustainability efforts across the Authority. A copy of the SMP Highlights Report can be found at https://www.massport.com/environment/sustainability-management-plan.
    - **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 2015 SMP. The first Annual Sustainability Report was published in April 2016. A copy of the Annual Sustainability Report can be found at https://www.massport.com/environment/sustainability-management-plan.

Table 3-1 provides a summary of the status of each planning concept, as of December 31, 2015. Descriptions are provided in subsequent sections of this chapter.

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

		Completion				Completion	
	Status as of Dec. 31, 2015	Short-Term 2018	Long-Term 2030		Status as of Dec. 31, 2015	Short-Term 2018	Long-Term 2030
Terminal Area Projects/ Planning Concepts				**Buffer Projects/ Open Space (continued)**			
				Bayswater Embankment	C		
Terminal E Renovations and Enhancements	U	✈		Bremen Street Park	C		
Terminal E Modernization	R		✈	Bremen Street Dog Park	C		
Terminal B Renovations	C			Greenway Connector	C		
Terminal B Airline Optimization Project	E	✈		Narrow Gauge Connector	U	✈	
Terminal C to E Connector	U	✈		**Airport Parking Projects/ Planning Concepts**			
Terminal A to B Connector	U		✈	West Garage Parking Consolidation	C		
Terminal B to C Connector	E		✈	Logan Airport Parking Project	E	✈	
Terminal C Roadway Enhancements	E		✈	**Airside Area Projects/ Planning Concepts**			
Service Area Projects/ Planning Concepts				Runways 22R and 33L Runway Safety Area Improvements	C		
SWSA Program (Rental Car Center)	C			Runway 33L Light Pier Replacement	C		
Relocated CNG Station in the NCA	E		✈	Runway 4R Light Pier Replacement	E	✈	
Replacement Cargo Facilities in the NCA	E		✈	Governors Island Aircraft Parking	H		✈
Replacement Hangar	E		✈	Runway 15L-33R RSA Project	C		
Central Commissary	E		✈	Runway Incursion Mitigation (RIM) Study	E		✈
New/Replacement GSE Consolidated Facility in the NCA	E		✈	Airside Improvements Planning Project	C		
Joint Operations Center (JOC)	E		✈	Taxiway N Realignment/other taxiway improvements	E	✈	
Buffer Projects/ Open Space				**Airport-Wide Projects/ Planning Concepts**			
SWSA Buffer (Phases 1 and 2)	C			Massport Strategic Plan	C		
Neptune Road Airport Edge Buffer	C			Resiliency Planning	C		
Navy Fuel Pier	C			Logan Sustainability Management Plan	C		
Saratoga Street Sidewalk Lighting Enhancements	C						

Notes: Anticipated completion dates and status as of December 31, 2015 as denoted by ✈. Short-term projects are anticipated to be completed by 2018 and long-term projects are anticipated to be completed by 2030. Details of each project or planning concept are provided in the sections that follow.

C – Completed prior to or during 2015.
D – Project in design, or awaiting funding
E – Planning concepts undergoing evaluation and/or feasibility analysis
H – Project or planning concept on hold
X – Project cancelled
U – Project under construction
R – Project undergoing MEPA, NEPA/FAA, or other review

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**.

Terminal E Renovation and Enhancements Project under construction (left, top right). Completed project section (bottom right).
Source: Massport

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

Notes: See Table 3-2 for a description of the numbered projects. Status as of December 31, 2015.

1. Terminal E Renovation and Enhancements
2. Terminal E Modernization
3. Renovations and Improvements at Terminal B
4. Terminal B Airline Optimization
5. Terminal C to E Connector
6. Terminal A to B Connector
7. Terminal B to C Connector
8. Terminal C Roadway Enhancements
9a. Logan Airport Parking Project - Economy Garage Concept
9b. Logan Airport Parking Project - Terminal E Surface Lot Concept

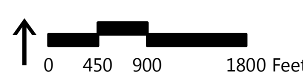


Table 3-2 Description and Status of Projects/Planning Concepts in the Terminal Area (December 31, 2015)

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). An approximately 94,000-square-foot addition to the west side of Terminal E will allow passenger holdrooms to be reconfigured to accommodate the passenger loads associated with larger aircraft. Additionally, interior renovations throughout the terminal are planned to enhance overall passenger service. The project also includes airfield improvements to allow safe and efficient operations of these aircraft. These improvements include modifications to the airfield to meet required Federal Aviation Administration (FAA) safety and design standards. Other airfield modifications include stabilizing select runway shoulders and taxiway turning areas (fillets).	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 will help 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 2015 and the FAA issued a Finding of No Significant Impact (FONSI) on July 29, 2015. Construction is underway and will be complete in 2017.
2. Terminal E Modernization Project (incorporates former West Concourse Project) To accommodate existing and long-range forecasted demand for international service in an efficient, environmentally sound manner that also improves customer service, Massport is planning to modernize the existing international Terminal E. Modernizing Terminal E 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. 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. Previously, a satellite FIS facility was planned and permitted in 2001 for Terminal B, but never constructed (EEA # 9791). As part of Phase 2, the Terminal E Modernization Project will also construct a weather-protected direct connection between Terminal E and the Massachusetts Bay Transportation Authority (MBTA) Blue Line Airport Station, which will improve the passenger experience and convenience. As part of this project, the existing on-Airport gas station will be relocated to the Southwest Service Area.	The project, including the MBTA connection, is in the conceptual design phase. An ENF was filed with the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) in October 2015. A joint federal Environmental Assessment/state Draft Environmental Impact Report (Draft EA/EIR) was filed in July 2016 to comply with the FAA's review under NEPA as well as MEPA. On September 16, 2016, the Secretary of EEA issued a Certificate on the Draft EIR finding that the project adequately and properly complies with MEPA. (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 *2015 EDR*.) Massport filed the Final EA/EIR on September 30, 2016. On November 10, 2016, the FAA issued a FONSI and 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 Terminal E Modernization Project. Following permitting and design, the initial construction is scheduled to begin in 2018. Future EDRs and ESPRs will provide updates as final design and construction proceeds.

Table 3-2 Description and Status of Projects/Planning Concepts in the Terminal Area (December 31, 2015) (Continued)

Description	Status
Massport Projects/Planning Concepts	
3. Renovations and Improvements at Terminal B	
In response to a number of airline consolidations and realignments, Massport has initiated analysis of terminal changes to better accommodate these ongoing airline partnership changes and facilitate broader flexibility in terminal utilization. This includes renovation of existing spaces, connection of the Terminal B Piers, construction of some new spaces, and reconfiguration of eight aircraft gates to better facilitate passenger processing.	Following issuance of a FONSI by the FAA, construction of the Terminal B renovations and improvements commenced in 2012 and were completed in 2014. Approximately 79,000 square feet of existing space was renovated and approximately 84,000 square feet of new space was added. Eight existing aircraft loading gates were reconfigured.
4. Terminal B Airline 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 (now 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.	Planning concepts for the project are currently undergoing evaluation.
5. Terminal C to E Connector	
Massport is connecting Terminals C and E to provide a greater post-security connectivity between terminals and to improve flexibility for airlines. 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 under construction in 2015. Construction was completed in May 2016.
6. Terminal A to B Connector	
As part of an Airport-wide effort to enhance terminal connectivity post-security, a connector between Terminals A and B is under consideration.	The airside connector from Terminals A to B is still being considered, but this project is not currently in the five-year Capital Program. Completion would not occur until after 2018. A landside connection between Terminals A and B was completed in February 2016.
7. Terminal B to C Connector	
Also part of the Airport-wide effort to enhance terminal connectivity post-security, a connector between Terminals B and C is under consideration.	The connector from Terminals B to C is still being considered but this project is not currently in the five-year Capital Program. Completion would not occur until after 2018.

Table 3-2 Description and Status of Projects/Planning Concepts in the Terminal Area (December 31, 2015) (Continued)

Description	Status
Massport Projects/Planning Concepts	
8. Terminal C Roadway Enhancements	
Massport is currently evaluating options to modify the layout of Terminal C on both the arrival and departure levels to alleviate congestion and better manage peak hour traffic operations.	This project is in the conceptual alternatives evaluation phase.
9. Logan Airport Parking Project	
As one element of its comprehensive transportation strategy, Massport proposes to build up to 5,000 new on-Airport commercial parking spaces at Logan Airport. 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. These drop-off/pick-up trips generate up to four vehicle trips per air passenger, compared to two trips for those who drive and park. 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. 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. For additional information on these efforts please see Chapter 5, *Ground Access to and from Logan Airport*. The construction of additional commercial parking spaces at Logan Airport is predicated on a regulatory change, to be adopted by the Massachusetts Department of Environmental Protection (MassDEP), whereby MassDEP would amend the Logan Airport Parking Freeze to allow for some additional commercial parking spaces at Logan Airport. Massport has identified two potential sites for the new parking, Economy Garage (shown as 9a in **Figure 3-1**) and Terminal E Surface Lot (shown as 9b in **Figure 3-1**).	Massport has proposed that MassDEP amend the Logan Airport Parking Freeze by increasing the commercial parking freeze limit by 5,000 spaces. MassDEP has conducted stakeholder process, which will be followed by initiating the public process to amend the Parking Freeze regulation. MassDEP is expected to release a draft regulation change for public comment in early 2017. Massport expects to initiate a parallel process with EEA by filing an ENF for new parking facilities sometime in early 2017.

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

1 Previously, a Satellite FIS Facility was planned and permitted in 2001 for Terminal B but never constructed.

Service Area Projects/Planning Concepts

Logan Airport's service areas contain airline support businesses and operations. Land uses in the service areas continually 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, the Jet Fuel Storage Facility to the north, and the airside apron area 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 NCA is the likely location for terminal gates, aircraft parking, hangars, and cargo. In the interim, portions of the NCA will continue to be used for economy parking.
- **North Service Area (NSA)** is north of the NCA near the MBTA's Wood Island Station and Runway End 15R. The NSA includes two flight kitchens, weather and navigation equipment, the temporary bus/limousine pool, Neptune Road Airport edge buffer, and the Green Bus Depot. Massport recently completed the Greenway Connector running parallel to the MBTA Blue Line corridor in this section of the Airport.
- **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 taxi and bus/limousine pools. The RCC reduces Airport VMT as well as improves roadway and intersection operations through: consolidating 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 would be eliminated); improving intersection and roadway infrastructure, including signal coordination and dedicated ramp connections; and creating a Ground Transportation Operations Center (GTOC) enabling efficient planning and operation of Airport-wide transit activities. The entire SWSA was redeveloped to accommodate the new RCC and associated facilities. The taxi pool was temporarily relocated to Lot B, which is on Harborside Drive between the Logan Office Center Garage and the Hyatt Hotel. These functions returned to the SWSA in 2015.
- **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 Boston Harbor and on the east and north by Logan Airport's airside area. The SCA, which provides landside access and secured airside access, is Logan Airport's primary cargo area. It also 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.

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. These planning concepts are also detailed in **Table 3-3**. 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 | **2015 Environmental Data Report**

Service Areas

0 450 900 1800 Feet

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

2015 Environmental Data Report

Notes: See Table 3-3 for a description of the numbered projects. Status as of December 31, 2015.

1. SWSA Redevelopment Program (complete)

Locations To Be Determined

2. Relocated CNG Station in the NCA
3. Replacement Cargo Facilities in the NCA
4. Replacement Hangar
5. Central Commisary
6. New/Replacement GSE Facility in the NCA
7. Joint Operations Center

Table 3-3 Description and Status of Projects/Planning Concepts in the Service Areas (December 31, 2015)

Description	Status
Massport Projects/Planning Concepts	
1. Southwest Service Area (SWSA) Redevelopment Program The SWSA Redevelopment Program consolidated on-Airport and most off-Airport rental car operations and facilities into one integrated facility (Rental Car Center [RCC]) to better serve tenants and the traveling public, reduce ground transportation and air quality impacts on-Airport and in the surrounding neighborhoods, and reduce associated off-Airport impacts. The program also accommodates a portion of off-Airport rental car operations. Redevelopment of the SWSA was needed because the existing SWSA and rental car facilities were inefficient and inadequate in meeting future needs at the Airport. The SWSA Redevelopment Program replaced and upgraded existing ground transportation uses within the SWSA. The redevelopment included a consolidated car rental facility 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 includes a customer service center and four quick turn-around maintenance and service facilities. Leadership in Energy and Environmental Design® (LEED) Gold certification was awarded in 2015. RCC construction was preceded by numerous enabling activities that reorganized the SWSA through multiple sub-phases allowing for enough of the site to be cleared for staging and construction. Some of these enabling projects included reorganization of rental car operations within the SWSA. Others included 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). The project also included the demolition of the existing flight kitchen to allow the extension of Hotel Drive.	A Final Environmental Impact Report/Environmental Assessment (FEIR/EA) was prepared in accordance with the Secretary of Energy and Environmental Affairs' Certificate on the Notice of Project Change (NPC). The FEIR/EA was filed on March 1, 2010. An extended comment period closed on May 24, 2010. The Secretary's Certificate finding that the FEIR adequately and properly complies with the Massachusetts Environmental Policy Act (MEPA) was issued on May 28, 2010. The Federal Aviation Administration issued a Finding of No Significant Impact (FONSI) on March 1, 2010. This project was completed in late 2014 and attained LEED Gold status in 2015.
Phase 2 of the SWSA Buffer (EEA #14137) (see **Table 3-5**) was integrated with the proposed SWSA Redevelopment Program.	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, 2015) (Continued)

Description	Status
Massport Projects/Planning Concepts	
1. Southwest Service Area (SWSA) Redevelopment Program (Continued) **Ground Transportation Operations Center (GTOC)** The new GTOC within the RCC facility functions as the hub for management of ground transportation at the Airport. GTOC staff will assume direct responsibility for: ■ 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 including 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, the status of curbside Dynamic Message Signs, emergency alerts, and other information.	Construction of the GTOC was completed in 2013 as part of the RCC project.
2. 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 several potential on-Airport parcels for relocation of the existing CNG station. Relocation is not expected to occur before 2018.
3. Replacement Cargo Facilities in the NCA (location to be determined) Construction of new cargo facilities in the NCA would compensate for the loss of cargo facilities that resulted from 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 2018. Hangar upgrades for Buildings 8 and 9 are complete.
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 that could accommodate Group V aircraft. The location of the replacement hangar is still under consideration.	Demolition of the former American Airlines hangar commenced in 2014, and was completed in August 2015. Prior to demolition, American Airlines relocated to the refurbished Northwest Hangar.

Table 3-3 Description and Status of Projects/Planning Concepts in the Service Areas (December 31, 2015) (Continued)

Description	Status
Tenant Projects/Planning Concepts	
5. Centralized Commissary (location to be determined) Massport is planning for a centralized Commissary that will streamline 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. A location for the Commissary has not yet been determined.	Construction of the Commissary would be complete after 2018.
6. New/Replacement 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 2018.
7. Joint Operations Center (JOC) (location to be determined) The JOC is envisioned as a state-of-the-art enterprise wide-operations and situational awareness center that consolidates Massport's complex and dispersed operations into a unified management center with a Common Operational Picture (COP). 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 Airport monitoring), TSA staff, and camera monitoring within the structure of one common facility.	Massport is in the pre-design and planning phase of development of a common command and control JOC.

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 (shown on **Figure 3-4**) and planning concepts under consideration for Logan Airport's airside area as of December 31, 2015.

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

2015 Environmental Data Report

Notes: See Table 3-4 for a description of the numbered projects. Status as of December 31, 2015.

1. Runway 22R and 33L RSA Improvements
2. Runway 33L Light Pier Replacement
3. Runway 4R Light Pier Replacement
4. Governors Island Aircraft Parking
5. Runway 15L-33R RSA Improvement

6a. Straightening and Realignment of Taxiway N

Airport-wide

6b. FAA Landing Procedure

7. Runway Incursion Mitigation (RIM) Program

Table 3-4 Description and Status of Projects/Planning Concepts on the Airside (December 31, 2015)

Description	Status
1. Runway 22R and 33L Runway Safety Area (RSA) Improvements	
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 RSAs at all locations. At Logan Airport, the FAA standard RSA is typically 500 feet wide by 1,000 feet long at each runway end. Where this space is not available, the 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.	Massport filed an Environmental Notification Form (ENF) with the Massachusetts Environmental Policy Act (MEPA) office on June 30, 2009, that described the proposed RSA enhancements at both runway ends. A Draft EA/EIR was filed on July 15, 2010. A Final EA/EIR was filed January 31, 2011, and the Secretary's Certificate was issued March 18, 2011. Remaining environmental permits were secured 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.
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.	Mitigation measures for eelgrass and salt marsh impacts are implemented. See Chapter 9, *Project Mitigation Tracking* for more information.
2. Runway 33L Light Pier Replacement.	
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 a Notice of Project Change NPC) to the RSA project in January 2012. The Secretary's Certificate was issued March 9, 2012. All local, state, and federal permits were secured 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 33L Light Pier replacement and FAA testing of new ILS equipment.
3. Runway 4R Light Pier Replacement.	
Massport plans to replace the aging Runway 4R approach light pier. This will likely be a replacement of the existing wooden light pier with concrete pier/pilings.	A design consultant was recently selected and initial environmental and geotechnical investigations are underway. Following environmental permitting and design, construction could begin in 2017.

Table 3-4 Description and Status of Projects/Planning Concepts on the Airside (December 31, 2015) (Continued)

Description	Status
4. Governors Island Aircraft Parking Massport has considered providing additional aircraft parking at Governors Island for the following: Remain overnight (RON) aircraft, cargo aircraft, and international aircraft. RON aircraft are generally commercial passenger aircraft that fly into the Airport at night and fly out in the morning. Airlines sometimes schedule and position more aircraft than there are gate positions, therefore remote aircraft parking positions are required. Remote aircraft parking is appropriate for cargo aircraft that generally arrive in the morning and remain on the ground until their late evening departure. Some international scheduled and charter aircraft that have long turnaround times should be parked remotely when there is a high demand for gates.	The site is potentially being considered for the development of 20 to 50 aircraft positions and ancillary uses in the future. If the concept is deemed feasible and planning continues, it is anticipated that construction would not occur until after 2018.
5. Runway 15L-33R RSA Improvement As part of an ongoing program to improve safety at Logan Airport, and in close coordination with the 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.
6. Logan Airside Improvements Planning Project The project included construction of a new unidirectional Runway 14-32, Centerfield Taxiway, extension of Taxiway D, realignment of Taxiway N, improvements to the southwest corner taxiway system, relocation of cargo buildings, and reduction in approach minimums on Runways 22L, 27, 15R, and 33L. These airfield improvements were to reduce current and projected levels of aircraft delay and enhance airfield safety at Logan Airport. The new unidirectional Runway 14-32, Centerfield Taxiway, extension of Taxiway D, improvements to the southwest corner taxiway system, and relocation of cargo buildings are all complete. The remaining components of this project and status are presented below.	As part of its Record of Decision (ROD) for the Airside Improvements Planning Project under the National Environmental Policy Act (NEPA), the FAA initially deferred its decision on Centerfield Taxiway (Taxiway M) pending an operational review to identify any other potential beneficial actions. The FAA directed the technical work on the operational review and conducted briefings with a citizen panel. The FAA divided the study into two phases. Phase 1 focused on current conditions and Taxiway N, and Phase 2 included operations with both Taxiway N and the Centerfield Taxiway. Both of these phases were completed and the public comment period on the project ended in September 2007. The FAA approved the Centerfield Taxiway in April 2007. Construction of the Centerfield Taxiway began in spring 2008 and was completed in August 2009. The Centerfield Taxiway is being used as intended by the Environmental Impact Statement (EIS) for taxiing for long-haul domestic and international flights using Runway 22L and to improve flow on the airfield and reduce taxiway congestion. Massport paved the taxiway with warm mix asphalt, which reduces energy consumption and has air quality benefits.
6a. Straightening and realigning Taxiway N. Other taxiway modifications are under consideration.	This project component is anticipated to be complete after 2018.

Table 3-4 Description and Status of Projects/Planning Concepts on the Airside (December 31, 2015) (Continued)

Description	Status
6b. Reduction in approach minimums on Runways 22L, 27, 15R, and 33L by FAA. (Operational change)	Reduction in approach minimums on Runways 15R and 33L was approved in the Airside EIS/EIR. Implementation will be affected by realignment of the ILS localizer. Construction impacts from relocating the ILS localizer were addressed as part of the proposed enhancements to the RSA at the end of Runway 33L (see above). The new Runway 33L RSA deck accommodated the relocation of the localizer. Additional navigational upgrades were installed as part of the Runway 33L Light Pier Replacement Project in 2012. Runway 33L began operating as a Category III ILS in March 2013.
7. Runway Incursion Mitigation and Comprehensive Airfield Geometry Analysis (RIM) Study FAA recently initiated a new, 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 the FAA to identify areas that need to be addressed and plan for the implementation of measures. Massport issued a Request for Proposals in December 2015 and a consultant was selected in 2016. Work is underway and an update will be provided in the *2016 ESPR*.

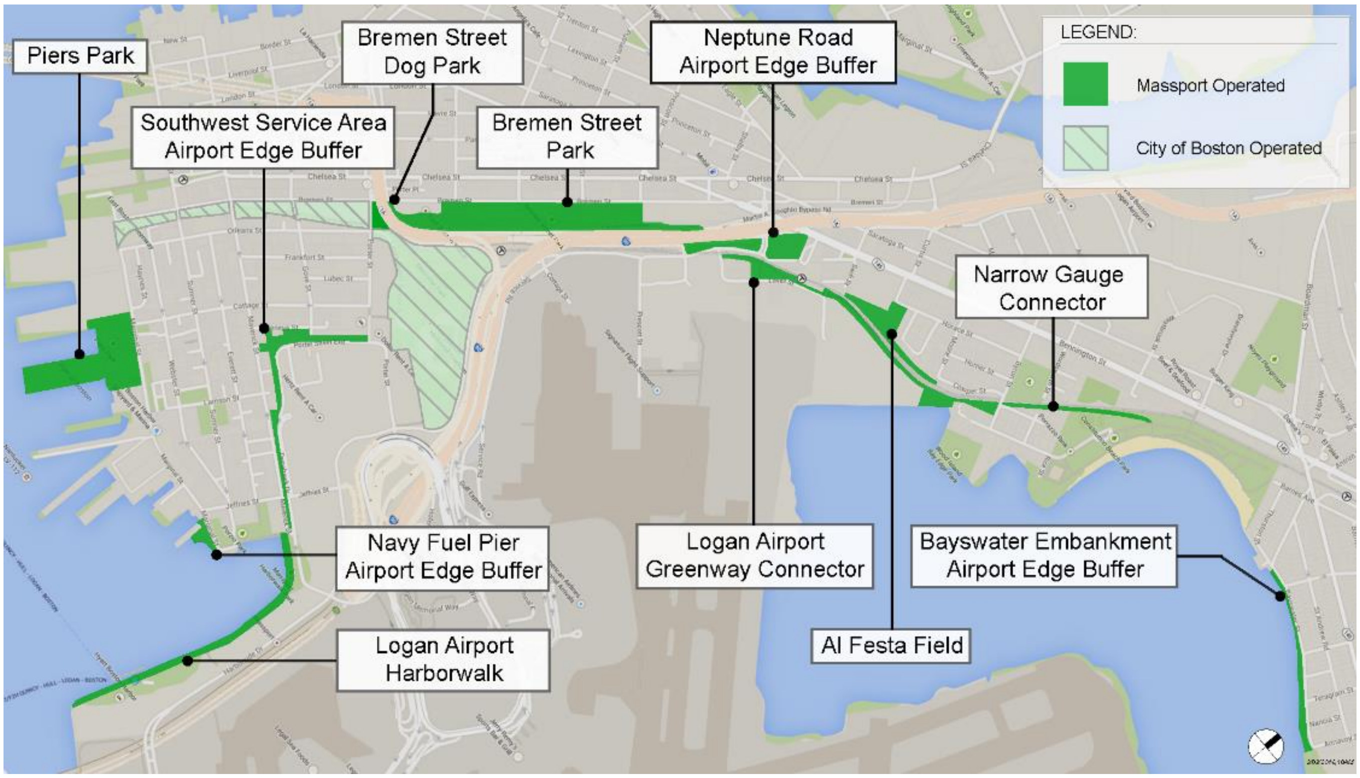
Notes: See **Figure 3-4** for the location of airside projects/planning concepts.
1 Information on the FAA's RIM program can be found at https://www.faa.gov/airports/special_programs/rim/.

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 2015. 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.

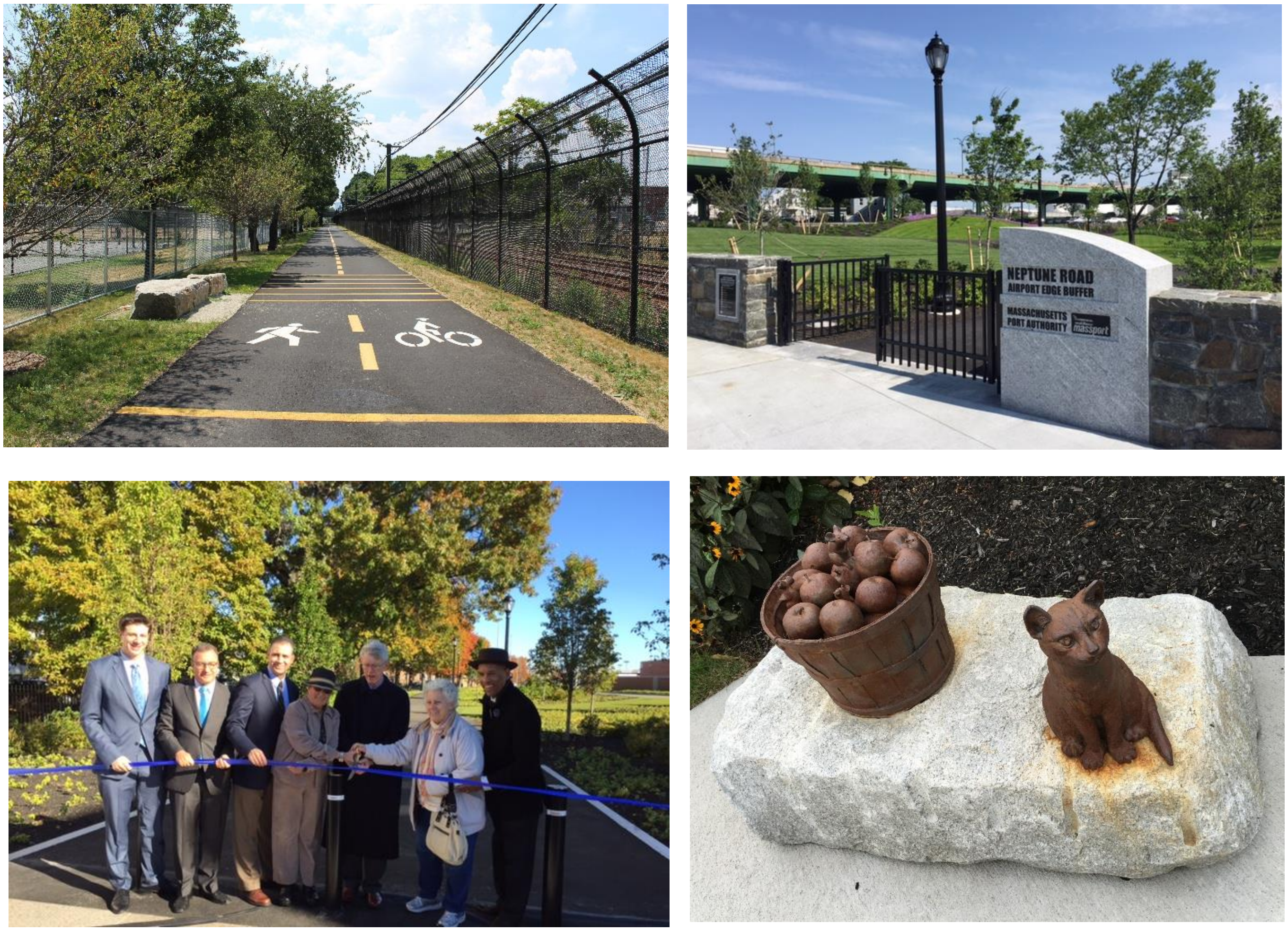
Most recently, Massport officially opened the Bremen Street Dog Park in September 2015. The dog park provides 22,655 square feet of play space for neighborhood dogs and is the first of its kind in East Boston. The park provides amenities such as exercise equipment for dogs, pet waste stations, and water 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 1/2-mile Greenway Connector connects the pedestrian/bicycle path to the City of Boston/Narrow Gauge Connector to Constitution Beach. In 2015, construction on the Narrow Gauge Connector was underway by the City of Boston. The Narrow Gauge Connector is a 1/3-mile multiuse 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 this park when it was completed in 2016. There are pedestrian and bike counters along the Greenway Connector. In 2015, there were 11,545 East Boston Greenway users that were recorded by the counters.

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 2015. **Figure 3-6** shows the location of these buffer projects.



Narrow Gauge Connector (top left), Southwest Service Area Buffer ribbon cutting (bottom left), and Neptune Road Airport Edge Buffer (top and bottom right)
Source: Massport

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

2015 Environmental Data Report

Notes: See Table 3-5 for a description of the numbered projects. Status as of December 31, 2015.

1. SWSA Buffer
2. Neptune Road Airport Edge Buffer
3. Navy Fuel Pier Buffer
4. Bayswater Embankment
5. Bremen Street Park
6. Bremen Street Dog Park
7. The Greenway Connector
8. Narrow Gauge Connector

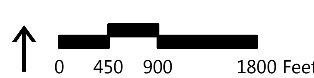


Table 3-5 Description and Status of Airport Edge Buffer Projects/Open Space (December 31, 2015)

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 of this project involved additional landscaping and solid barriers. 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 2015.
3. Navy Fuel Pier Buffer The Navy Fuel Pier Buffer project began with the Army Corps of Engineers' remediation of the former Navy Fuel Pier, which was completed in 2001. The project involved beautification of the property (0.7 acres) 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 buffer was completed in 2007.

Table 3-5 Description and Status of Airport Edge Buffer Projects/Open Space (December 31, 2015) (Continued)

Description	Status
4. Bayswater Embankment This project involved creation of a landscaped buffer between Bayswater Street and Boston Harbor.	Construction of this Airport edge buffer was completed in 2003.
5. Bremen Street Park The 18-acre Bremen Street Park was constructed by the Central Artery/Tunnel (CA/T) Project as East Boston's second largest neighborhood park. The park contains a variety of facilities, a direct pedestrian connection to 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.	Final construction of the park was completed in 2008. Massport continues to operate the park and provide community facilities.
6. Bremen Street Dog Park This recreational area allows for all types and sizes of dogs to utilize the 22,655 square-foot space located on the corner of Bremen and Porter Streets in East Boston.	The Dog Park was opened in September 2015.
7. The Greenway Connector The one-half mile pedestrian/bicycle path connects the Bremen Street Park pedestrian/bicycle path to the City of Boston/Narrow Gauge Connector to Constitution Beach. Together the Greenway and Narrow Gauge Connectors provide a continuous pedestrian/bicycle path from Piers Park to Constitution Beach 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.
8. Narrow Gauge Connector The Narrow Gauge Connector is a 1/3-mile multiuse path and extension of the East Boston Greenway network being constructed by the City of Boston. Now completed, this portion of the East Boston Greenway will allow people to continuously walk from Piers Park to Constitution Beach.	Construction of this project was ongoing in 2015 and the park was opened in May 2016. The City of Boston completed final plantings in the Spring of 2016 and turned the project over to Massport in Spring of 2016 for ownership, maintenance, and security.

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

Airport Parking Projects/Planning Concepts

The total number of employee and commercial parking spaces permitted at Logan Airport is limited by the Logan Airport Parking Freeze under the State Implementation Plan (SIP) and the 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* contains additional information on past and current existing supply of parking at Logan Airport.

As one element of its comprehensive transportation strategy, Massport proposes to build up to 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,[3] has periodically had the unintended consequence of causing an increase in environmentally harmful drop-off/pick-up vehicle trips. These drop-off/pick-up trips generate up to four vehicle trips per air passenger, compared to two trips for those who drive and park. 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. While the intent of the Parking Freeze has been to shift air passengers to 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 over HOV modes that generate a higher level of VMT and associated air emissions (**Figure 3-7**).

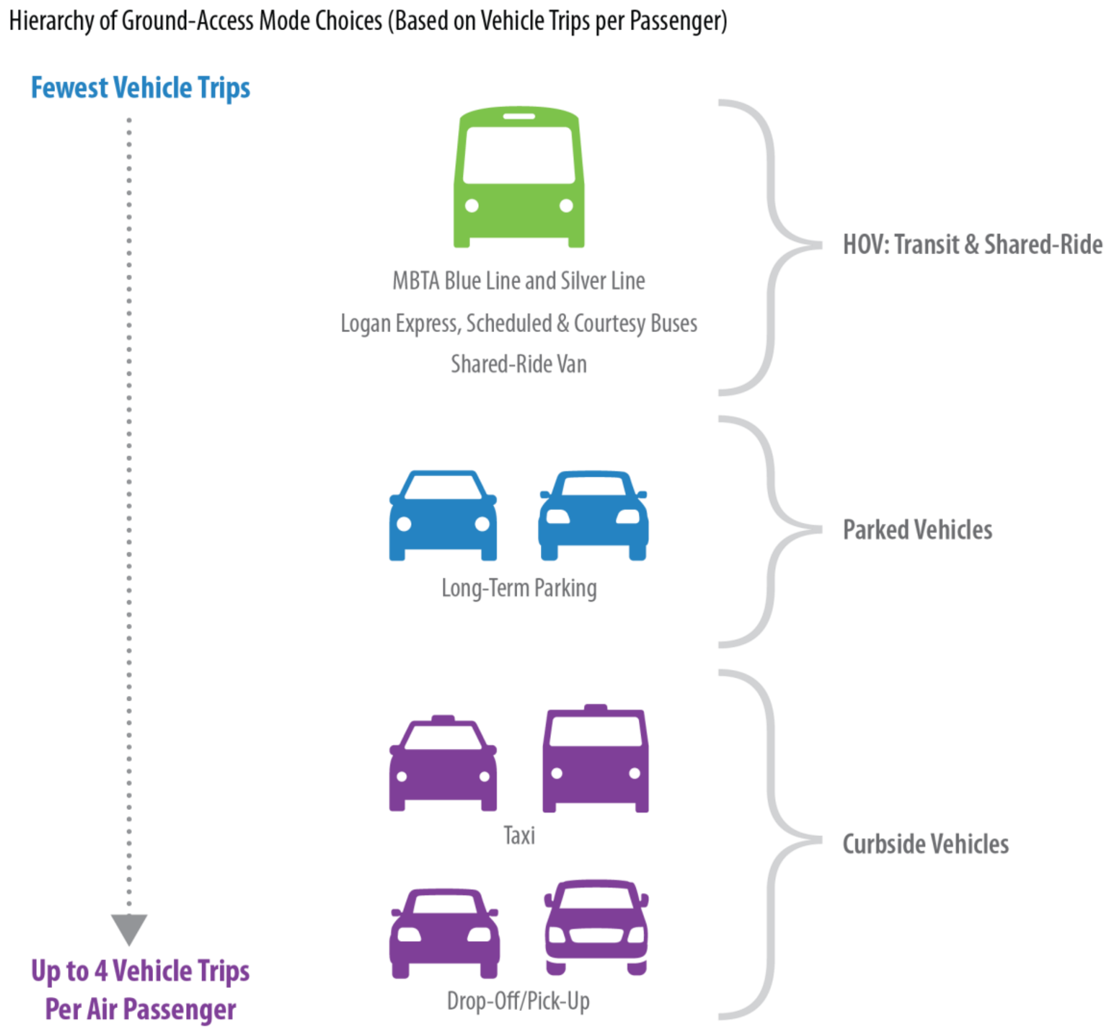
In addition to the Logan Airport Parking Project, Massport is committed to a comprehensive transportation strategy, which includes continued operational and capital commitment to the Logan Express services and the Silver Line 1 service, as well as continued partnership and marketing of private bus carriers. For additional information on these efforts, please see Chapter 5, *Ground Access to and from Logan Airport*.

The construction of additional commercial parking spaces at Logan Airport is predicated on a regulatory change,[4] to be adopted by MassDEP, whereby MassDEP would amend the existing Logan Airport Parking Freeze to allow for some additional commercial parking spaces at Logan Airport. MassDEP has conducted a stakeholder process, which will be followed by initiating the process to amend the Parking Freeze regulation. Massport expects to initiate a parallel process with EEA by filing an ENF for new parking facilities sometime in early 2017. Information provided in the ENF is intended to help inform commenters on the proposed MassDEP regulatory amendment 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.

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

3 310 Code of Massachusetts Regulations 7.30 and 40 Code of Federal Regulations 52.1120.
4 310 Code of Massachusetts Regulations 7.30.

Figure 3-7 Ground-Access Mode Choice Hierarchy



Note: Short-term parking is included under "drop-off/pick-up"

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

2015 Environmental Data Report

Notes: See Table 3-6 for a description of the numbered projects. Status as of December 31, 2015.

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

0 450 900 1800 Feet

Table 3-6 Description and Status of Airport Parking Projects/Planning Concepts (December 31, 2015)

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. These spaces constitute all remaining spaces under the Logan Airport Parking Freeze. The West Garage addition is atop the existing Hilton Hotel parking lot. 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 MEPA review was required for the consolidation of existing on-Airport parking spaces. The consolidation project was completed in late 2015.
2. Logan Airport Parking Project	
As one element of its comprehensive transportation strategy, Massport proposes to build up to 5,000 new on-Airport commercial parking spaces at Logan Airport. 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. These drop-off/pick-up trips generate up to four vehicle trips per air passenger, compared to two trips for those who drive and park. 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. 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. For additional information on these efforts please see Chapter 5, *Ground Access to and from Logan Airport.* The construction of additional commercial parking spaces at Logan Airport is predicated on a regulatory change, to be adopted by the Massachusetts Department of Environmental Protection (MassDEP), whereby MassDEP would amend the Logan Airport Parking Freeze to allow for some additional commercial parking spaces at Logan Airport. 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**).	Massport has proposed that MassDEP amend the Logan Airport Parking Freeze by increasing the commercial parking freeze limit by 5,000 spaces. MassDEP has conducted stakeholder process, which will be followed by initiating the public process to amend the Parking Freeze regulation. MassDEP is expected to release a draft regulation change for public comment in early 2017. Massport expects to initiate a parallel process with EEA by filing an ENF for new parking facilities sometime in early 2017.

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.

Strategic Plan

In 2013, Massport began a strategic planning effort to position the Authority's aviation, maritime, and real estate lines of business, and its administrative support structures and workforce to meet the region's 21st century transportation and economic development challenges. The strategic planning initiative's primary goal was to formulate a vision for Massport as a transportation and economic development engine for the Commonwealth of Massachusetts in the 21st century focusing on the horizon years of 2022 and beyond. While Massport has periodically prepared and implemented strategic plans for its various lines of business and major assets, the most recent effort is the first time that Massport has ever prepared an Authority-wide strategic plan. One outcome of this effort is Massport's updated vision:

> *A world class organization of people moving people and goods – and connecting Massachusetts and New England to the world – safely and securely and with a commitment to our neighboring communities.*

During this process, the importance of viewing the Authority as a single consolidated entity has become clear: Massport's transportation and economic assets have a synergistic impact on many key sectors of the regional economy. Boston's knowledge economy benefits simultaneously from Logan Airport's growing network of international destinations, Hanscom Field's general aviation (GA) facilities used by major corporations, and real estate development on Massport properties in the South Boston Waterfront. Through the "One Massport" lens, Massport's critical role in the region's visitor economy becomes clear:

- Over 33.4 million passengers traveled through Logan International Airport in 2015.
- Since JetBlue Airways initiated commercial flights at the Worcester Regional Airport in late 2013, more than 350,000 passengers have used this convenient service.
- Hanscom Field continues to serve as the region's premier corporate and business aviation facility and serves as a critical GA reliever for Logan Airport. In 2015, Hanscom Field handled nearly five times the number of GA operations than occurred at Logan Airport.
- Nearly 350,000 customers now use Cruiseport Boston annually.
- In 2015, the Conley Terminal handled a record 237,166 TEUs (twenty-foot equivalent units).

The strategic planning analysis has identified several strategic challenges for Massport's three airports. At Logan Airport, passengers are up, but flights are down over the long-term; the increase in passengers will continue to result in pressure points on terminal and landside facilities. International passengers have been growing at a faster rate than domestic passengers, placing increasing demand on the limited Terminal E facilities; the Terminal E Modernization Project strives to accommodate the projected growth while reducing environmental impacts associated with terminal apron operations.

Worcester Regional Airport continues to focus on providing commercial air service and premier general aviation services to the greater Worcester region. Massport and its tenants are already advancing projects to improve Worcester Regional Airport's all-weather reliability and have created a new first-class Fixed Based Operator (FBO) facility. Hanscom Field is envisioned to remain as the premier corporate and business aviation facility for the Boston and New England region and will also remain as a commercial/general aviation and limited cargo facility. FBO improvements are also underway at Hanscom Field.

Ground access at Logan Airport will continue to face strategic challenges as Massport strives to minimize the traffic, environmental, and community impacts of surface transportation while providing air passengers and employees with as many options as possible for convenient travel to and from the Airport. To meet these challenges, Massport's overarching ground access goal is to minimize the number of motor vehicles used traveling to and from Logan Airport.

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 adaptation strategies to make Massport's facilities more resilient to the likely effects of climate change. The study was completed and implementation 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 its Floodproofing Design Guide; and has developed a resilience framework that will provide consistent metrics for the short- and long-term resilience 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 Guidelines were published in November 2014 and revised in April 2015.

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 the 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, social responsibility, operational efficiency, and natural resource conservation considerations. The Logan Airport SMP is intended to promote and integrate sustainability Airport-wide and to coordinate on-going sustainability efforts across the Authority. 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 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/environment/sustainability-management-plan.

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 2015 SMP. The first Annual Sustainability Report was published in April 2016.

In 2015, 320 high school and college students earned a paycheck, valuable work experience, and perhaps the start of a career thanks to Massport's Community Summer Jobs Program. Winthrop Parks and Recreation, pictured with Massport staff and CEO, is a participant of the program.

4

Regional Transportation

Introduction

This chapter places Boston-Logan International Airport in the context of the New England region's intermodal transportation system and reports on the status of the region's airports in 2015. Logan Airport, one of three airports[1] owned and operated by the Massachusetts Port Authority (Massport), functions within a larger network of New England regional airports. Massport is committed to ongoing efforts to support an efficient regional air and surface transportation network. Current air traffic levels and airline service trends at the New England regional airports are discussed in this chapter. Airport improvement projects and long-range regional transportation planning initiatives within the regional transportation network are also discussed. This chapter focuses on 2015 and specifically describes:

- Passenger and aircraft activity levels at New England regional airports[2] including:
  - Hanscom Field, MA;
  - Worcester Regional Airport, MA;
  - Manchester-Boston Regional Airport, NH;
  - Portsmouth International Airport at Pease, NH;
  - Burlington International Airport, VT;
  - Bangor International Airport, ME;
  - Portland International Jetport, ME;
  - T.F. Green Airport, RI;
  - Bradley International Airport, CT; and
  - Tweed-New Haven Airport, CT.
- 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.
- Regional long-range transportation planning efforts.

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

2 A review of activity levels at Logan Airport is provided in Chapter 2, *Activity Levels*, of this report.

2015 Regional Transportation Highlights and Key Findings

Key findings for New England regional airports, the regional transportation system in 2015, and status updates for long-range planning efforts include:

- The New England region is anchored by Logan Airport and a system of 10 other commercial service, reliever, and general aviation (GA) airports[3] (regional airports). Together, these 11 airports accommodate nearly all of New England's commercial[4] air travel demand. Logan Airport serves as a major domestic origin and destination market and acts as the primary international gateway for the region. The region is also served by rail service (provided by Amtrak) which connects Boston to the New York/Washington D.C. metropolitan areas to the south and Portland, ME to the north.
    - The total number of air passengers using New England's commercial service airports, including Logan Airport, increased by 4.1 percent from 46.8 million in 2014 to 48.7 million annual air passengers in 2015 (**Table 4-2**).
    - The increase in the region's passenger traffic is driven by continued growth at Logan Airport, and other regional airports. Bradley International Airport, Portland International Jetport, and Bangor International Airport also saw increases in passenger traffic.
    - Passenger levels at the majority of other regional airports remained flat or continued to decline due to continued airline service reductions in 2015. Though the economy has largely recovered from the recession in 2008/2009, airlines continue to monitor growth carefully and trim services at various secondary and tertiary airports across the nation, even as they add capacity in more profitable markets.
- Air passenger activity levels in the New England region in 2015 represented a record high for the region, returning to passenger levels prior to the 2008/2009 economic downturn and exceeding the historic peak of 48.0 million regional air passengers in 2005. Overall U.S. passenger traffic exceeded pre-recession levels in 2014, continuing to show strong growth and reaching a new peak in 2015.
- Of the 48.7 million passengers using New England's commercial service airports in 2015, 68.6 percent of passengers (33.4 million) used Logan Airport compared to 67.6 percent (31.6 million) in 2014. (**Figure 4-3**).[5]
- Worcester Regional Airport (ORH) is an important aviation resource that accommodates corporate GA activity and commercial airline services. Massport has continued investment in Worcester Regional Airport by acquiring and modernizing Worcester Regional Airport to better serve the commercial airline travel demands of the central Massachusetts region.

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3 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 the Federal Aviation Administration (FAA) to relieve congestion at Commercial Service Airports and to provide improved general aviation access to the overall community. General Aviation Airports are public-use airports that do not have scheduled service or have less than 2,500 annual passenger boardings.

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

5 Based on airport passenger statistics from 1985 to 2015.

- 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, JetBlue Airways has already handled over 350,000 passengers at ORH since commencing operations in late 2013.
- Massport recently started construction on Worcester's Category (CAT) III Instrument Landing System to enhance operational and safety conditions 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.

- Hanscom Field (BED) 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 some 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 2015, consistent with Hanscom Field's role as a premier corporate airport, new hangars are being built to accommodate the need for corporate jet services.
- The *New England Regional Airport System Plan (NERASP)* study, which was 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 (PVD), and Manchester-Boston Regional Airport (MHT). 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.[6] **Table 4-1** and **Figure 4-2** depicts the distribution of air passengers at these airports.

Table 4-1 **Passenger Activity Levels at Logan Airport and T.F. Green (PVD) and Manchester-Boston Regional (MHT) Airports, 1995 and 2015 Comparison**

	Market Share (passengers in millions)		**Change**	**Percent Change**
	1995	**2015**		
Logan Airport	24.1	33.4	9.3	39%
MHT & PVD	3.2	5.6	2.4	75%
Total	27.3	39.0	11.7	43%
Percent Logan Airport	88%	86%	(2%)	

- Aircraft operations activity levels have declined significantly throughout the region since 2000, as part of an ongoing trend of larger aircraft size, higher aircraft load factors, and reduced service operations levels in less profitable markets. Total aircraft operations in the region declined from 1.6 million in 2000 to approximately 991,041 in 2015 (**Table 4-3**).

6 *New England Regional Airport System Plan*, Federal Aviation Administration, 2006.

- Massport continued to engage in metropolitan cooperative planning efforts including the Massachusetts Department of Transportation's (MassDOT's) GreenDOT initiative,[7] the Healthy Transportation Compact,[8] the *South Boston Waterfront Transportation Plan*, and the Boston Metropolitan Planning Organization (Boston MPO) initiatives.
- Massport is supporting MassDOT's efforts to expand Boston's South Station to meet the current and future demand for rail mobility within Massachusetts and along the 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 service or via taxi or other unscheduled mode. Overall, NEC ridership reached a new record in 2015, surpassing 2014 record levels. Amtrak's share of the Northeast total passenger market has increased substantially since the introduction of Acela Express service in 2000. In fiscal year (FY) 2015, the NEC carried 11.7 million passengers on its Acela Express and Northeast Regional services, up 0.5 percent from the prior year. Acela Express accounted for 3.5 million passengers, while the Northeast Regional accounted for 8.2 million passengers.
- Massport is collaborating with MassDOT, the City of Boston, and the Massachusetts Convention Center Authority to advance the improvements listed in the *South Boston Waterfront Transportation Plan*.
- Massport and the other New England state transportation agencies collaborated with the Federal Aviation Administration (FAA) on the *New England Regional Airport System Plan – General Aviation* study to provide an understanding of GA airports, infrastructure, and capital needs for the New England region.

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 GA airports (regional airports).[9] Together, these 11 airports accommodate nearly all of New England's air travel demand. Logan Airport serves a major domestic origin and destination market and acts as the primary international gateway for the region. The regional airports range in role and activity levels from Bradley International Airport, which served close to 6 million commercial passengers in 2015, to Hanscom Field, which does not currently handle any commercial or charter flights but serves as New England's largest GA facility (**Table 4-2**).

7 Massachusetts Department of Transportation. *GreenDOT*. https://www.massdot.state.ma.us/greendot.aspx. Accessed June 9, 2016.

8 Massachusetts Department of Transportation. *Healthy Transportation Compact.* https://www.massdot.state.ma.us/GreenDOT/HealthyTransportation/HealthyTransportationCompact.aspx. Accessed June 9, 2016.

9 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).

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.

- Worcester Regional Airport (ORH) is located in central Massachusetts, approximately 50 miles west of Logan Airport. Worcester Regional Airport is an important aviation resource that accommodates 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 approximately 39,014 operations in 2015, with GA accounting for over 90 percent of aircraft activity (**Table 4-3**). Massport, in conjunction with the City of Worcester and other community stakeholders, actively promoted the reintroduction of scheduled airline service at the airport and successfully secured new services provided by JetBlue Airways. On November 7, 2013, JetBlue Airways commenced non-stop services to Orlando International and Fort Lauderdale-Hollywood airports using 100-seat Embraer 190 aircraft. This service has proven to be highly popular, with JetBlue Airways achieving consistently high load factors (close to

85 percent[10]) and handling over 117,000 passengers in 2015. To date, JetBlue Airways has served over 350,000 passengers at ORH.

- Hanscom Field (BED) 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 some 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 2015, Hanscom Field accommodated approximately 127,467 GA operations, close to five times the number of GA operations that occurred at Logan Airport (**Table 4-3**). 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, Hanscom Field has also accommodated niche commercial airline services in the past.

Apart from Hanscom Field and Worcester Regional Airport, the regional airports closest to Logan Airport are T.F. Green Airport (PVD) in Warwick, RI and Manchester-Boston Regional Airport (MHT) 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, which was 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.[11]

Prior to 2005, the Central Artery/Tunnel (CA/T) construction project and high air fares made Logan Airport less attractive for many air travelers in the Greater Boston area. Many passengers viewed T.F. Green Airport and Manchester-Boston Regional Airport as convenient alternatives to Logan Airport. After the introduction of low-cost services on Southwest Airlines at these two airports, the two airports captured an increasing share of the Greater Boston market. However, after completion of major portions of the CA/T project in 2004, as well as JetBlue Airways' entry and expansion at Logan Airport, Logan Airport began to recapture passengers from its core service area that were previously using the regional airports.

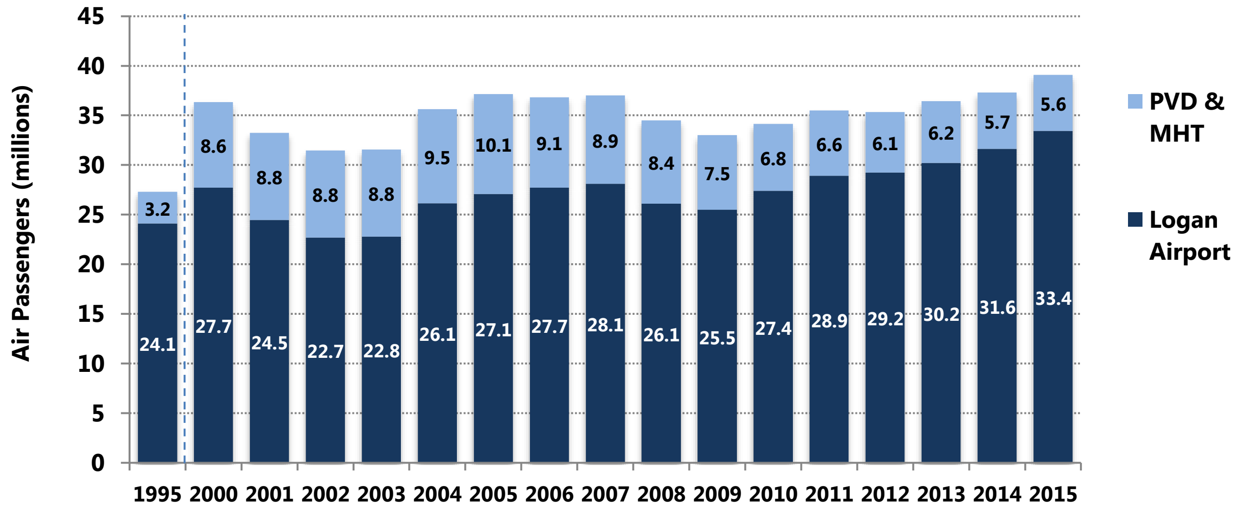
Logan Airport is well-positioned in terms of access and competitive airfares and available air services to meet the demands of the core Boston passenger market. Passenger traffic at T.F. Green Airport and Manchester-Boston Regional Airport peaked in 2005, and declined significantly in recent years due to an industry-wide trend of airline service reductions at smaller airports. However, T.F. Green Airport and Manchester-Boston Regional Airport remain well situated to serve their own catchment areas, and continue to accommodate considerably more passengers than before the entry of Southwest Airlines in the late 1990s. In 2015, T.F. Green and Manchester-Boston Regional Airports' share of the combined Greater Boston passenger market continued the declining trend from recent years. In 2015, the two airports served 14 percent (5.6 million) of the combined passengers at the three main commercial airports serving the Greater Boston area, down from 15 percent (5.7 million) in 2014 and a high share of 28 percent (8.8 million) in 2002.

10 JetBlue Airways services at Worcester Regional Airport had an average load factor of 84 percent in both 2014 and 2015 (U.S. DOT, T100 Database)

11 *New England Regional Airport System Plan*, Federal Aviation Administration, 2006.

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, 1995-2015



Source: Massport and individual airport data reports.

In addition to Logan Airport and the regional airports discussed above, a third tier of 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.

The 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 2015, New England's 11 commercial airports accommodated 48.7 million passengers. As shown in **Table 4-2**, total air passenger traffic at the New England airports increased by 4.1 percent in 2015, up from 46.8 million in 2014. Passenger traffic in the New England region in 2015 represented a record high for the region, returning to passenger levels prior to the 2008/2009 economic downturn and exceeding the historical peak of 48.0 million in 2005. Overall passenger traffic growth at the New England airports was slower than overall growth in the U.S. passenger market, which increased by 5.0 percent in 2015.[12] This was due to the lack of significant passenger growth at other New England airports apart from Logan Airport. Overall U.S. passenger traffic exceeded pre-recession levels in 2014, continuing to show strong growth and reaching a new peak in 2015.

Traffic growth in the New England region continued to be driven by growth at Logan Airport. In 2015, Logan Airport saw a year-over-year passenger growth of 5.7 percent, while total passenger traffic at other New England airports increased by only 0.7 percent. The 10 regional airports accounted for a total of 15.3 million passengers in 2015, compared to 15.2 million passengers in 2014. The ten regional airports' share of New England passengers decreased to 31.4 percent in 2015, compared to 32.4 percent in 2014 (**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 a drop in passenger demand and widespread airline capacity reductions, particularly at the 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. In 2015, airline service and passenger traffic did not grow substantially at the regional airports.

12 Based on U.S. DOT, Bureau of Transportation Statistics for total U.S. scheduled passenger traffic.

Table 4-2 Passenger Activity at New England Regional Airports and Logan Airport, 2011-2015

	Passenger Levels (millions)[1]					Percent Change
Airport	**2011[2]**	**2012[2]**	**2013[2]**	**2014[2]**	**2015**	**(2014-2015)**
Bradley International	5.61	5.38	5.42	5.88	5.93	1.0%
T.F. Green	3.88	3.65	3.80	3.57	3.57	0.0%
Manchester-Boston Regional	2.71	2.45	2.42	2.10	2.08	(0.9%)
Portland International Jetport	1.68	1.62	1.68	1.67	1.73	3.7%
Burlington International	1.29	1.25	1.23	1.22	1.19	(2.3%)
Bangor International	0.43	0.46	0.48	0.49	0.52	6.3%
Worcester Regional	0.11	0.03	0.02	0.12	0.12	2.0%
Portsmouth International	0.01	0.03	0.04	0.09	0.09	(4.1%)
Tweed-New Haven Regional	0.08	0.08	0.07	0.07	0.07	0.0%
Hanscom Field	0.01	0.01	0.0[3]	0.0[3]	0.0[3]	0.0%
Subtotal	**15.80**	**14.95**	**15.17**	**15.19**	**15.29**	**0.7%**
Logan Airport	28.91	29.24	30.22	31.63	33.45	5.7%
Total	**44.71**	**44.19**	**45.39**	**46.82**	**48.74**	**4.1%**

Source: Massport and individual airport data reports.

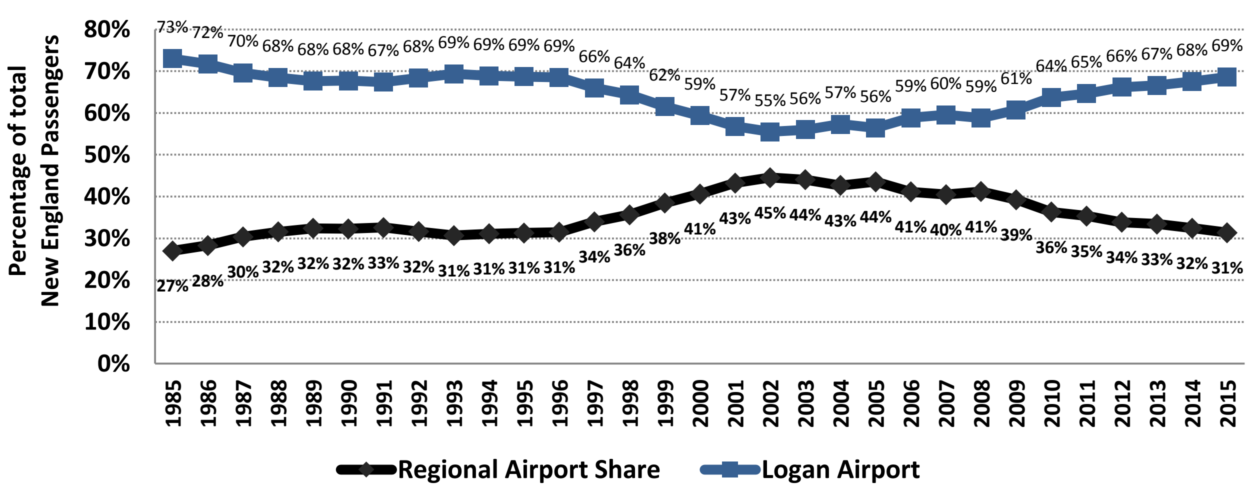
Notes: Data for Logan Airport includes domestic, international, and general aviation passengers.

1 All passengers in millions. Passenger levels are enplaned plus deplaned passengers (where available) or enplaned passengers times two.

2 Reflects updated 2011 to 2014 passenger statistics for Burlington International, Bangor International, and Portsmouth International airports based on latest available airport records.

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 2015.

Figure 4-3 Regional Airports' Share of New England Passengers, 1985-2015



Source: Massport and individual airport data reports.

Among the regional airports, Bangor International Airport, Portland International Jetport, Worcester Regional Airport, and Bradley International Airport experienced some passenger traffic growth in 2015, while passenger levels at the other regional airports remained flat or continued to decline slightly. Portland International Jetport and Bradley International Airport experienced the largest increases, with passenger traffic growth of 3.7 percent (61,000) and 1.0 percent (58,000) respectively in 2015 (**Table 4-2**). Passenger levels at T.F. Green Airport and Tweed-New Haven Regional Airport remained flat in 2015. Burlington International, Manchester-Boston Regional, and Portsmouth International Airports 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) remained flat in 2015, increasing 0.3 percent from approximately 987,652 operations in 2014[13] to 991,041 operations in 2015. An increase in aircraft operations at Logan Airport was offset by an overall decline in aircraft operations at the 10 regional airports. Total operations at Logan Airport increased by 2.5 percent (9,133 operations) compared to 2014, while total operations at the regional airports decreased by 0.9 percent (5,744 operations).

Commercial operations in the New England region increased slightly from approximately 585,186 operations in 2014 to 588,374 operations in 2015. This represented a year-over-year change of 0.5 percent in 2015. Commercial operations at Logan Airport increased by 2.2 percent in 2015, offsetting a decline of 1.7 percent at the other regional airports. This reflects the continued trend of airlines monitoring capacity and continuing to trim services on less profitable routes, even as they add capacity in more profitable markets. Aircraft operations have increased at a slower pace than passenger demand, with airlines also moving towards larger aircraft sizes and operating with higher passenger loads. These trends are seen across the industry. In 2015, total U.S. commercial aircraft operations remained flat compared to 2014, although total U.S. passenger traffic increased by 5.0 percent year-over-year.[14]

Combined GA operations at the regional airports and Logan Airport totaled 371,918 operations in 2015, an increase of 0.7 percent from the previous year. A sharp drop in crude oil prices in 2015 resulted in falling jet fuel prices, which helped to boost GA activity at Logan Airport and some of other regional airports in 2015. GA operations at Logan Airport, which remain a small portion of the Airport's total aircraft operations, increased by 6.6 percent (1,750 operations) in 2015. Overall GA operations at the regional airports increased by 0.3 percent (988 operations). Military operations at the regional airports decreased 7.6 percent (2,537 operations) in 2015, continuing the declining trend in military operations seen over the past decade.

13 Reflects updated CY 2014 aircraft operation statistics for some regional airports based on updated FAA tower counts since the publication of the *2014 EDR*. See Table 4-2 for more details.

14 Based on U.S. DOT, Bureau of Transportation Statistics for total U.S. scheduled passenger traffic.

GA operations continue to be the dominant type of aircraft activity at the regional airports. In 2015, GA accounted for 55.6 percent of total aircraft operations or 343,752 operations at the regional airports. In comparison, GA represented only 7.6 percent of aircraft activity or 28,166 operations at Logan Airport, which primarily accommodates the region's domestic and international commercial airline operations. Commercial airline operations accounted for 39.4 percent of total operations or 243,610 operations at the regional airports in 2015. In comparison, commercial operations accounted for 92.4 percent of total operations or 344,764 operations at Logan Airport in 2015.

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 2015, the regional airports accounted for 31.4 percent of the region's passenger traffic, but 62.4 percent of aircraft activity. On average, there were approximately 24.7 passengers per aircraft operation at the regional airports compared to 89.7 passengers per operation at Logan Airport in 2015, largely reflecting aircraft sizes.

Total aircraft operations in the region in 2015 were well below the region's level of aircraft operations in 2000. Total aircraft operations are down by almost 40 percent, falling from 1.6 million operations in 2000 to 991,040 operations in 2015. There were similarly large reductions in all three categories of activity – commercial, GA, and military. A number of factors have contributed to the declines. A shift to larger capacity aircraft and higher passenger load factors and a concurrent reduction in airline services at smaller regional airports have contributed to the declining trend in commercial airline operations. Factors negatively affecting GA activity include high fuel prices through most of 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 2015 are provided in Appendix F, *Regional Transportation,* and are summarized in the table below.

Table 4-3 Aircraft Operations by Classification for New England's Airports, 2014 and 2015

	2014				2015				Percent Change (2014-2015)			
Airport	**Commercial[1]**	**General Aviation[2]**	**Military[2]**	**Total**	**Commercial[1]**	**General Aviation[2]**	**Military[2]**	**Total**	**Commercial[1]**	**General Aviation[2]**	**Military[2]**	**Total**
Bradley International[3]	79,060	14,752	2,665	**96,477**	76,425	14,402	2,680	**93,507**	(3.3%)	(2.4%)	0.6%	**(3.1%)**
T.F. Green[3]	44,351	29,490	1,036	**74,877**	42,417	22,700	430	**65,547**	(4.4%)	(23.0%)	(58.5%)	**(12.5%)**
Manchester-Boston Regional	38,674	12,293	908	**51,875**	38,060	12,934	811	**51,805**	(1.6%)	5.2%	(10.7%)	**(0.1%)**
Portland International Jetport	29,538	16,535	560	**46,633**	30,415	17,916	567	**48,898**	3.0%	8.4%	1.3%	**4.9%**
Burlington	26,057	40,858	6,842	**73,757**	25,178	41,576	5,912	**72,666**	(3.4%)	1.8%	(13.6%)	**(1.5%)**
Bangor[3]	14,428	15,548	11,567	**41,543**	13,618	16,487	10,684	**40,789**	(5.6%)	6.0%	(7.6%)	**(1.8%)**
Portsmouth	8,278	24,440	7,621	**40,339**	8,547	26,848	7,499	**42,894**	3.2%	9.9%	(1.6%)	**6.3%**
Tweed-New Haven	4,795	26,273	529	**31,597**	6,316	27,711	685	**34,712**	31.7%	5.5%	29.5%	**9.9%**
Worcester Regional[3]	2,368	29,138	956	**32,462**	2,414	35,711	889	**39,014**	1.9	22.6%	(7.0%)	**20.2%**
Hanscom Field[3]	256	133,437	602	**134,295**	220	127,467	592	**128,279**	(-14.1)	(4.5%)	(1.7%)	**(4.5%)**
Subtotal	**247,805**	**342,764**	**33,286**	**623,855**	**243,610**	**343,752**	**30,749**	**618,111**	**(1.7)**	**0.3%**	**(7.6%)**	**(0.9%)**
Logan Airport	337,381	26,416	NA	**363,797**	344,764	28,166	NA	**372,930**	2.2%	6.6%	NA	**2.5%**
Total	**585,186**	**369,180**	**33,286**	**987,652**	**588,374**	**371,918**	**30,749**	**991,041**	**0.5%**	**0.7%**	**(7.6%)**	**0.3%**

Source: FAA tower counts; Massport individual airport data reports.
Notes: Ranked by commercial operations. FAA tower counts used for all airports except Logan Airport and Portsmouth International.
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 2014 aircraft operation statistics based on updated FAA tower counts since the publication of the 2014 EDR report.
NE New England

Airline Passenger Service in 2015

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 by changing the size of the aircraft flown on the route. Changes in flight frequency and changes in aircraft size both affect the number of seats available to passengers, also known as seat capacity. Airline services are therefore typically discussed in terms of seat capacity as well as the number of flight departures.[15] This section examines changes in airline departures and seat capacity at the regional airports in 2015 and provides an overview of new and discontinued routes.

Service Developments at the Regional Airports

In 2015, a total of 13 airlines provided scheduled passenger service from the 10 regional airports to 41 non-stop destinations.[16] Portsmouth International Airport was the only airport to see substantial increase in scheduled commercial services in 2015, while the majority of 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, focusing on profitability and continuing to reduce frequencies on less profitable routes.

Table 4-4 shows the share of scheduled domestic departures for Logan Airport and the ten regional airports for the August peak travel month from 2011 to 2015. In 2015, Logan Airport accounted for 62.8 percent of domestic departures in the New England region with 3,325 weekly departures. Medium-size airports – Bradley International Airport, T.F. Green Airport, and Manchester-Boston Regional Airport – accounted for 24.1 percent of the region's domestic departures with 1,274 weekly departures. Smaller New England airports accounted for 13.1 percent of the region's domestic departures with 691 weekly departures. Overall, the regional airports' combined share of scheduled domestic departures in the New England region declined further from 39.0 percent in 2014[17] to 37.2 percent in 2015. The share for the medium-size airports fell from 25.8 percent in 2014 to 24.1 percent in 2015, while the smaller airports also saw a slight share decline from 13.2 percent to 13.1 percent. Details of scheduled passenger operations by market and carrier for the regional airports for the years 2000 to 2015 are presented in Appendix F, *Regional Transportation*.

15 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.

16 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 and Sanford service).

17 Updated since the publication of the *2014 EDR* to reflect scheduled departures for Allegiant Air not reported in the Official Airline Guide. See Table 4-4 for more details.

Table 4-4 Share of Scheduled Domestic Departures – Logan Airport and the Ten Regional Airports, 2011-2015 (for August peak travel month)

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

Source: Official Airline Guide Market Files; U.S. DOT T100
Note: Allegiant Air does not report to the Official Airline Guide; 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 in the Official Airline Guide.

Worcester Regional Airport

Worcester Regional Airport (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 lost all 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 2015, Jetblue Airways maintained daily service on 100-seat Embraer 190 aircraft to Ft. Lauderdale and Orlando, with no change from 2014.

Bradley International Airport

Annual seat capacity at Bradley International Airport in Windsor Locks, CT decreased by 5.6 percent in 2015. The capacity decline was driven by service reductions by both American Airlines (18.3 percent reduction in seats) and Southwest Airlines (7.2 percent reduction in seats). 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 also discontinued service to Pittsburgh in 2015. In addition, the carrier cut frequencies to Dallas/Ft. Worth and Miami and reduced seat capacity in the Charlotte, Philadelphia, and Washington National markets. Southwest Airlines discontinued its recently launched Atlanta service in 2015, but maintained service levels in other markets. JetBlue Airways was the only carrier to increase overall seat capacity substantially at Bradley International Airport in 2015. JetBlue Airways saw seat capacity growth of 14.7 percent in 2015, primarily due to its new twice daily Washington National service launched in 2014.

T.F Green Airport

T.F. Green Airport (RI) saw an overall seat capacity decrease of 1.3 percent in 2015. American Airlines, Cape Air, Delta Air Lines, and United Airlines reduced scheduled frequencies and available seat capacity at the airport, with American Airlines and Delta Air Lines implementing the most significant cutbacks. American Airlines reduced capacity on previous US Airways operated services by over 20,000 seats, while Delta Air Lines reduced capacity on its Atlanta and Detroit routes and discontinued Delta Connection service to Minneapolis. In 2015, T.F. Green Airport did gain international service by two new carriers. TACV Cabo Verde Airlines introduced one to two times weekly, year-round non-stop service to Praia (Cape Verde), shifting operations from Logan Airport to T.F. Green Airport in June 2015. Condor, a German leisure airline, also began one to two times weekly summer seasonal service to Frankfurt in June 2015.

Manchester-Boston Regional Airport

Manchester-Boston Regional Airport (NH) saw an overall reduction in both scheduled departures and seat capacity as Delta Air Lines reduced frequencies in all three of its markets: Atlanta, Detroit, and New York La Guardia. Southwest Airlines also trimmed frequencies on its Orlando and Chicago Midway services. These reductions were offset by some capacity growth by American Airlines and United Airlines at the Airport in 2015. American Airlines and United Airlines increased scheduled seat capacity by 6.2 percent and 2.8 percent respectively compared to 2014. Charlotte was the largest growth market for American Airlines, while United Airlines' growth was focused on the Newark market.

Portland International Jetport

Portland International Jetport (ME) experienced a 3.4-percent increase in airline seat capacity in 2015 due to service increases by American Airlines, United Airlines, and Southwest Airlines. American Airlines increased scheduled seats by 9.7 percent, adding frequencies in the Charlotte and Washington National markets. United Airlines and Southwest Airlines also increased seat capacity by 5.5 percent and 3.5 percent respectively. United Airlines added scheduled frequencies to New York (Newark), while Southwest Airlines increased seat capacity in its Baltimore market. Delta Air Lines and JetBlue Airways reduced seat capacity at Portland International Jetport in 2015, with Delta Air Lines decreasing frequencies to Detroit and down-gauging from large jet to RJ service in the New York La Guardia market and JetBlue Airways reducing frequencies to New York JFK.

Burlington International Airport

Burlington International Airport (VT) experienced an overall decline in airline capacity in 2015. Delta Air Lines, JetBlue Airways, United Airlines, and Porter Airlines reduced services at the airport, while American Airlines and Allegiant Air added some capacity in 2015. Delta Air Lines reduced seat capacity by 5.2 percent, decreasing scheduled seats to both New York La Guardia and Detroit. JetBlue Airways continued to reduce seat capacity in the New York JFK market. United Airlines increased capacity to Newark, but offset this growth with reductions in the Washington Dulles and Chicago O'Hare markets. Seasonal service to Toronto City Airport by Porter Airlines was adjusted to a more limited winter schedule in 2015, with a 17.0 percent reduction in scheduled departures. American Airlines began non-stop service to Charlotte in September 2015 and increased overall seat capacity at Burlington by 5.3 percent in 2015. Allegiant Air also saw some growth in 2015, increasing scheduled frequencies in its Orlando/Sanford market.

Bangor International Airport

Bangor International Airport (ME) saw an overall seat capacity decrease of 4.8 percent in 2015. American Airlines, Delta Air Lines, and United Airlines all decreased scheduled seats in 2015, while Allegiant Air had a slight increase in overall capacity at the Airport. American Airlines, Delta Air Lines, and United Airlines reduced seat capacity at Bangor International Airport by 3.3 percent (4,460 seats), 9.9 percent (10,540 seats), and 12.2 percent (1,980 seats) respectively. The Detroit market, served by Delta Air Lines, saw the largest service reduction with scheduled frequencies cut by over one third in 2015. New York La Guardia, Chicago O'Hare, Philadelphia, and Washington National also saw service reductions. 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

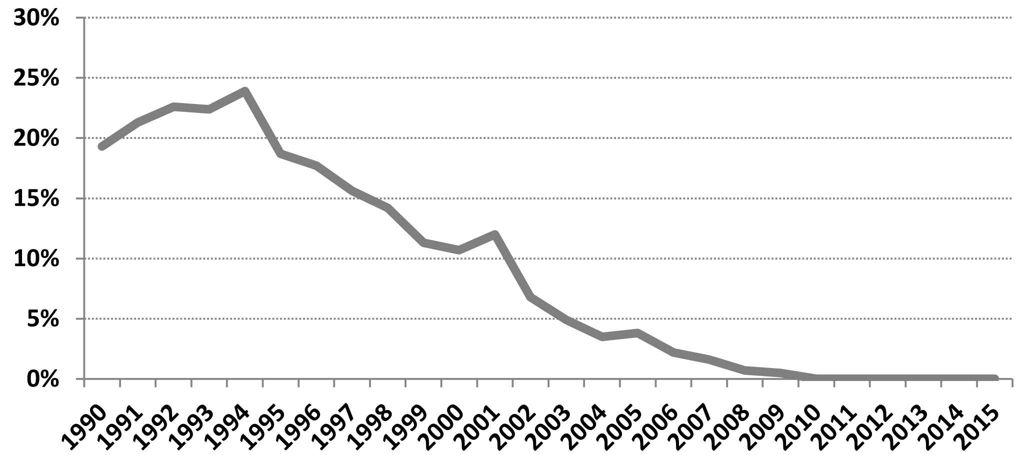
Among the other smaller regional airports, Tweed-New Haven Airport (CT) and Portsmouth International Airport (NH) are both served by a single carrier, while Hanscom Field (MA) has no scheduled commercial service. Scheduled seat capacity at Tweed-New Haven Airport declined slightly by 1.0 percent in 2015 as American Airlines, the only carrier offering scheduled service, reduced frequencies in its Philadelphia market. 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 Ft. Lauderdale as a third destination in late 2015. Portsmouth International Airport saw seat capacity growth of 49.8 percent in 2015 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 2015, 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 origin and destination (O&D) airports and airline connecting hubs. In 2010, the last scheduled flights from the regional airports to Logan Airport were eliminated. The significance of this trend is that it reduces pressure on Logan Airport to provide connecting service for small planes from small communities to other destinations, resulting in more convenient air service routings for passengers, and opening up 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, 1990-2015



Source: Official Airline Guide Market Files (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 MassDOT completed a wide-ranging economic impact study 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.[18] In particular, Massport's three airports are noted to 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.[19] 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.[20] 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. Hanscom Field is particularly important for its function as an active joint commercial/military facility, which is aided by its proximity to the Boston-area technology and research industry. 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:

18 Massachusetts Department of Transportation Aeronautics Division. Massachusetts Statewide Airport Economic Impact Study Update Executive Summary. (2014). http://www.massdot.state.ma.us/portals/7/docs/airportEconomicImpactSummary.pdf Accessed July 26, 2015.

19 *Ibid.*

20 Massachusetts Department of Transportation Aeronautics Division. Massachusetts Statewide Airport Economic Impact Study Update Executive Summary. (2014). http://www.massdot.state.ma.us/portals/7/docs/airportEconomicImpactSummary.pdf Accessed July 26, 2015.

- 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
- 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

Massport continues to invest in Hanscom Field (BED) 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 and premier business aviation facility for the region. In FY 2015, Massport invested $4.1 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*.[21]

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

- Massport rehabilitated the Runway 5 safety area beyond the runway end, including a portion of Taxiway G.
- 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 also began.
- 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.
- 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.

Planned projects for FY 2016 and beyond include:

- The airfield lighting control system will be replaced.

21 Massport. March 2016. *The State of Hanscom*. https://www.massport.com/media/387147/StateOfHanscom-2015.pdf. Accessed June 9, 2016.

- Airfield pavement replacement will continue to be an ongoing project in coming years.
- Rehabilitation of the T-Hangar roof.
- Rehabilitation of landside roadways.
- Improvements to airfield drainage.
- The electrical feeders for Hangars 1 and 2 will be replaced.

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 to the 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 the Massachusetts Department of Environmental Protection 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.
- Massport is in the process of working with General Services Administration (GSA) to acquire a parcel of land north of the airfield currently owned by the U.S. Navy. The transfer is expected to be complete in 2017. Initial planning for aviation uses of this parcel is underway.

Worcester Regional Airport

The *Worcester Regional Airport Master Plan Update*, completed in 2008, was funded by the FAA and the former Massachusetts Aeronautics Commission. The *Worcester Regional Airport Master Plan* provides a strategic roadmap to guide airport development through 2020. Near-term projects were focused on maintaining essential operations, safety, and security functions and included runway pavement reconstruction, runway safety area upgrades, and a vegetation removal and maintenance plan. Long-term initiatives include upgraded corporate/GA facilities including a fixed base operator (FBO) facility and hangars, which has already been completed, as well as a new Airport Rescue and Firefighting Facility (ARFF), and ongoing runway and taxiway pavement rehabilitation. Various demand-driven projects including terminal enhancements and additional parking facilities were also identified; however, these projects depend on the level and type of future aviation activity realized at Worcester Regional Airport (ORH).

An aircraft at Worcester Regional Airport.
Source: Massport

- 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, JetBlue Airways has already handled over 350,000 passengers at ORH since commencing operations in late 2013.
- Massport is currently pursuing enhancements to 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 the Airport. Massport submitted an Environmental Notification Form for the *Worcester Regional Airport CAT-III Instrument Landing System and Taxiway Project* to the Massachusetts Executive Office of Energy and Environmental Affairs in January 2014. The Massachusetts Environmental Policy Act (MEPA) Office determined that no further review was required, allowing the project to advance into the detailed permitting phase. The FAA issued a FONSI in February 2015. All local, state, and federal permits were secured by late 2015 and construction is underway, with completion anticipated in 2017.
- Massport started a $3 million renovation project in April 2014 that includes the demolition of the control tower, safety upgrades, and a CAT III Instrument Landing System. This project was completed in 2015.
- In January 2012, Massport approved a proposal by Rectrix Commercial Aviation Services, Inc. to develop an aircraft hangar and office space at Worcester Regional Airport. The FAA issued a FONSI on August 13, 2013. Construction started on the $6.7 million project in August 2013. The Rectrix project includes 27,000 square feet of hangar and office space that will house large corporate jets and a regional aircraft maintenance facility. Rectrix will offer private jet charters and FBO services, including transient aircraft parking and fueling services from the new hangar facility. The FAA issued a FONSI on April 4, 2014. Construction was completed in November 2015.
- In October 2014, Massport received a FONSI from FAA for a future maintenance hangar at Worcester Regional Airport. A developer for the proposed 40,000 to 50,000 square-foot hangar has yet to be identified.
- Massport and third party developers have committed to invest in the following additional airside and landside improvement projects over the next few years:
  - Installation of a new terminal roof and HVAC system;
  - Airside and landside pavement rehabilitation;
  - Rehabilitation of the existing ARFF station (underway);
  - Security improvements; and
  - Obstruction removal.

Long-term Worcester Roadway Improvements

In 2008, the Central Massachusetts Regional Planning Commission initiated the *Worcester Regional Mobility Study*[22] that was envisioned as a transportation plan with the goal of improving the movement of people and goods throughout the Greater Worcester Region. The final Study was released in May 2011. One of the Study's objectives was to improve ground transportation access between the regional roadways and Worcester Regional Airport within the context of an "economic development corridor" that could benefit other local businesses. Several alternative routes were identified and recommended for further study including a new interchange off Interstate 90 in the vicinity of Route 56. The Study also assessed a range of alternatives to address regional mobility concerns and recommended 13 roadway infrastructure improvements intended to reduce congestion, enhance regional mobility, and address existing interchange/intersection constraints. The study presented the recommended phasing and packaging of recommended alternatives into short-term (zero to five years), mid-term (five to 10 years), and long-term actions (over 10 years).

Near-term Worcester Directional Signage Improvement Program

The Central Massachusetts Regional Planning Commission also supported Massport's goal to identify immediate actions for improving roadway access to Worcester Regional Airport through a signage improvement program. In collaboration with MassDOT and the City of Worcester, Massport identified six primary routes now used by travelers to access Worcester Regional Airport. Massport also developed a sign design and placement plan. The goal was to improve directional signage on these roads between Worcester and the Massachusetts Turnpike and Interstate 290 by achieving the following objectives:

- To ensure that key decision points would be adequately signed;
- To reduce sign "clutter" by removing old and unnecessary signs; and
- To design and install new airport trailblazer signs consistent with the Manual on Uniform Traffic Control Devices standards.

MassDOT has installed the desired signs that were produced by the Massport Sign Shop. To date, more than 85 signs have been installed including several signs on Auburn roads approved by the Town of Auburn in March 2011.

T.F. Green Airport

In September 2011, the FAA issued a Record of Decision (ROD) approving the Preferred Alternative for the T.F. Green Airport Improvement Program, which will allow 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 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 completed in 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:

22 Central Massachusetts Regional Planning Commission. *Worcester Regional Mobility Study.* http://www.cmrpc.org/sites/default/files/download/Worcester_Mobility_Study_RFP_02262008.pdf. Accessed June 9, 2016.

- 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 16 and 34 Ends, partial reconstruction of Taxiway C, and construction of the associated airport service road. Construction was substantially complete at the end of 2015.
- The Runway 5 End extension began in the summer of 2016 and will be completed by the end of 2017. This project involves extension of the primary runway from its current length of 7,166 feet to 8,700 feet, which will allow for long haul flights to West Coast destinations. The project also involves 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

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. Recent customer service enhancement initiatives have included the construction of a new 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 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 the FAA. Elements of the project include demolishing the Highlander Inn and Conference Center and associated buildings.

- Upgrades to the terminal building heating, ventilation, and air conditioning (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

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. The goal of the Connecticut Airport Authority is to transform Bradley International Airport and the state's five GA airports (Danielson, Groton/New London, Hartford Brainard, Waterbury-Oxford, and Windham 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 airport hotel, 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.

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 state's various transportation agencies. The unified MassDOT brought together many Commonwealth entities that plan, build, own, operate, and maintain all modes of transportation, under a five-member board of directors. In 2015, the MassDOT Board was expanded to an 11-member board of directors and a separate five-member Massachusetts Bay Transportation Authority (MBTA) Financial Oversight Board. (Massport remains an independent authority focused on airport and seaport needs with its own board, including the Secretary of MassDOT as an ex officio member.) 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 2011, MassDOT continued to make strides in improving the existing transportation system by addressing structurally deficient infrastructure with innovative construction techniques, developing a comprehensive environmental responsibility and sustainability initiative, and continuing to invest in the Boston metropolitan area's rapid transit.

Logan Airport's functional role is New England's premier commercial airport, providing an essential and efficient 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[23] (although not in Boston itself) and identify a need for access to alternative forms of short-distance travel across these regions.[24] 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.[25] 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

23 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, Boston)

24 FAA: Capacity Needs in the National Airspace system 2007-2025 (commonly referred to as FACT-2) and TRB: ACRP Report 31: Innovative Approaches to Addressing Aviation Capacity Issues in Coastal Mega-regions.

25 Transportation Research Board ACRP 03-23: Integrating Aviation and Passenger Rail Planning.

air travel.[26] Boston's South Station is undergoing planning and design for expansion that would support current and future rail mobility in Massachusetts and along the NEC including supporting future high-speed rail. In 2012, Amtrak services in the NEC had a 54-percent share[27] of the Boston-New York City markets (excluding traffic by other surface modes such as private car and bus).

Massachusetts Statewide Airport System Plan

The MassDOT Aeronautics Division completed the *Massachusetts Statewide Airport System Plan* in 2010. The *Massachusetts Statewide Airport System 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.

Boston and Statewide Long-term Transportation Vision

In July 2015, the Boston MPO published its quadrennial long-range plan for the region and its transportation network, titled *Charting Progress to 2040*.[28] 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 vision described by the Boston MPO identifies the Boston metropolitan region as continuing to be an economic, educational, and cultural hub which will continue to contribute 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. The variety of transportation options will allow people to find jobs and services within easy reach of affordable housing, and will reduce environmental impacts thereby improving air and environmental quality. 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 the *2010 Massachusetts State Freight Plan*[29] found that air freight shipping will grow more quickly than any other shipping mode.

In 2014, MassDOT developed the Commonwealth's first fully multimodal long-range transportation plan known as *weMove Massachusetts*.[30] 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.

26 America 2050. *Where High-Speed Rail Works Best.* http://www.america2050.org/pdf/Where-HSR-Works-Best.pdf. Pages 1-2. Accessed June 9, 2016.

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

28 Boston Region Metropolitan Planning Organization. *Charting Progress to 2040.* http://www.ctps.org/lrtp. Accessed June 9, 2016

29 Massachusetts Department of Transportation. September 2010. *State Freight Plan.* https://www.massdot.state.ma.us/portals/17/docs/freightplan/MAFreightPlanSeptember2010v2.pdf. Accessed June 9, 2016.

30 Massachusetts Department of Transportation. *weMove Massachusetts.* https://www.massdot.state.ma.us/wemove/Home.aspx. Accessed June 9, 2016.

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 between 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.

Massport is an active participant in the development of the Boston MPO long-range transportation plan and has a representative on the *weMove Massachusetts* Stakeholder Advisory Group.

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, the FAA New England Region, in concert with the New England Airport Directors and New England State Aviation Directors, completed the NERASP.[31] The results of this study describe the foundation of a 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 system 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

31 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).

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.

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.[32] 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;
- Engaging in regional projects;
- Undertaking research; and
- Increasing public awareness of shared interests.

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

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.[33]

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 Penn Station in New York, of which about half are Acela Express. On Saturdays and Sundays, a total of 12 departures and 14 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 30.9 million one-way trips in FY 2015, a decrease of 0.1 percent from FY 2014. The NEC represented about 38 percent of total system-wide Amtrak ridership. In FY 2015, the NEC carried 11.7 million passengers on its Acela Express and Northeast Regional services, up 0.5 percent from the prior year. Acela Express accounted for 3.5 million passengers, while the Northeast Regional accounted for 8.2 million passengers. Overall NEC ridership reached a new record in 2015, surpassing 2014 record levels.

33 New England Governors/Eastern Canadian Premiers. http://www.coneg.org/negecp. Accessed June 13, 2016.

Amtrak's share of the Northeast total passenger market has increased substantially since the introduction of Acela Express service in 2000.

Recent forecasts of Amtrak ridership along the NEC indicate that ridership could reach 17.4 million passengers in 2020, 26.2 million passengers in 2030, and 43.5 million passengers in 2040. This forecast indicates that the substantially reduced travel times of high-speed rail transportation would become more attractive along the NEC.[34]

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

The *Northeast Corridor Infrastructure Master Plan*, a new regional rail planning study, was released in May 2010. The Master Plan[35] 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,[36] 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 is currently preparing a future plan for the NEC. Potential impacts of this plan are being evaluated in a Tier 1 Draft Environmental Impact Statement that was completed in November 2015, which is available online at: http://www.necfuture.com/tier1_eis/deis/.

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.[37] 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.[38]

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

34 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. Accessed June 10, 2016.

35 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. Accessed December 1, 2016.

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

37 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. Accessed June 10, 2016.

38 *Ibid.*

Acela Express high-speed service to support the next-generation high-speed rail proposed.[39] 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 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.[40]

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 24-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 is scheduled for completion in the summer of 2017.[41]

RIDOT is also planning improvements to Providence Station. Among other benefits, this project may include new capacity for high-speed services.[42]

Boston-South Station Expansion

In support of the Northeast Corridor Capital Investment Program, MassDOT is planning to expand Boston-South Station to meet the infrastructure and capacity needs to accommodate future growth 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 mobility within Massachusetts and throughout New England and the NEC.[43] The proposed South Station Expansion project will result in a number of benefits to rail mobility, summarized below.[44]

- Support increased ridership by improving the rail system's ability to absorb future demand along the MBTA's South Side commuter rail lines and along the NEC.

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39 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. Accessed June 10, 2016.

40 *Ibid.*

41 Amtrak. *NEC Projects, Kingston Station Capacity Expansion.* https://nec.amtrak.com/content/kingston-station-capacity-expansion. Accessed June 28, 2016.

42 Amtrak. *NEC Projects, Providence Station Improvements.* https://nec.amtrak.com/content/providence-station-improvements. Accessed June 28, 2016.

43 Massachusetts Department of Transportation. *About this Project.* http://www.massdot.state.ma.us/southstationexpansion/Home.aspx. Accessed June 10, 2016.

44 Massachusetts Department of Transportation. *South Station Expansion Draft Environmental Impact Report.* http://www.massdot.state.ma.us/southstationexpansion/DEIR.aspx. Accessed June 10, 2016.

- Improve operational performance by providing the ability to meet Amtrak's and the MBTA's established objective of 95 percent on-time performance.
- Help to induce a mode shift by improving access, convenience, and availability of transit.
- Increase efficiency and capacity of the rail system by providing new train layover facilities.

Additional benefits include improving the passenger experience, pedestrian and bicycle improvements, improved vehicular circulation, and improved multimodal connections.

In October 2014, MassDOT submitted a Draft Environmental Impact Report (DEIR) to the Secretary of Energy and Environmental Affairs. The Secretary issued a Certificate in December 2014. MassDOT submitted a Final Environmental Impact Report (FEIR) in June 2016. The FEIR summarizes changes to the project since the DEIR, incorporates additional environmental analyses outlined in the Secretary's Certificate, and responds to comments on the DEIR. MassDOT is also preparing an Environmental Assessment under the federal National Environmental Policy Act, which will be released in 2017.

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 time between Boston and Warwick is approximately 1.25 to 1.5 hours. On weekdays, ten of the 20 daily outbound trips from Boston to Providence currently continue on to Warwick, while ten of the 20 daily inbound trips to Boston also stop in Warwick. Expanded weekday service to Wickford, RI commenced in 2012, with an eventual extension to Kingston, RI also planned. Additionally, RIDOT, in cooperation with the City of Pawtucket, is currently considering alternatives to reintroduce a commuter rail station in Pawtucket, RI.

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.

GreenDOT

GreenDOT is a comprehensive sustainability initiative with three primary objectives: reduce greenhouse gas (GHG) emissions; promote the healthy transportation options of walking, bicycling, and public transit; and support smart growth development. GreenDOT is MassDOT's policy mechanism to achieve the GHG reduction targets set out in the Executive Office of Energy and Environmental Affairs GHG reduction plan set forth by the Global Warming Solutions Act of 2008. MassDOT's mode shift goal is to triple the current mode share of bicycling, public transit, and walking, each by 2030 (information on GreenDOT provided at www.massdot.state.ma.us/GreenDOT.aspx).

Massport is fulfilling the intention of GreenDOT by working to reduce GHG emissions associated with surface transportation to the Airport and by providing more accommodations for walking, bicycling, and public transit. Massport supports GreenDOT's smart growth development goal by actively working to improve public transportation in the metropolitan area, a key component of smart growth principles.

Massport has participated in an interagency Transportation Sustainability Committee organized by MassDOT, leading up to the development of MassDOT's GreenDOT Implementation Plan. The final GreenDOT Implementation Plan was completed in December 2012 and was developed to serve as the framework for embedding the sustainability goals of GreenDOT into the core business and culture of MassDOT. The Implementation Plan captures current MassDOT innovations, leading sustainability policies of the Commonwealth, and national best practices, and presents a guide to achieve the sustainability and livability vision of MassDOT.[45] The Implementation Plan identifies fifteen sustainability goals organized under seven sustainability themes: Air; Energy; Land; Materials; Planning, Policy & Design; Waste; and Water. These goals work towards decreasing resource use, minimizing ecological impacts, and improving public health outcomes from MassDOT's operations and planning processes. In 2014, MassDOT published *The GreenDOT Report: 2014 Status Update*, which provides a progress update to the 2012 Implementation Plan.[46]

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,

45 Massachusetts Department of Transportation. December 2012. *GreenDOT Implementation Plan*. https://www.massdot.state.ma.us/Portals/0/docs/GreenDOT/finalImplementation/FinalGreenDOTImplementationPlan12.12.12.pdf. Accessed June 10, 2016.

46 Massachusetts Department of Transportation. September 2014. *The GreenDOT Report: 2014 Status Update.* https://www.massdot.state.ma.us/Portals/0/docs/GreenDOT/StatusUpdate2014_GreenDOT.pdf. Accessed November 29, 2016.

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, Massachusetts Department of Transportation, 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 real solutions to meet the growing and changing transportation needs of the district, and improving the public realm of the area, all 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.

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 occasionally used by Massport to support its ground transportation planning initiatives.

Metropolitan Area Planning Council (MAPC)

Massport is also an ex-officio member of MAPC, which is a regional planning agency serving the people who live and work in 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. Massport was not an executive committee member in 2015.

Summary of Regional Long-Range Transportation Planning Efforts

The aim of regional transportation planning efforts is to reduce over-reliance on Logan Airport and to provide New England travelers with a variety of viable transportation options. The NERASP study conducted in 2006 has helped to develop the primary commercial airport system in New England in order to support these benefits. Meanwhile, the NEG/ECP works to coordinate the highway, aviation, freight, and commuter rail transportation networks. Rail service such as the Amtrak NEC and proposed improvements such as the Boston-South Station Expansion also help to balance the passenger load among various modes of transportation. Other supporting planning forums include GreenDOT, the Healthy Transportation Compact, and the Boston MPO.

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. The ground transportation strategy is designed to provide a broad range of high occupancy vehicle (HOV), transit, and shared-ride options for travel to and from Logan Airport and to minimize vehicle trips, by providing convenient transit, shuttle, bike, and pedestrian connections to the Airport. The strategy also aims to provide 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 Boston-Logan International Airport (Logan Airport or the 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 2015, which are compared to past conditions. Activity levels include measures of ridership, traffic volumes, and parking demand and its impacts under Logan Airport's constrained parking supply.[1]

Massport is implementing multiple strategies 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,[2] which generate up to four vehicle trips instead of two. Massport has continued 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 close to 30 percent.[3] Measures implemented by Massport to increase HOV use include a blend of strategies related to pricing (incentives and disincentives), service availability, service quality,

1 Appendix G, *Ground Access,* includes additional figures.

2 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 or black car that may not carry a passenger during all segments of travel to and from Logan Airport. 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 alternative mode of transportation. The 2016 passenger survey and future documents will analyze trends associated with TNCs.

3 According to the *2013 Logan Airport Air Passenger Ground Access Survey*, 27.8 percent of air passengers accessing Logan Airport used HOV modes of travel.

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 HOV mode share.

Continuing improvements to support HOV include: new Back Bay Logan Express pilot service (since May 2014); free Massachusetts Bay Transportation Authority (MBTA) Silver Line outbound (from Logan Airport) boardings; a new 1,100-car parking garage at the Framingham Logan Express; reduced holiday travel parking rates at Logan Express facilities; increased parking rates on the Airport; and support for private coach bus and van operators.

Even with Massport's industry-leading efforts promoting and providing HOV/shared-ride mode use, private passenger vehicle trips continue to increase with growth in air travel. As Logan Airport air traveler numbers have increased, a constrained parking supply at Logan Airport has resulted in an increase in drop-off/pick-up vehicle trips. The greater number of vehicle trips means increasing vehicle miles traveled (VMT) and associated emissions – the opposite effect of the Logan Airport Parking Freeze[4] (the Parking Freeze) regulation's intent.

Massport remains concerned that a constrained parking supply at the Airport will continue to cause an increase in both vehicle trips and curbside congestion due to drop-off/pick-up activity by private vehicles. These trips increase automobile emissions both locally and regionally, which is contrary to the intended air quality goals of the Massachusetts State Implementation Plan (SIP).[5] As part of its Long-Term Parking Management Plan, Massport is considering a series of remedies to limit increases in this type of drop-off/pick-up activity.

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*.

2015 Ground Access Highlights and Key Findings

- Current Annual Average Daily Traffic (AADT) and annual average weekday daily traffic (AWDT) values are 2 and 5 percent (respectively) lower than peak recorded (2007) on-Airport traffic volumes despite a 19.0-percent increase in passenger levels from 2007 to 2015. VMT over the same timeframe has decreased by roughly 9 percent, although, due to changes in modeling procedures, a direct VMT comparison cannot be made.

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4 310 Code of Massachusetts Regulations 7.30 and 40 Code of Federal Regulations 52.1120.

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

- The total number of air passengers increased by 5.7 percent to 33.4 million in 2015, compared to 31.6 million in 2014. During the same period, VMT on-Airport increased by 6.5 percent. There are likely many factors that contribute to the change in VMT. These factors will be further investigated in the *2016 ESPR*.
- The distribution of parking exits by length of stay have stayed relatively constant between 2014 and 2015, with a 1.1-percent decrease since 2014. The trend for the last few years has been to have vehicles generally parked for longer durations than in the past. This increase in parking duration likely contributed to a lower turnover of parking spaces, and therefore resulted in the higher peak days.
- Massport continued to be in full compliance with the Logan Airport Parking Freeze regulations in 2015. Daily parking demand in 2015 more frequently approached the Parking Freeze cap as compared to 2014, despite an increase in terminal area parking rates on July 1, 2014. As one element of its comprehensive transportation strategy, Massport proposes to build up to 5,000 new 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. The construction of additional commercial parking spaces at Logan Airport is predicated on a regulatory change,[6] by MassDEP, whereby MassDEP would amend the existing Logan Airport Parking Freeze to allow for some additional commercial parking spaces at Logan Airport. MassDEP has conducted a stakeholder process, which will be followed by initiating the process to amend the Parking Freeze regulation. Massport expects to initiate a parallel process with the Executive Office of Energy and Environmental Affairs (EEA) by filing an Environmental Notification Form (ENF) for new parking facilities sometime in early 2017.
- 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, all without increasing the number of drop-off/pick-up trips due to a constrained parking supply.
- The *2014 EDR* reported a 10.5-percent decrease in on-Airport VMT. This reflects Massport's efforts to reduce VMT through the opening of the Rental Car Center (RCC), which: (1) consolidated rental car operations to one location; (2) provides one unified rental car shuttle; (3) relocated the taxi and limousine/bus pool closer to terminal area roadways; and (4) included additional improvements to alternative transportation systems.
- Massport is currently offering a pilot program, Back Bay Logan Express, to determine whether a frequent, direct, express bus service increases HOV service from the City of Boston. This particular service has been valuable in providing an alternative to air passengers and employees who have been 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 to the Airport. After the re-opening of Government Center Station in March 2016, this pilot program has continued. Ridership in 2015 for the Back Bay Logan Express totaled 290,796 passengers, an average of about 805 riders per day. In 2014, the service averaged 624 riders per day, with a total of 152,892 passengers between April 28 and December 31, 2014.

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6 310 Code of Massachusetts Regulations 7.30.

- In 2015, Massport consolidated 2,050 temporary parking spaces in an addition to the West Garage and at the existing surface lot between the Logan Office Center and the Harborside Hyatt. These spaces constitute all the remaining spaces permitted under the Logan Airport Parking Freeze.
- As part of the Terminal E Modernization Project, Massport will construct a weather-protected direct connection between Terminal E and the MBTA Blue Line Airport Station, which will improve the passenger experience and convenience. The project, and the MBTA connection, is in the conceptual design phase and future Environmental Data Repots (EDRs) and Environmental Status and Planning Reports (ESPRs) will provide updates as final design and construction proceed (see Chapter 3, *Airport Planning,* for additional information on this project.)

Ground Transportation Modes of Access to Logan Airport

The Logan Airport EDRs and ESPRs 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 uses the following definitions:

HOV (Shared-Ride) Modes

- Public transit (Blue Line rapid transit, Silver Line bus rapid transit, MBTA bus, 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 Autos;
- Taxis (regardless of the number of passengers in a vehicle); and
- Rental Cars
- Transportation Network Companies, or TNCs (such as Uber, Lyft, and Fasten).[7]

7 A 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 will be discussed in the *2016 ESPR.*

Although private automobiles, taxis, and rental cars often carry multiple occupants, they are not categorized as HOV modes.[8] The *Ground Access Planning Considerations* section later in this chapter includes further discussion of the Logan Airport HOV mode share.

Massport has been 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, HOV or shared-ride service; (2) drive to Logan Airport and park; or (3) drop-off/pick-up mode, which can involve a private vehicle, taxi, limousine or taxi alternative. In this categorization, the major "modes" are:

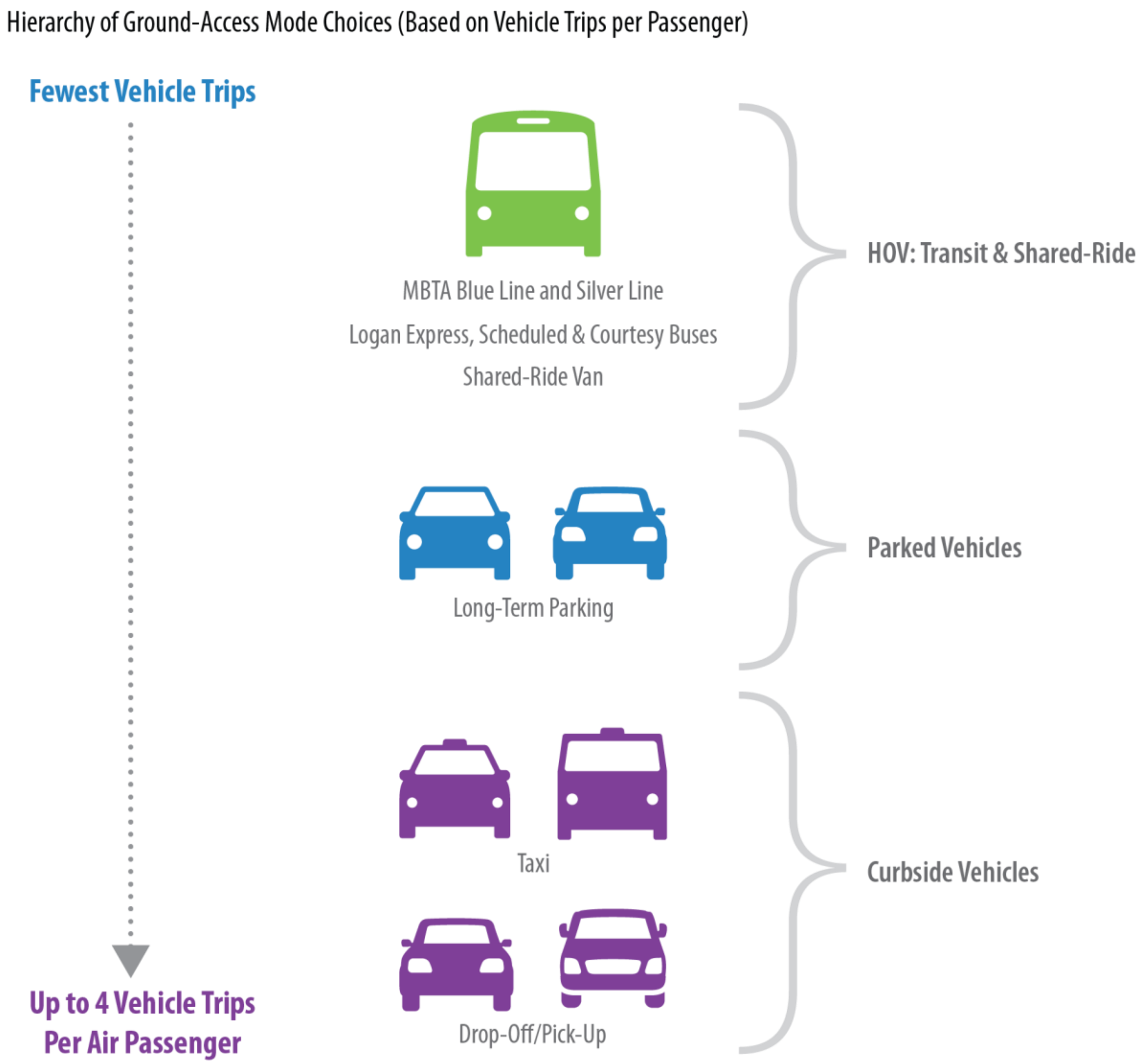
- Transit and shared-ride:
  - MBTA services (Blue Line, Silver Line);
  - Massport services (Logan Express); and
  - Private operators (scheduled coach express bus, shared-ride vans, courtesy shuttles).
- Private vehicles that are parked for the duration of the trip.
- Vehicles that drop-off or pick-up passengers at the terminal curbs, but do not remain on-Airport:
  - Private vehicles that do not park for the duration of a passenger's trip;
  - Taxicabs; and
  - "Black car" limousines.[9]

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 passenger (and a single vehicle trip from the Airport for the arriving passenger). Vehicles that do not remain on the Airport for a passenger's trip duration, such as those private vehicles that have dropped off a passenger at the curb, generate a trip to and a trip from the Airport for a departing passenger. In the case of taxicabs and black car limousines, many of them depart Logan Airport empty after dropping off a passenger. As **Figure 5-1** shows, when measured in terms of vehicle trips generated, the most environmentally desirable mode is transit/HOV/shared-ride, followed by drive-and-park, with the least desirable mode being drop-off/pick-up**.**

8 The *2013 Logan Airport Air Passenger Ground Access Survey* indicates that the average occupancy of these automobile modes (private automobiles, taxis, and rental cars) is 1.9 persons per vehicle, indicating that Massport is somewhat conservative in the calculation of HOV/SOV split. The HOV mode share goal is based on modal categories and not on actual vehicle occupancy. The findings of the *2016 Logan Airport Air Passenger Ground Access Survey* will be reported in the *2016 ESPR*.

9 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



Note: Short-term parking is included under "drop-off/pick-up"

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

This section reports on Logan Airport's traffic-related activity for 2015, 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 2015.

Gateway Traffic Volumes

Gateway roadways are defined as access points to/from Logan Airport, which 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 now equipped with permanent traffic count stations, as part of the Airport-wide Automated Traffic Monitoring System (ATMS). These stations provide data to calculate:

- AADT, annual average daily traffic;
- AWDT, annual average weekday daily traffic; and
- AWEDT, annual average weekend daily traffic.

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 based on a combination of the seasonality (monthly variation) of counts from other ATMS stations, air passenger levels, and parking exits. On occasion, traditional automated traffic recorder (ATR) counts are collected to supplement the ATMS data.

Annual Average Daily Activity Levels

Table 5-1 summarizes the daily gateway traffic volumes at Logan Airport for the years 2011 through 2015. It includes AADT, AWDT, AWEDT, and annual air passengers, for reference.

The AADT entering and departing Logan Airport via its gateway roadways increased by 0.1 percent between 2014 and 2015. The change in average daily traffic can be attributed to:

- A 5.7-percent increase in air passenger activity in 2015;
- A 3.0-percent increase in taxi dispatches in 2015; and
- A 1.1-percent decrease in parking activity (exits) in 2015.

Historically, the highest AADT recorded at Logan Airport was in 2007, when AADT reached 110,690, AWDT was 119,200, and AWEDT was 91,320 that same year. These gateway traffic volumes corresponded to an annual air passenger level of 28,102,455 passengers. Current AADT and AWDT values are 2 and 5 percent (respectively) lower than current on-Airport traffic volumes despite a 19.0-percent increase in air passenger levels from 2007 to 2015.

Table 5-1 Logan Airport Gateways: Annual Average Daily Traffic, 2011 - 2015

	AADT		AWDT		AWEDT		Annual Air Passengers	
Year	**Volume**	**Percent Change**	**Volume**	**Percent Change**	**Volume**	**Percent Change**	**Level of Activity**	**Percent Change**
2011	99,449	5.6%	104,863	6.0%	85,879	4.0%	28,909,267	5.4%
2012	99,281	(0.2%)	104,439	(0.4%)	86,494	0.7%	29,236,087	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	108,251	**0.1%**	113,365	**(0.2%)**	95,453	**0.6%**	**33,449,580**	**5.7%**

Source: Massport
Notes: Numbers in parentheses ( ) represent negative numbers.
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 within 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 within 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[10] 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, based on the prior terminal roadway system. The VISSIM model was developed for a larger study area than the original VMT model, which only focused on the major Airport gateways, the circulation roadways, and the terminal areas. The VISSIM model now accounts for a larger on-Airport study area from Lovell Street and the North Cargo Area (NCA) to Harborside Drive and the South Cargo Area (SCA), and includes the Southwest Service Area (SWSA). The overall VMT growth due to the slightly larger study area is negligible. The study area of the VISSIM model roadway network can be found in Appendix G, *Ground Access*. The VISSIM model not only

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

estimates VMT associated with curbside activity and parking, but also with Logan Airport operations, rental car activity, and hotel activity.

The model was calibrated to existing evening (PM) peak hour volume data to improve the accuracy of the results. Adjustment factors were determined to calculate morning peak hour, highest 8-hour, and average weekday VMT from the updated VISSIM model. The adjustment factors for the 2015 VMT calculations were determined by using 2011 to 2015 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 2015 condition.

Estimated VMT Calculations and Modeling Results

Consistent with previous years, the following specific time periods were analyzed for 2015:

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

Table 5-2 summarizes the VMT estimates for Logan Airport-related traffic from 2011 through 2015. As noted above, based on the traffic data obtained from Massport's ATMS, the change in on-Airport daily traffic volumes between 2014 and 2015 was negligible. However, 2015 evening peak hour gateway volumes grew by roughly 5 percent when compared to 2014. Additionally, a shift in gateway traffic entering/exiting the Airport from the Ted Williams Tunnel to the Sumner/Callahan Tunnels was noted. Daily traffic volumes in the Ted Williams Tunnel decreased by 8.4 percent (from 49,600 to 45,400 vehicles) while volumes in the Sumner/Callahan Tunnels increased by 19.5 percent (from 29,800 to 35,600 vehicles). The distance between the terminal curbsides and the Sumner/Callahan Tunnel portal is roughly 100 feet longer entering the Airport and 315 feet longer exiting the Airport when compared to the Ted Williams Tunnel. Therefore, each trip shifting to the Sumner/Callahan Tunnel from the Ted Williams Tunnel generates a net increase in VMT. While there are likely other small factors that contribute to the change in VMT, this increased distance per tunnel trip and the increase in peak hour gateway traffic are the primary contributors to a 6.5-percent increase in VMT. Details of the 2015 VMT modeling results are presented in Appendix G*, Ground Access.*

Table 5-2	**Airport Study Area Vehicle Miles Traveled (VMT) for Airport-Related Traffic, 2011 - 2015**				
Analysis Year	**AM Peak Hour**	**PM Peak Hour**	**High 8-Hour**	**Average Weekday**	**Average Weekday Percent Change**
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%**

Source: VHB and Massport.
Note: 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, relocation of the taxi and bus/limousine pools, and terminal curbside reallocations in support of the unified shuttle.

Since 2000, the highest average weekday VMT estimated at Logan Airport was in 2007, when weekday VMT was modeled at 184,613. Although VMT was estimated at lower levels in 2015, a direct comparison between values cannot be made. The current VMT model (adopted in 2011) includes a substantially bigger on-Airport study area than the previous model, which was limited to terminal access roads.

FIGURE 5-2 **Logan Airport Roadway Network**

2015 Environmental Data Report

Parking Garages
Terminal Buildings
Airport Roadways

0 450 900 1800 Feet

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 utilization 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).

Logan Airport Parking Freeze[11]

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]). 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 2015 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[12] 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.

Under the Parking Freeze regulations, 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, and must be provided free of charge when demand exceeds the limit. Additional information on parking demand and conditions under constrained parking is provided later in this section.

11 310 Code of Massachusetts Regulations 7.30 and 40 CFR 52.1120.

12 310 Code of Massachusetts Regulations 7.31.

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

	Type of Spaces		
Year	**On-Airport Commercial Spaces**	**On-Airport Employee Spaces**	**Total Logan Airport Spaces Permitted**
2011 - 2012	18,019	2,673	20,692
2012 - 2013	18,265	2,673	20,938[1]
2013 - 2014	18,415	2,673	21,088[2]
2014 – 2015	**18,415**	**2,673**	**21,088**

Source: Massport.

1 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.

2 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 emissions by shifting air passengers to travel modes requiring fewer vehicle trips. However, by constraining parking on-Airport, 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 *2013 Logan Airport Air Passenger Ground Access Survey,* if parking was not an option for passengers who parked on-Airport, 75 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, or black car/limousine service). Prior surveys of Logan Airport air passengers have consistently shown approximately the same result.

As air traveler numbers have increased, the constrained parking supply at Logan Airport has periodically had the unintended consequence of contributing to 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). As one element of its comprehensive transportation strategy, Massport proposes to build up to 5,000 new 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.

The construction of additional commercial parking spaces at Logan Airport is predicated on the approval of a regulatory change[13] by MassDEP. whereby MassDEP would amend the existing Logan Airport Parking Freeze to allow for some additional commercial parking spaces at Logan Airport. MassDEP has conducted a stakeholder process, which will be followed by initiating the process to amend the Parking Freeze regulation.

13 310 Code of Massachusetts Regulations 7.30.

Massport expects to initiate a parallel process with EEA by filing an ENF for new parking facilities sometime in early 2017.

Parking Space Availability Changes

Table 5-4 provides a summary of the Logan Airport commercial parking space inventory.

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** and **5-4**). Massport continued to be in full compliance with the Logan Airport Parking Freeze[14] in 2015. Massport diverted or valet-parked passenger vehicles 109 out of 260 working days. Vehicle diversions primarily occurred on Tuesdays and Wednesdays, during hours of peak parking demand. Activity in 2015 seems to indicate that peak day parking demand has not dampened despite the July 2014 parking rate increases for on-Airport parking.

14 310 Code of Massachusetts Regulations 7.30 and 40 CFR 52.1120.

Table 5-4 Logan Airport Parking Freeze: Allocation of Commercial Parking Spaces, 2011-2015

	Number of Spaces						Status
Location and Facility	**March 2011**	**March 2012**	**March 2013**	**March 2014**	**March 2015**	**September 2015**	
Terminal Area							
Central Garage and West Garage	10,375	10,344	10,396	10,267	10,267	10,340	
Terminal B Garage	2,380	2,632	2,553	2,254	2,254	2,201	
Terminal E Lot 1	269	269	269	275	243	237	
Terminal E Lot 2	257	257	251	248	248	249	
Terminal E Lot 3	229	222	222	219	219	217	
North Cargo Area (NCA)							
Economy Parking Garage	2,880	2,789	2,809	2,809	2,809	2,864	
Overflow/Temp Lots	666	-[1]	-[1]	-[1]	832	863	
Total in-service revenue commercial spaces	17,056	16,513	16,500	16,072	16,872	16,971	Excludes hotel and general aviation (GA) spaces (noted below)
Signature Flight Support (General Aviation)	35	35	35	35	35	35	
Hotel (Hilton, Hyatt)	505	505	505	505	305	305	One Hilton lot eliminated for West Garage expansion
Total in-service commercial spaces	17,596	17,053	17,040	16,612	17,212	17,311	Includes hotel and GA spaces
Total commercial spaces (Freeze limit)[2, 3]	17,619	18,019	18,265	18,415	18,415	18,415	Includes in-service and designated spaces

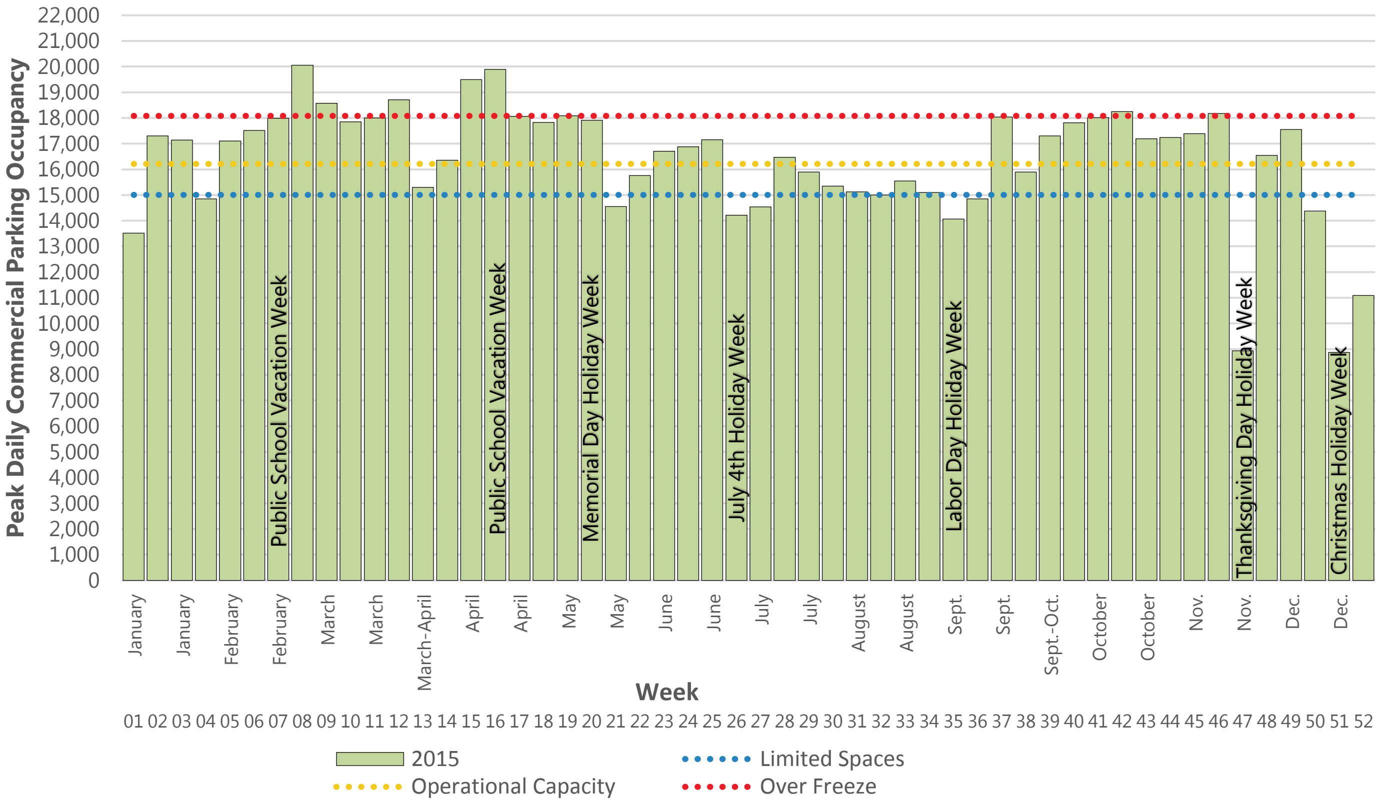
Source: Massport, Parking Freeze Inventory, March 2011, March 2012, March 2013, March 2014, and March and September 2015.

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

2 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.

3 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, 2015



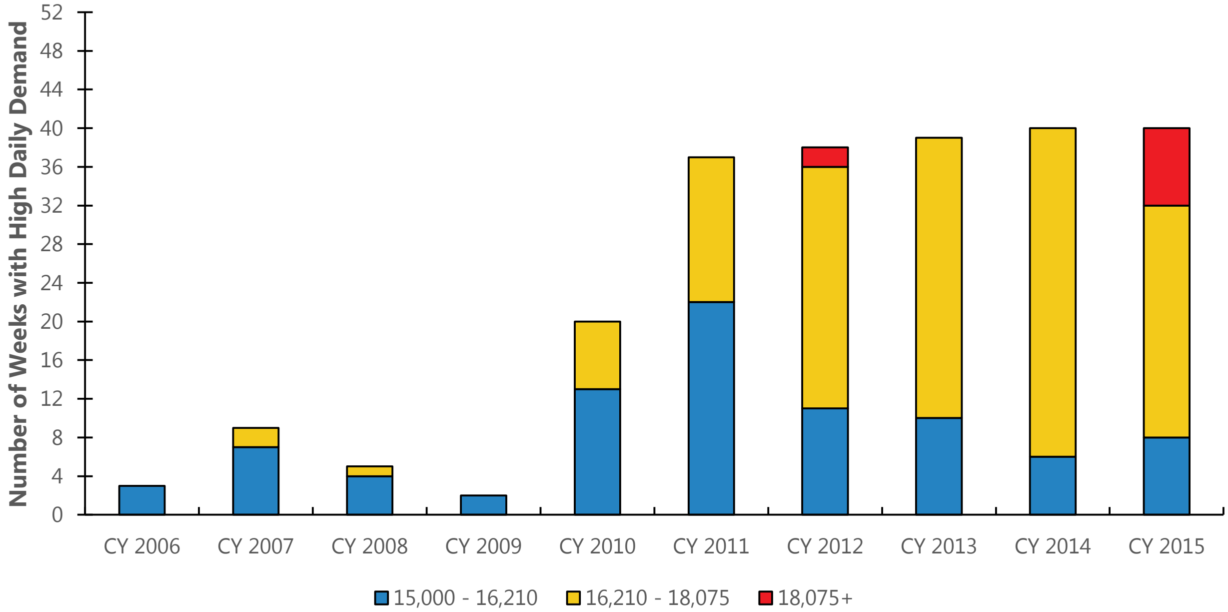
Source: Massport.

Notes: The chart shows the highest daily count for each week in 2015.
In 2015, the operational capacity of in-service commercial spaces was 16,210.
At no time in 2015 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 2015.

Operational Adjustments to Meet Parking Demand

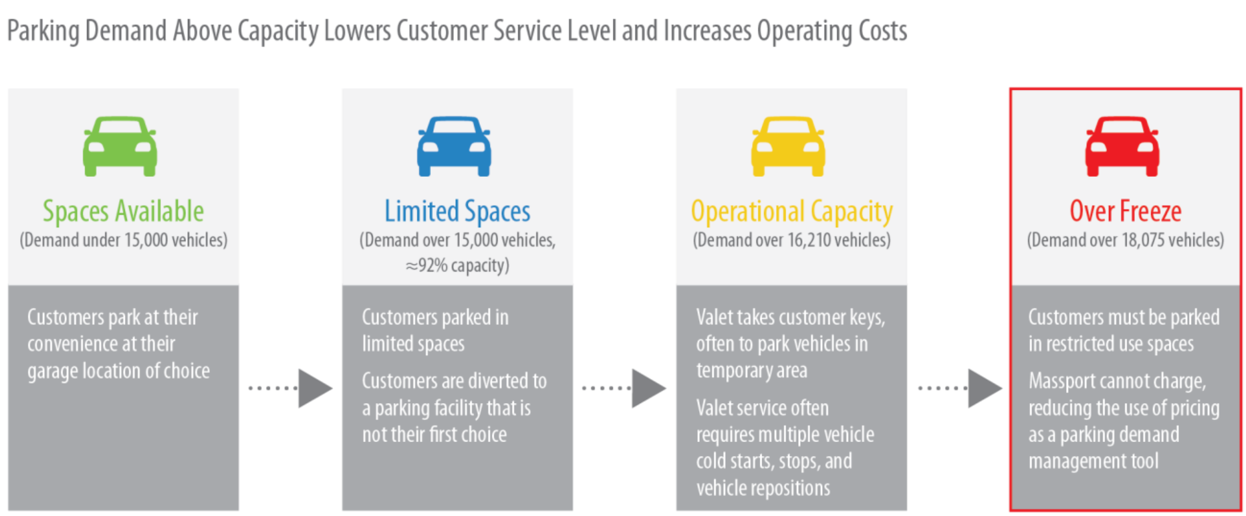
The inadequate supply of parking causes air passengers to circulate on Airport roadways to find parking, and in overflow conditions, cars are diverted or moved to non-garage parking areas, including overflow lots, some of which are located off-Airport. Not only does parking demand activity above capacity 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 2015 Parking Demand and Capacity



Source: Massport

Note: 18,075 represents the total number of on-Airport parking spaces allocated within the Parking Freeze in 2015. Hotel and general aviation uses are excluded from the commercial Parking Freeze limit.

The number of diverted and valeted vehicles has increased significantly over the past several years. In 2015, 104,384 vehicles were diverted or valeted. These vehicle diversions increase on-Airport VMT. The peak of valet operations coincides with peak parking demand, requiring Airport operations to utilize available space to meet parking demand.

Parking Exits by Duration

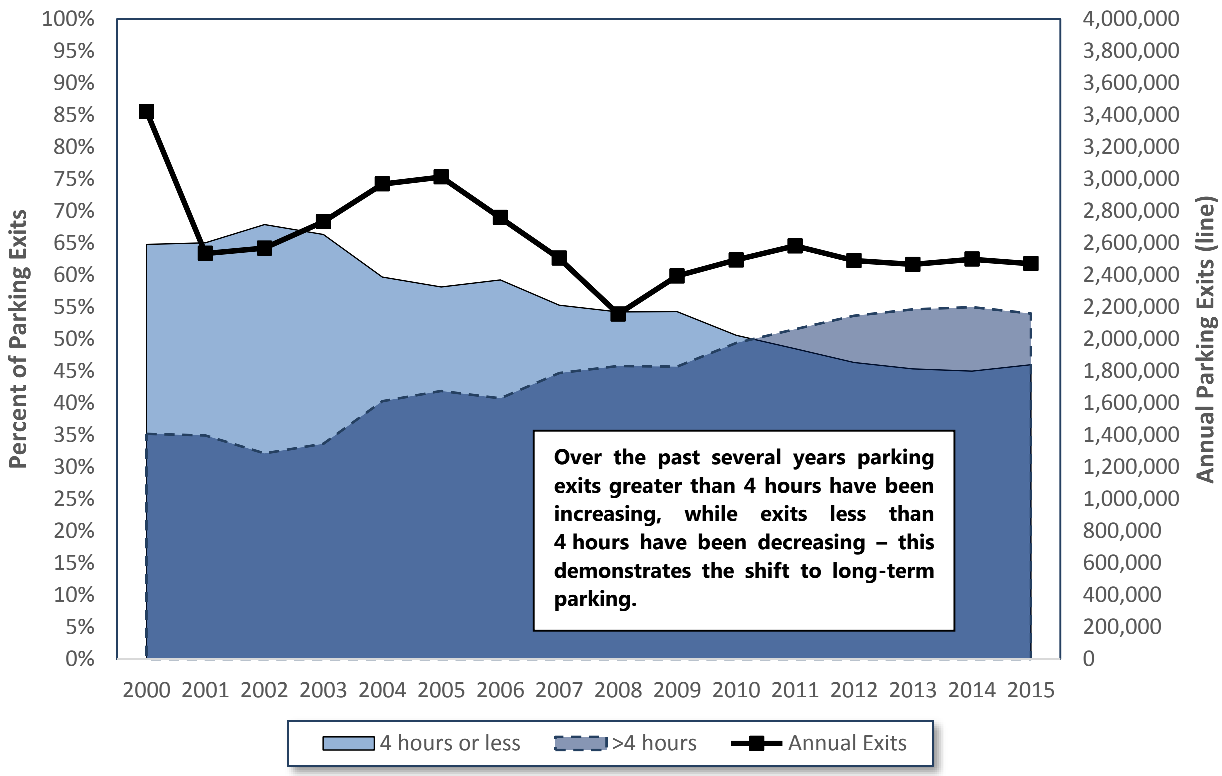
Peak-day parking demand increased in 2015 from 2014, however the total annual parking activity (as defined by revenue parking exits) decreased slightly, as presented in **Table 5-5**. The distribution of parking exits by length of stay have stayed relatively constant between 2014 and 2015, with a 1.1-percent decrease since 2014. The trend for the last few years has been to have vehicles generally parked for longer durations than in the past, with durations of four hours of greater gaining shares of the total over time (**Figure 5-6**). This increase in parking duration likely contributed to a lower turnover of parking spaces, and therefore resulted in the higher peak days as shown earlier in **Figure 5-3**.

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

		0-4 hrs.	>4-24 hrs.	>1-4 days	>4 days	Total
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%	
Percent change – 2014 to 2015		**(0.3%)**	**2.6%**	**(4.1%)**	**1.5%**	**(1.1%)**

Source: Massport.
Note: Numbers in parentheses ( ) represent a reduction

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



Source: Massport.

2015 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 2014, while parking rates for Logan Express remote parking have remained substantially lower than those at Logan Airport. As noted earlier, however, demand for on-Airport parking in the terminal area is not price-sensitive and these parking rate increases have so far failed to dampen parking demand.

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 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. The parking rates for the three major off-Airport parking providers (PreFlight, Park Shuttle & Fly, and Thrifty) vary from $15.95 to $20.00 for daily parking and from $96 to $120 for weekly parking.

Table 5-6 On-Airport Commercial Parking Rates, 2011 - 2015

Terminal Area Facility	**2011**	**2012**	**2013**	**2014**	**2015**	**Economy Parking**	**2011**	**2012**	**2013**	**2014**	**2015**
Central/West Parking Garage, Terminal B Garage, Terminal E Lots						Economy Parking Garage					
0 to 30 minutes	$3	$3	$3	$3	$3	Daily Rate	$18	$18	$18	$20	$20
31 minutes to 1 hour	$6	$6	$6	$6	$6	Additional days 0 to 6 hours	$9	$9	$9	$10	$10
1 to 1.5 hours	$9	$9	$9	$11	$10	Additional days 6 to 24 hours	$18	$18	$18	$20	$20
1.5 to 2 hours	$12	$12	$12	$14	$14	Weekly Rate (6-7 days)	$108	$108	$108	$120	$120
2 to 3 hours	$15	$17	$17	$19	$19						
3 to 4 hours	$18	$21	$21	$23	$23						
4 to 7 hours	$22	$25	$25	$27	$27						
7 to 24 hours (Daily)	$24	$27	$27	$29	$29						
Additional days 0 to 6 hours	$12	$14	$14	$15	$15						
Additional day(s) 6 to 24 hours	$24	$27	$27	$29	$29						

Source: Massport; most recent rates effective July 1, 2014.

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 also reduced the number of on-Airport employee spaces to further reduce VMTs.

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 2015, Massport diverted or valet-parked private passenger vehicles to various on-Airport locations approximately 109 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 utilize 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 that it controls both at Logan Airport and at Massport-controlled off-Airport locations to achieve its ground access objectives.

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

Parking Plan Element	Progress to Date (since 2014)
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 ▪ Work to increase the supply of Massport-controlled off-Airport parking at Logan Express sites	▪ 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. ▪ A new 1,100 car parking garage opened in Framingham on April 15, 2015, increasing on-site capacity at that location by approximately 600 spaces.
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 ▪ 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 ▪ Evaluate increased parking prices for terminal-area parking to encourage Airport passengers and visitors to consider transit and shared-ride alternatives	▪ Massport has reduced parking rates at Logan Express facilities from $11.00 per day to $7.00 per day.

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

Parking Plan Element	Progress to Date (since 2014)
Parking Demand: ▪ Increase alternative HOV mode options to decrease use of private vehicles	▪ Implemented new Back Bay Logan Express scheduled bus service in May 2014 as a pilot program. ▪ Offers discounted parking and bus fares at all Logan Express locations during peak air travel periods. ▪ 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 680 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.
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 supports the Sunrise Shuttle, which provides early morning bus service from East Boston prior to the start of MBTA service. ▪ Massport provides employee parking in Chelsea with free 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.

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 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 RCC has sheltered bicycle parking racks for use by both employees and passengers.

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 utilize the unified bus system or pedestrian connections to the terminals. In the North Service Area, connections to/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 2015, there were 11,545 East Boston Greenway users that were recorded by the counters. Massport assumed ownership of the park, known as the Narrow Gauge Connector, in the spring of 2016.

Ground Transportation Ridership and Activity Levels in 2015

This section of the chapter:

- Provides an overview of transportation services available to Logan Airport users from the Boston metropolitan area;
- Reports on 2015 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, 2011 – 2015

	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**
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**
Percent Change (2014-2015)	**(11%)**	**N/A**	22%	(2%)	13%	**(60%)**	**5%**

Source: Massport
Notes: Numbers in parentheses ( ) represent negative numbers.
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 and 2013 values are estimates. No information available for 2014 or 2015.
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.

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 below, 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 below. **Figure 5-8** depicts Logan Express bus locations with respect to the regional transportation network.

The 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. Service hours for all four locations are roughly 3:00 AM to 1:00 AM the next day.

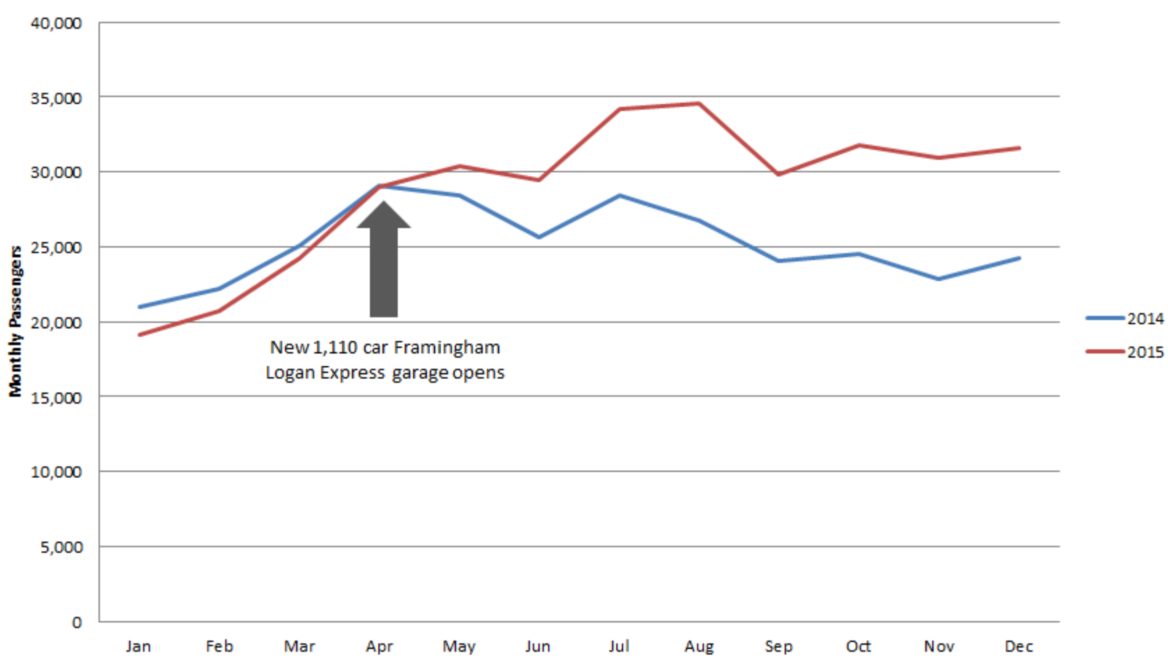
As illustrated in **Table 5-8**, air passenger ridership on Logan Express increased by approximately 9 percent from 2014 to 2015. Employee ridership decreased by approximately 2 percent between 2014 and 2015. A detailed breakdown of the Logan Express ridership is presented in Appendix G, *Ground Access*.

New Framingham Logan Express 1,100-space garage.
Source: Massport

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 600 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 including energy-efficient LED lighting, water saving fixtures, bike racks, and priority parking for alternative fuel vehicles. The new facility has been a success: 2015 ridership of the Framingham Logan Express increased by 10 percent compared to the 2014 ridership, with 428,623 riders in 2015 versus 391,134 riders in 2014. The increase in passengers since the garage opened is displayed in **Figure 5-7**.

Figure 5-7 Framingham Logan Express Ridership



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 to observe whether a frequent, direct, express bus service from the downtown business area provides a viable alternative mode of transportation to the Airport.

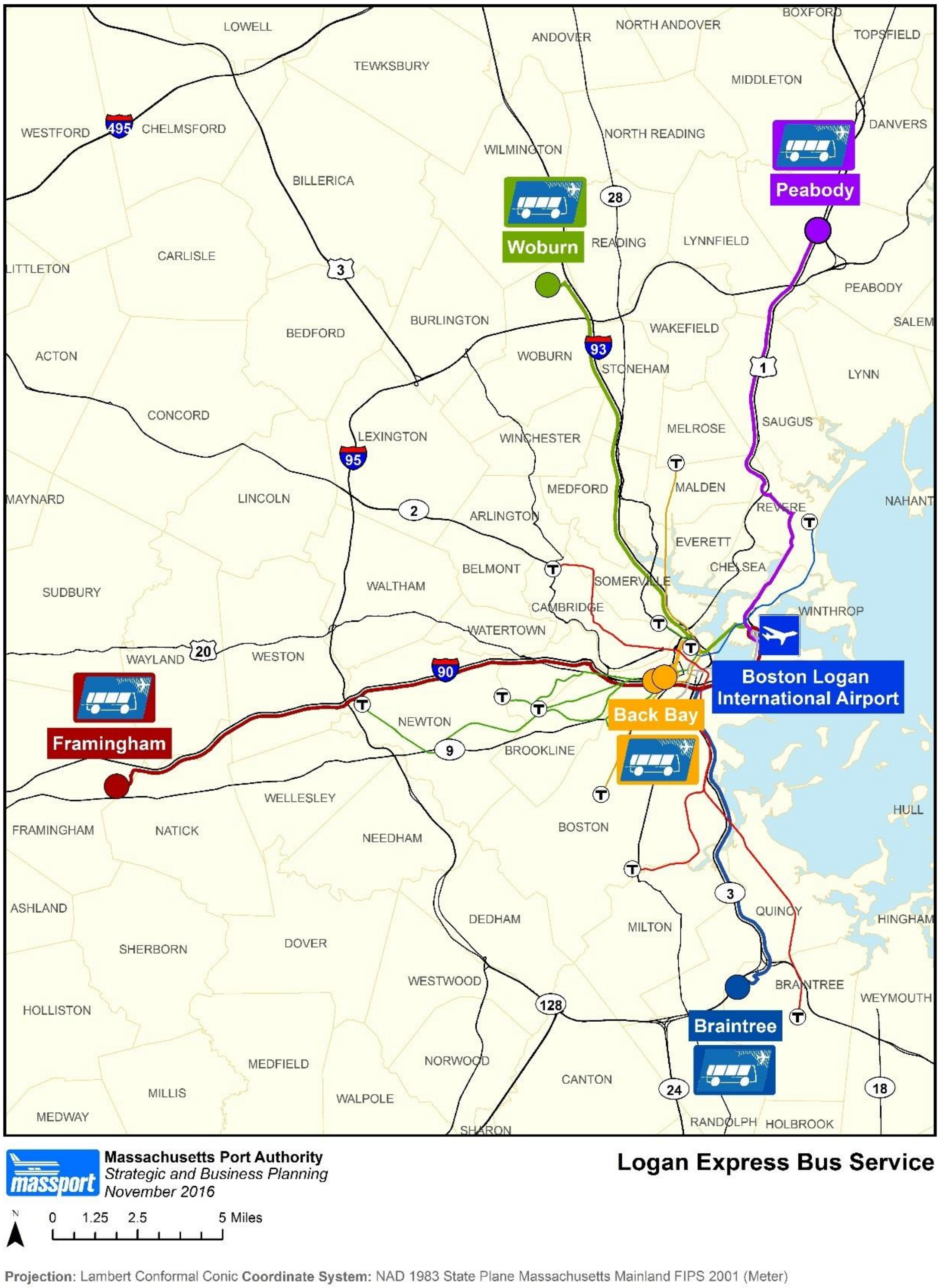
The Back Bay Logan Express Pilot has been valuable in providing an alternative to air passengers and employees who had been impacted by the temporary, two-year Government Center station closure (a key connection to the Blue Line and Logan Airport), and it provides a new transit alternative to the Airport. After the re-opening of Government Center Station in March 2016, this pilot program has continued. Ridership in 2015 for the Back Bay Logan Express totaled 290,796 passengers, an average of about 805 riders per day. In 2014, the service average 624 riders per day, with a total of 152,892 passengers between April 28 and December 31, 2014. 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

Month	January	February	March	April	May	June	6 Month Total
Ridership	16,742	14,671	24,930	23,175	27,636	25,655	132,809

Month	July	August	September	October	November	December	6 Month Total
Ridership	28,118	28,746	27,311	25,848	25,126	22,838	157,987
							2015 Total
							290,796

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



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 *2013 Logan Airport Air Passenger Ground Access Survey,* these services are used by over 7 percent of Logan Airport's air passengers. Almost 17 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, the majority 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 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 nearly 2.1 million riders entered Airport Station in 2015 (see **Figure 5-10**). This is about an 11-percent decrease compared to 2014. As noted in previous reports, fare gate data do not distinguish between Airport related riders and East Boston users. Airport passenger ridership levels on the Blue Line can no longer be directly identified as part of the ESPR/EDR reporting.[15] Since fare gate data are combined, there is no way of discerning whether the drop-in boardings at Airport Station are related to air passengers or East Boston riders.

Silver Line (SL1) Ridership

The Silver Line bus rapid transit 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, 2015 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.

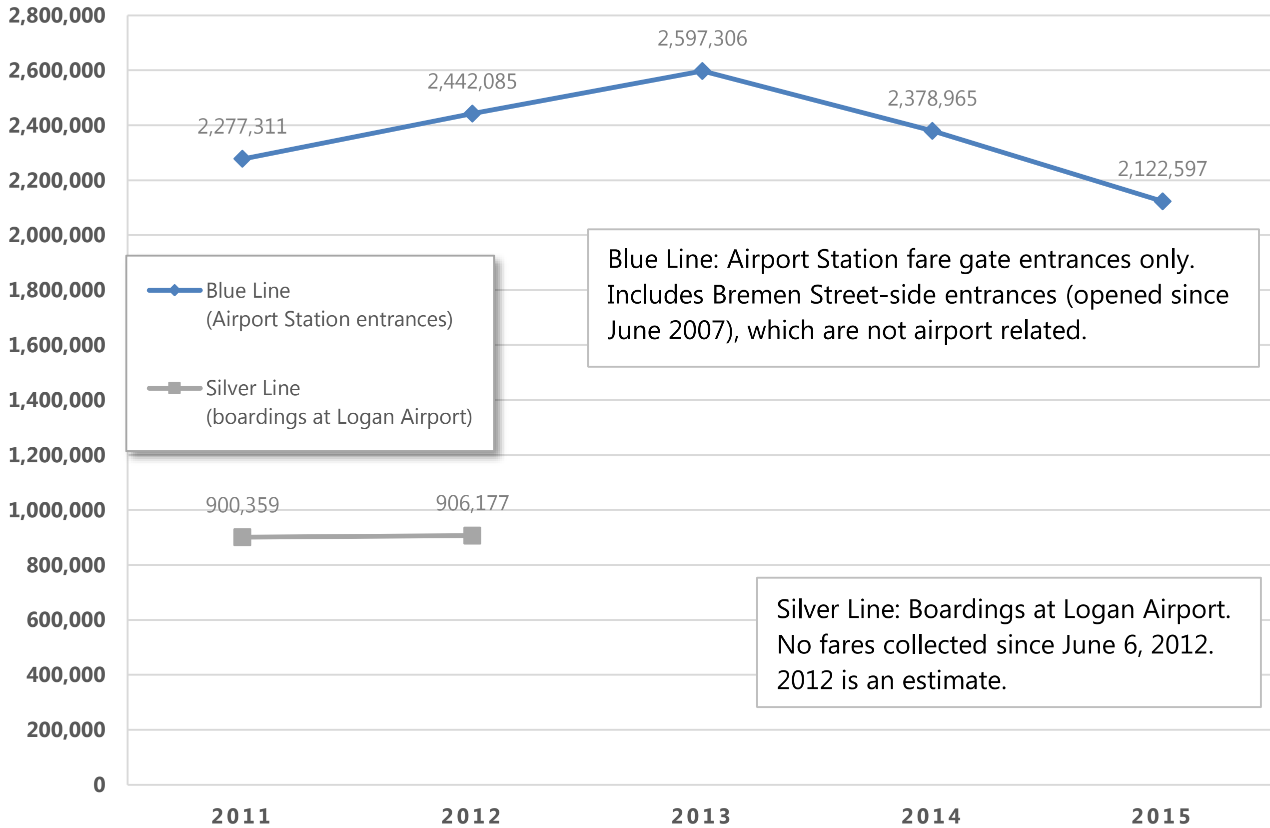
Eight SL1 buses are owned by Massport and are operated by the MBTA with a Massport subsidy. The Silver Line is the only MBTA rapid transit service that provides a direct, one-seat connection to each Airport terminal (the Blue Line requires a second-seat ride on a free Massport shuttle to connect riders to terminals, while express MBTA transit buses connect only at Terminal C, and local bus service to the Airport is very 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.

15 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), 2011-2015



Source: Massport

Water Transportation: Water Taxis and MBTA Ferries

Three companies provide water transportation within the Boston area: City Water Taxi, Rowes Wharf Water Shuttle, and the MBTA's 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; Lovejoy Wharf near North Station; and stops in the North End, Charlestown, Chelsea, and East Boston. The MBTA Harbor Express provides services to Long Wharf and destinations outside of the Inner Harbor, including Hingham and Hull.[16] 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.

16 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 2015, the one-way fare to cross the Boston Harbor from Long Wharf to Logan Airport costs $13.75, and $17 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.

Water transportation accounts for less than 1 percent of the mode share to Logan Airport, according to the *2013 Logan Airport Air Passenger Ground Access Survey*. Annual ridership on privately-provided water transportation experienced an increase of 5 percent in 2015 compared to 2014, while ridership on the MBTA Harbor Express declined by 60 percent (**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 overall use of these HOV modes increased by about 7 percent in 2015 compared to 2014, with a substantial shift from courtesy vehicles to the use of scheduled vans and limousines. The use of scheduled buses stayed relatively constant between 2014 and 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 Activity Levels (Estimated Ridership) for Other Scheduled and Unscheduled HOV Modes: Scheduled Buses, Shared-Ride Vans, Courtesy Vehicles, and Limousines, 2011 - 2015

	Scheduled and Unscheduled HOV Modes			
Year	**Scheduled Buses**	**Scheduled Vans & Limousines**	**Courtesy Vehicles**	**Limousines (unscheduled)**
2011	360,237	473,199	594,706	1,095,420
2012	377,608	311,737	653,728	1,199,011
2013	374,792	207,738	646,739	1,168,774
2014	373,138	148,048	651,583	1,506,705
2015	371,853	237,188	470,616	1,802,350
Percent Change (2014 - 2015)	(<1%)	60%	(38%)	20%

Source: Massport
Notes: Numbers in parentheses ( ) represent decreased ridership.
Ridership is estimated based on dispatched vehicles, according to records from the Logan Airport bus/limousine pool, and the average occupancy per vehicle, according to the ground-access survey.

Non-HOV (Automobile) Modes

Logan Airport passengers can access the Airport by a number of automobile modes, including private automobiles, taxis, and rental cars. These modes account for about 72 percent of the access modes used by air passengers, based on the *2013 Logan Airport Air Passenger Ground Access Survey*. Although these modes are categorized as non-HOV, they frequently carry more than one passenger per vehicle. Based on the 2013 survey results, the average vehicle occupancy for these automobile modes is estimated at 1.9 to 2.1 passengers per vehicle.

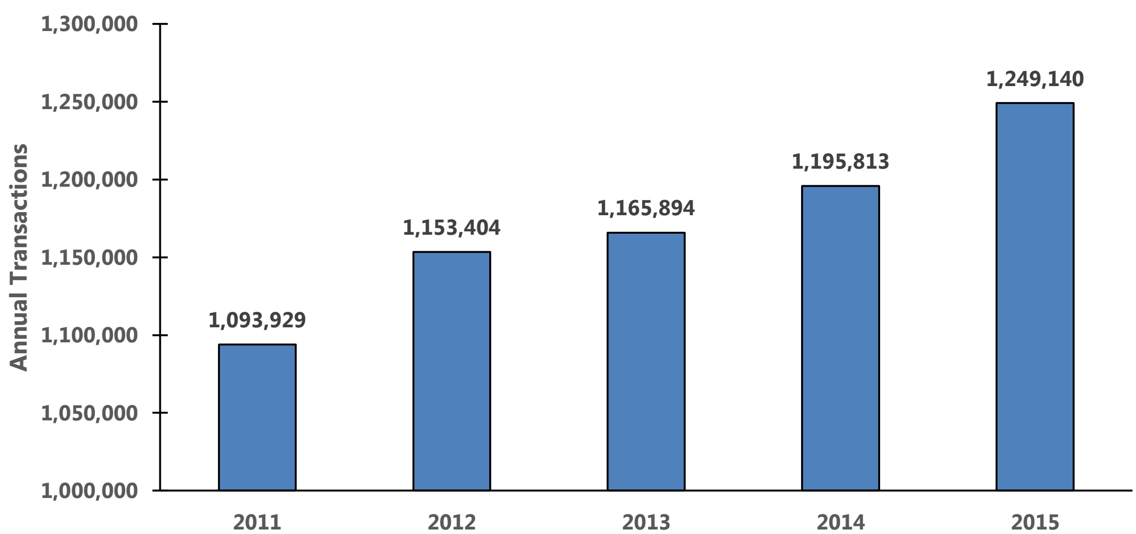
Automobile Access

Private automobile access to the Airport is classified as either curbside drop-off or parked on-Airport (terminal area or remote/Economy). Traffic conditions 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, 2011-2015



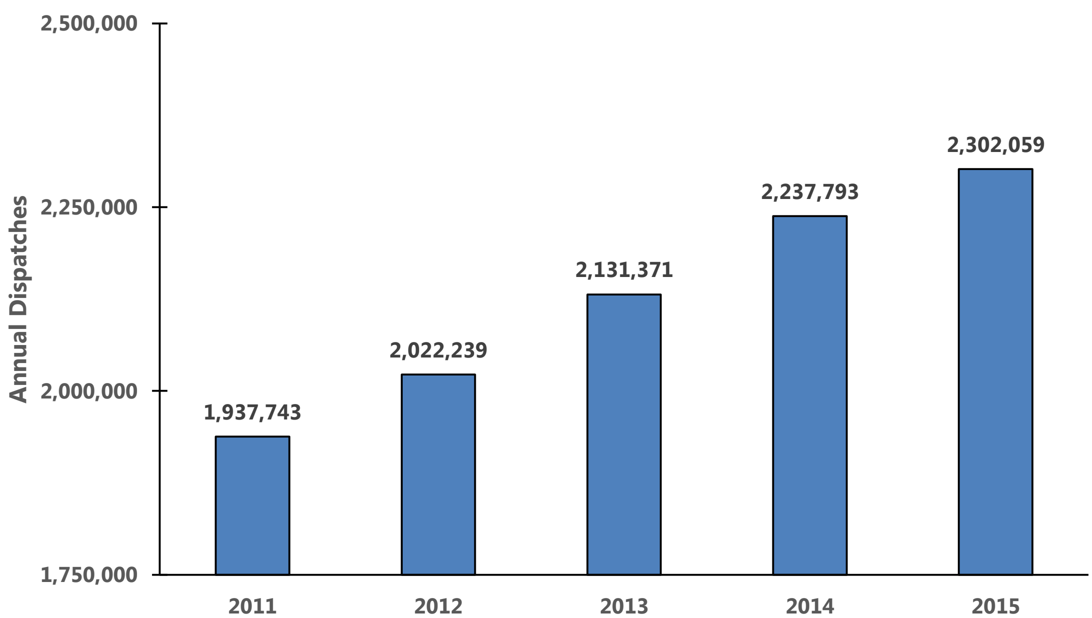
Source: Massport

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 2015 by 3 percent over the 2014 level (**Figure 5-12**). However, in 2015, there were approximately 252 hours (experienced on 187 days) during which Logan Airport had a shortage of cabs and had to resort to multiple passenger/party loading at the curbs.

Taxi dispatches reflect the increase in air passenger levels. Taxi use in 2015 reached the highest recorded level at Logan Airport (2.3 million dispatches in 2015 when Logan Airport served 33.4 million annual air passengers).

Figure 5-12 Annual Taxi Dispatches at Logan Airport, 2011-2015



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 proceed to the short job lane at Logan Airport's taxi pool; this allows these "green cabs" to be dispatched to the terminals in a shorter amount of time.

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 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.[17] In subsequent environmental documents, the 35.2-percent HOV mode share became a declared goal related to ground access to Logan Airport.[18]

Progress toward this goal is measured using the triennial air passenger ground-access survey. The latest survey, which was conducted in 2013, revealed an air passenger ground-access mode share of 28 percent for HOV/shared-ride modes, which is a share consistent with past surveys. 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 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.[19] The latest survey was conducted in the spring of 2016; results from that survey will be shared in the *2016 ESPR*.

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 *2013 Logan Airport Air Passenger Ground Access Survey* indicates an average occupancy of 2.0 air passengers per private vehicle used for airport ground access.

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

18 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]

19 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.

Table 5-11 Average Vehicle Occupancy by Vehicular Ground Access Mode (2013)

Mode	Vehicle Occupancy	% SOV Trips
Private Vehicle	2.0	24%
Taxicab	1.8	28%
Rental Vehicle	1.6	37%
Subtotal for Automobile Modes	**1.9**	**28%**
Car Service ("black car" limousine by reservation)	1.9	30%
Courtesy Shuttle	3.6	7%
Shared-Ride Van or Limousine (scheduled or reservation)	4.4	7%

Source: Massport, *2013 Logan Airport Air Passenger Ground-Access Survey*. Based on air passengers departing on both weekdays and weekend days.

Notes: The true average occupancy per vehicle arriving at the Airport cannot be computed from the responses to the survey because it is not possible to identify multiple travel parties arriving in a single vehicle. 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 traveling are excluded from the 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
- 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 to a constrained parking supply.

Massport is investigating alternative methods to describe the mode use and travel patterns of air passengers using Logan Airport to better reflect these considerations and track progress toward meeting all of 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.[20] As described earlier in this chapter, during many weeks in 2015, 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 is not showing 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.

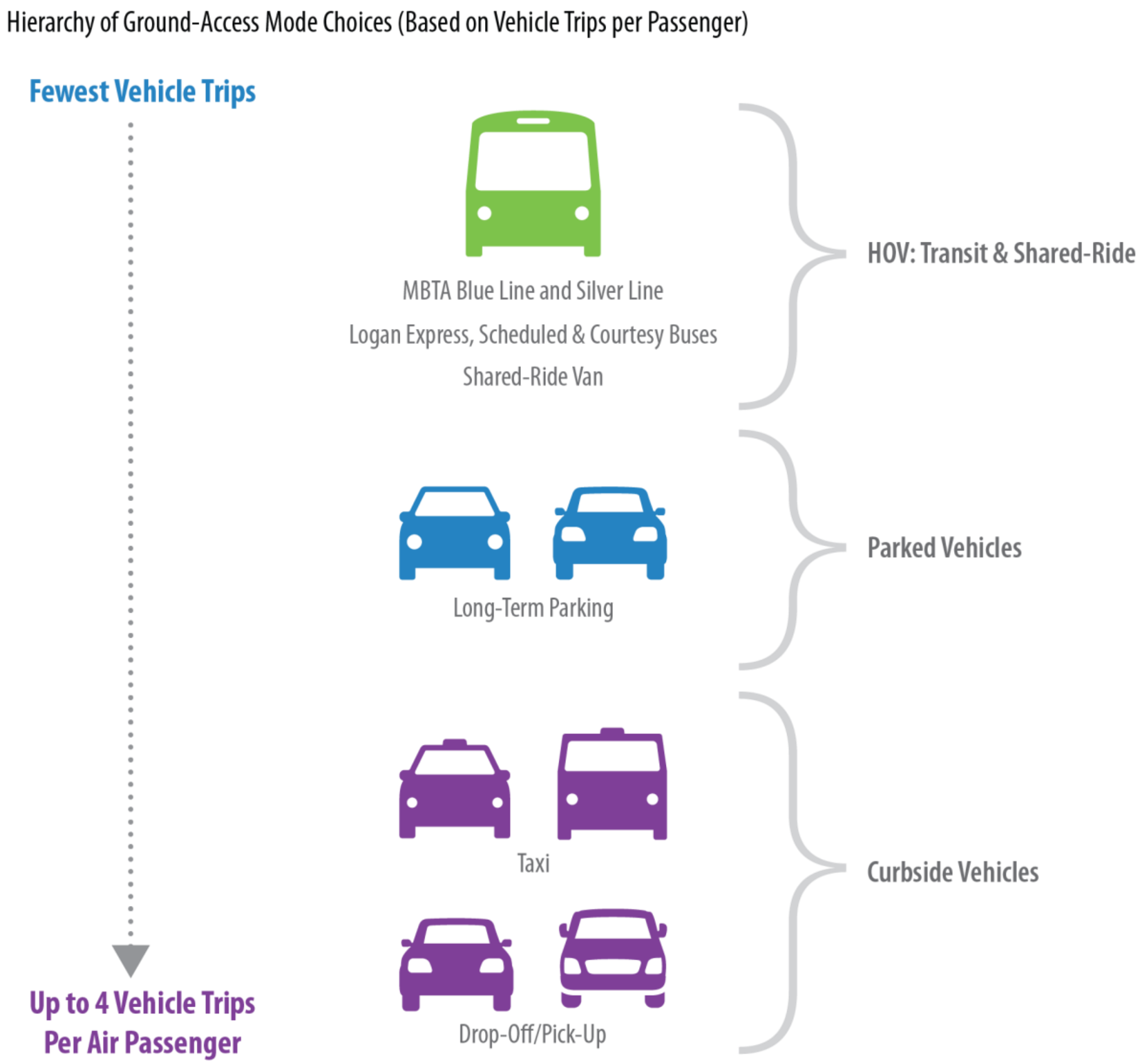
With the Logan Airport Parking Freeze (and current capacity levels) in place, weekday demand is outpacing supply on a regular basis. Under such conditions, travelers arriving at the Airport to park on Tuesdays and Wednesdays would find themselves unable to park their cars on-Airport.

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 5-13**). As one element of its comprehensive transportation strategy, Massport proposes to build up to 5,000 new 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.

The construction of additional commercial parking spaces at Logan Airport is predicated on the approval of a regulatory change,[21] by MassDEP, whereby MassDEP would amend the existing Logan Airport Parking Freeze to allow for some additional commercial parking spaces at Logan Airport. MassDEP has conducted a stakeholder process, which will be followed by initiating the process to amend the Parking Freeze regulation. Massport expects to initiate a parallel process with EEA by filing an ENF for new parking facilities sometime in early 2017.

20 LeighFisher, August 2011.
21 310 Code of Massachusetts Regulations 7.30.

Figure 5-13 Ground-Access Mode Choice Hierarchy



Note: Short-term parking is included under "drop-off/pick-up"

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, limousine, and alternative taxi modes (such as TNCs). Drop-off/pick-up vehicle activity is growing in response to the constrained parking supply.

Passenger surveys have shown that under constrained parking conditions, approximately 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 taxi 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, Massport will construct a weather-protected direct connection between Terminal E and the MBTA Blue Line Airport Station, which will improve the passenger experience and convenience. The project, and the MBTA connection, is in the conceptual design phase and 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's Green Line Station), and Logan Airport. In addition to serving an area that generates a significant number of trips to the Airport, the service served transit riders inconvenienced by the two-year closure of Government Center station, where the Green Line meets the Blue Line. After the re-opening of Government Center in March 2016, this pilot program has continued.

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 passenger and employee demand. The Framingham Logan Express, which opened in April 2015, carries the highest number of non-employee passengers of all the Logan Express services. The completion of this new facility increased capacity by 600 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 the 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 10,761 customers as of December 31, 2015, compared to 9,011 at the end of 2014. 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/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 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 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; [22] and
- Complies 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 contributes $65,000 annually to the Logan TMA. Benefits and services provided by the Logan TMA in 2015 included:

- East Boston early morning shuttle service (Sunrise Shuttle; further details are provided below);
- Computerized ride-matching services for participating in carpools and vanpools; and
- 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.

Sunrise Shuttle

Originally launched in August 2007, this shuttle service provides low-cost transportation to Airport employees who live in nearby East Boston and Winthrop. A second shuttle route was added in October 2011 that serves East Boston's Orient Heights neighborhood and Winthrop.

22 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).

The Sunrise Shuttle services operate outside of MBTA service hours between 3:00 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 1,000 riders per month.

Ground Access Goals

Table 5-12 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 5-12 Ground Access Planning Goals and Progress (2015)

Goal	2015 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.	The *2013 Logan Airport Air Passenger Ground Access Survey* revealed that 28 percent of air passengers use high-occupancy vehicles (HOV)/shared-ride modes to access the Airport. The most recent survey was completed in the spring of 2016 and results will be presented in the *2016 Environmental Status and Planning Report (ESPR)*. 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 rapid transit 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, with current HOV mode share close to 30 percent 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 and Winthrop. 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.

Table 5-12 Ground Access Planning Goals and Progress (2015) (Continued)

Goal	2015 Update
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 developing transportation improvement plans for the South Boston Waterfront, including alternatives that would improve Silver Line access between South Station, the South Boston Waterfront, and the Airport.
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 2015, 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. The total number of parking spaces at the Airport in 2015 remains within the Logan Airport Parking Freeze limits. As one element of its comprehensive transportation strategy, Massport proposes to build up to 5,000 new 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. The construction of additional commercial parking spaces at Logan Airport is predicated on a regulatory change, by MassDEP, whereby MassDEP would amend the existing Logan Airport Parking Freeze to allow for some additional commercial parking spaces at Logan Airport. MassDEP has conducted a stakeholder process, which will be followed by initiating the process to amend the Parking Freeze regulation. Massport expects to initiate a parallel process with EEA by filing an ENF for new parking facilities sometime in early 2017.

6

Noise Abatement

Introduction

The Massachusetts Port Authority (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 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). The public can register noise complaints using the flight tracking interface on Massport's website.[1]

The foundation of Massport's 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 actual runway use, fleet mix, level of operations, noise levels, and modeled noise conditions at Logan Airport related to aircraft operations during 2015 and compares the findings to those for 2014. Historical comparisons to the years 1990 and 2000 are also provided.

Noise conditions for 2015 were assessed primarily through computer modeling, supplemented by the analysis of measured noise levels from Logan Airport's noise monitoring system. As of 2015, the Federal Aviation Administration (FAA) requires airports to use a new simulation tool for noise and air emissions, the Aviation Environmental Design Tool (AEDT), for National Environmental Policy Act (NEPA) projects and soundproofing eligibility. Massport undertook initial modeling of noise and air using AEDT; however, Massport has technical concerns related to the initial results at Logan Airport. Following a briefing with the FAA, it was decided that the initial AEDT results would not be published in the *2015 Environmental Data Report (EDR)* (pending further technical discussions with FAA's Office of Environment and Energy). Therefore, 2015 modeling for noise was performed with the FAA's Integrated Noise Model (INM) (and the Emissions and Dispersion Modeling System [EDMS] for air emissions). Adjustments to be incorporated into AEDT are currently under review and, if

1 Massport. *Flight Monitor.* http://www.massport.com/environment/environmental-reporting/noise-abatement/flight-monitor/. Accessed November 1, 2016.

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).

completed in a timely fashion, AEDT is expected to be the official model for next year's *2016 Environmental Planning and Status Report (ESPR)*.

This chapter presents summaries of the 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 2015. Both the 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.[3,4] To better understand the noise environment, analyses also include a number of supplemental noise metrics including Logan Airport's Cumulative Noise Index (CNI) and reporting on the 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 new aRea NAVigation (RNAV)[5] study being jointly undertaken by FAA and Massport, and a summary of the ongoing Boston Logan Airport Noise Study (BLANS) is also provided.

Appendix H, *Noise Abatement*, provides historical details since 1990 of operations, runway use, noise exposed population, and the status of the sound insulation program. Total runway use from all operations, usage by runway end, and DNL levels at U.S. Census Block group locations are included. The appendix also contains the *Flight Track Monitoring Report* for 2015 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.

2015 Noise Abatement Highlights and Key Findings

Since 2000, the number of daily aircraft operations at Logan Airport has declined by almost 25 percent (from 1,355 operations per day in 2000 to 1,022 operations per day in 2015) while aircraft have been experiencing increasing passenger loads. (The decline from the 1998 peak of 1,390 operations per day exceeds 25 percent.) Jet operations made up 86 percent of operations compared to 66 percent in 2000. Passenger volumes continue to increase at a higher rate than aircraft operations. In 2015, the overall number of air passengers was up by 20.6 percent compared to 2000. This trend reflects an increase in the use of larger aircraft in the fleet, airline consolidation, and increased load factors on the part of airlines.

Operations, Fleet Mix, and Runway Use 2015

- Aircraft operations in 2015 increased by 2.5 percent (from 363,797 operations in 2014 to 372,930 operations in 2015), and remained well below the 1998 peak of 507,449 operations. Operations in 2015 are 26.5 percent less than in 1998. At the same time, passenger volumes are at their highest, increasing by 5.7 percent from 31,634,445 passengers in 2014 to 33,449,580 passengers in 2015.
- Compared to 2014, 2015 had a modest increase in air carrier activity, with overall commercial traffic increasing by 2.2 percent in 2015 (337,380 to 344,764). In 2015 there was a continued shift of

3 14 CFR Part 150, Appendix A to Part 150 Noise Exposure Maps, Sec. A150.101(d)
4 24 CFR Part 51, Subpart B Noise Abatement and Control, Sec. 51.103(c)
5 RNAV – Area navigation, a method of instrument flight rules (IFR) navigation that allows an aircraft to choose any course within a network of navigation beacons, rather than navigate directly to and from the beacons.

operations away from the smaller Regional Jet (RJ) aircraft to larger air carrier aircraft on many routes, increasing the number of passengers carried but not operations.

- Almost 97 percent of all commercial jet operations at Logan Airport met the strictest Stage 4 international noise limits. Of the remaining 3 percent, only ten operations in 2015 were performed by aircraft retrofitted to satisfy Stage 3 standards; all other commercial jet operations were performed by aircraft originally certificated to Stage 3.[6] As of January 1, 2016, all Stage 2 aircraft are prohibited by the FAA from operating within the contiguous United States.
- There were two FAA-mandated airfield/airspace operating factors that influenced Logan Airport contour configurations in 2014 and 2015, including:
    1. Due to safety concerns, at airports across the United States in June 2014, the FAA temporarily halted the use of head-to-head operations,[7] or opposite direction operations, in which planes arrive on a runway in one direction and depart in the opposite direction. When in use at Logan Airport, the procedure has aircraft departing from Runway 15R and landing on Runway 33L during the late night (typically midnight to 5:00 AM) when weather conditions are appropriate, including good visibility and little wind. At Logan Airport, head-to-head operations are an important part of the use of the late night noise abatement runway (Runway 15R-33L) since this keeps operations over Boston Harbor instead of the community. Use of this procedure was restored in January 2015 and is reflected in the 2015 DNL noise contour.
    2. FAA also restricted the use of Converging Runways Operations (CRO) across the United States in January 2014 due to safety concerns. At Logan Airport, Runways 22L and 22R and Runway 27 were affected by this change. While Runway 22R is in use for departing aircraft, arrivals that would typically be directed to Runway 27 were sent by the FAA Air Traffic Control to arrive on Runway 22L. FAA conducted a test in 2014 allowing for these operations to occur during periods of lower demand. The results from this test were favorable and the process was adopted and continued in 2015.
- Dwell and persistence exceedances in 2015 remained below historical levels from most runway ends.
- The 2015 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) are by aircraft flying above 6,000 feet, the same percentage as 2014. This results in lower DNL exposure levels to communities under those flight paths.

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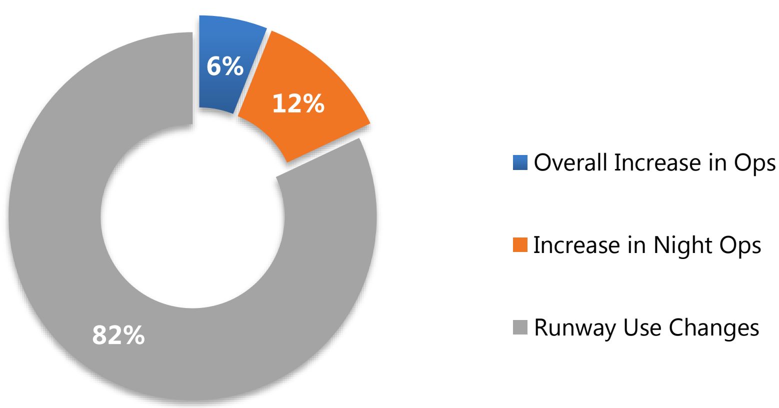
6 Jet aircraft currently operating at Logan Airport are categorized by FAA into the three groups: Stage 2, Stage 3, and Stage 4. The designation refers to a noise classification specified in FAR Part 36 that sets noise emission standards based on an aircraft's maximum certificated weight. Generally, the heavier the aircraft, the more noise it is permitted to make within the limits established by FAR Part 36.

7 Head-to-head operations, or opposite direction operations occur when aircraft depart from a runway end and aircraft are cleared to land to the opposite end of that runway. This results in aircraft overflights off only one end of the runway and is typically used as a noise abatement procedure when traffic levels are light.

Noise Levels and Population 2015

- For 2014 and 2015, differences between measured and modeled noise values have narrowed even more than reported in previous EDRs and ESPRs.[8] This improved accuracy in modeled results corresponds with the Airport's noise measurement equipment and monitoring system and its ability to correlate measured noise events with individual flight tracks, combined with the improvements in the INM database.
- The 2015 contours are smaller in areal 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 East Boston. Compared to 2000, in 2015, the number of people exposed to sound levels of DNL 65 dB or higher has declined by 20.6 percent (from 17,745 people in 2000 to 14,097 people in 2015).
- Compared to 2014, the 2015 DNL 65 dB noise contours were larger in most areas around the Airport due to changes in: (1) runway usage, primarily as a result of wind and weather conditions, (2) an increase in the number of nighttime operations, and (3) an increase in the number of overall operations. The overall number of people exposed to DNL values greater than or equal to 65 dB increased by 58.0 percent, from 8,922 people in 2014 to 14,097 people in 2015.[9] Noise contour changes specific to 2015 in comparison to 2014 are discussed below (**Figure 6-1**).

Figure 6-1 Reason for increase in Number of People Exposed to DNL Values Greater than or Equal to 65 dB



8 Several factors have resulted in better agreement between measured versus modeled levels. Beginning with the *2009 EDR*, flight track data and measurement data have come from the new monitoring system. The more accurate flight track data are used for the modeling inputs and for the measured aircraft event correlation.

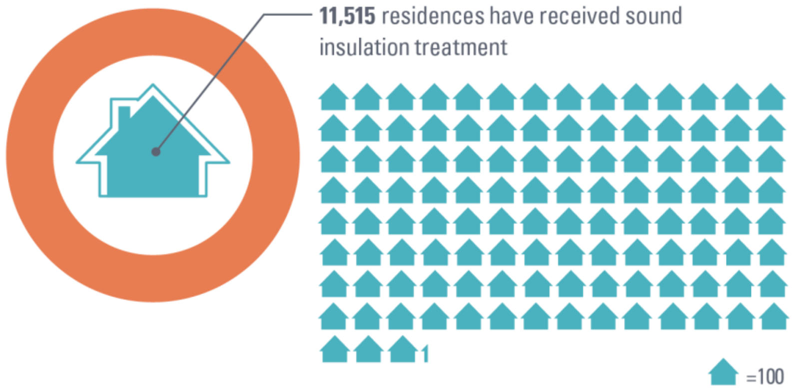
9 Population data were derived from the most recent 2010 United States Census block data.

1. Runway use changes from 2014 to 2015 were the largest factor in the increase in the number of people exposed to DNL values greater than or equal to 65 dB in 2015.
   - The DNL contour increased in East Boston and slightly in South Boston due to an increase in Runway 22R departures in 2015. Increased departures from Runway 22L also resulted in increases in Winthrop.
   - Increased arrivals to Runways 22L and 27 at night contributed to increases in Revere and Winthrop.
   - Unlike 2014, 2015 reflects almost a full year of the head-to-head night noise abatement procedures on Runway 15R-33L. While this reduces overall noise exposure by concentrating operations over water rather than over populated areas, it increases start-of-takeoff-roll (SOTR) noise in East Boston, north and west of the Runway 15R end.
   - Lower use of Runway 4R for arrivals in 2015 resulted in a reduction in the contour south of the Airport.
2. An additional factor influencing noise contour changes in 2015 was a 5.7-percent increase in nighttime operations (from 48,056 nighttime operations in 2014 to 50,786 nighttime operations in 2015). This increase in overall operations and nighttime operations is still well below the peak of 54,038 annual operations at night reached in 1999. As airlines have expanded to new destinations, the number of commercial operations, and in turn the number of nighttime operations, has increased. In 2015, there was an increase of 7.5 nighttime operations per day compared to 2014.[10]
3. The overall increase in operations was smaller than the increase in nighttime operations (2.5 percent overall versus 5.7 percent nighttime), but contributed to the expansion of the noise contours.

- The DNL and population levels in 2015 remain well below the peak levels reached in 1990 and are less than in the year 2000 when 17,745 people were exposed to DNL levels greater than or equal to DNL 65 dB.
- Massport is a national leader in sound insulation mitigation. To date, Massport has provided sound insulation for a total of 11,515 residential units, and will continue to seek funding for sound insulation for properties that are eligible and whose owners have chosen to participate.

10 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.

- Almost all of the residences exposed to levels greater than or equal to DNL 65 dB in 2015 have been eligible in the past to participate in Massport's residential sound insulation program (RSIP).



- In 2015, Massport received 17,685 noise complaints compared to 12,855 in 2014. This 37.6-percent increase in calls came from 82 communities in both 2014 and 2015. The increase in complaints continues to be primarily related to the FAA's RNAV departure procedures, which concentrate flight tracks along narrower corridors. Complaints were received from 1,903 individual complainants in 2015, as compared to 2,084 in 2014. As has been Massport's practice, all complaints were forwarded to the FAA.

FAA Reporting and Update

- On October 7, 2016, Massport and the FAA signed a Memorandum of Understanding (MOU) [11] 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 Record of Decision (ROD) approving construction of the unidirectional Runway 14-32 required that the FAA, Massport, and the Logan Airport Community Advisory Committee (CAC) jointly undertake a study to enhance existing and/or develop new noise abatement measures to further reduce noise impacts. The primary focus of the BLANS is to determine viable ways to reduce noise from aircraft operations to and from Logan Airport without diminishing airport safety and efficiency.[12] The RNAV departure portions of Phase 1 of the project, first implemented in 2010, continued to be utilized in 2015.
- During Phase 2 of the on-going BLANS, the Logan Airport CAC voted to abandon the Preferential Runway Advisory System (PRAS) because it had not achieved the intended noise abatement. Phase 3 of BLANS is a series of tests of a potential Runway Use Program which began in 2014 and continued throughout 2015. Test 1, which started in November 2014 and ended in May 2015 included having the FAA select runway use configurations in the morning (6:00 AM to 9:30 AM), when weather conditions permit, which are different from the configuration used the night before. This is designed to reduce the persistence of noise on residential communities. Test 2, which started in May 2015 and ended in November 2015, resulted in the FAA switching runway configurations at two points during the day (weather permitting) to reduce continuous operations over residential communities.

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11 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/. Accessed on October 31, 2016.

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

- In August 2016, the FAA notified the Logan Airport CAC and Massport that the FAA grant funding BLANS will expire at the end of fiscal year 2016 (September 30, 2016). FAA requested final close-out documentation by December 31, 2016.
- The percentage of aircraft following the Runway 27 departure procedure was at 84 percent for 2015 (an increase from 77 percent in 2014), which continued to remain in compliance with the FAA Runway 27 ROD.[13] The FAA determined in early 2012 that no further evaluation of the Runway 27 departure flight corridor is needed.[14]
- In May 2015, FAA announced that it had begun a nationwide study to re-evaluate the method for measuring effects of aircraft noise (DNL).[15] 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 will be 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. Future EDRs and ESPRs will provide updates, as available.

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.
- **"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. The DNL is the FAA-defined metric for evaluating noise and land use compatibility.[16]
- **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.

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13 FAA. Runway 27 Record of Decision. 1996.
14 FAA. Runway 27 Advisory Committee Meeting Notes 01/23/12, published March 5, 2012.
15 FAA. *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. Accessed November 11, 2016.
16 14 CFR Part 150, Appendix A to Part 150 Noise Exposure Maps, Sec. A150.101(b)

- **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 *2015 EDR* follows is defined in Appendix H, *Noise Abatement*. Regulations discussed include:

- Logan Airport Noise Abatement Rules and Regulations
- Federal Aviation Regulation (FAR) Part 36
- FAR Part 150
- FAR Parts 91 and 161

Noise Modeling Process

The sections below provide an overview of the noise modeling included in this *2015 EDR*. For this *2015 EDR*, Massport used the INM for noise modeling. Massport is working with the FAA on adjustments to the new combined noise and air quality modeling tool, AEDT.

Aviation Environmental Design Tool (AEDT)

In 2015, the FAA introduced a new combined noise and air quality modeling tool, AEDT. This new tool is a software system that dynamically models aircraft performance in space and time to produce fuel burn, emissions, and noise information.

Massport is actively evaluating the new model and working with the FAA to develop the types of Logan Airport-specific adjustments for the AEDT model that have been used for many years in the legacy model, the Integrated Noise Model (INM). These adjustments include:

- Over-water adjustment to account for higher noise levels due to acoustic reflections from the water surface;
- Hill effects, to better represent the line-of-sight exposure of slopes facing the Airport;
- Custom flight profiles and stagelength selection based on radar data; and
- Daily weather conditions (rather than an annual or multi-year average to allow better modeling of engine performance and acoustic propagation.

Once approved by FAA, the adjustments will allow the model to more accurately reflect the noise environment at Logan Airport. Several of these custom adjustments cannot yet be implemented directly in AEDT and will need to be evaluated by Massport and approved by FAA. Massport has reached out to FAA for consideration and approval of these adjustments and, if completed in a timely fashion, AEDT is expected to be the official model for next year's *2016 ESPR*. Additional information on AEDT is provided later in this chapter.

Based on Massport's proposed *2015 EDR* scope, the Secretary of the Executive Office of Energy and Environmental Affairs' (EEA) Certificate on the *2014 EDR* states that "noise contours for 2015 will be developed using AEDT and compared to the most recent version of INM which has been in place for all previous EDRs and ESPRs." For the 2015 calendar year, Massport tested the AEDT model for the first time and found that the AEDT modeled results are not consistent with the known noise environment at Logan Airport. Massport is actively working with the FAA to review preliminary results and to develop, at FAA's discretion, Logan Airport-specific model adjustments. (Please see **Figure 6-14** for the letter to the FAA.)

For this *2015 EDR*, Massport has used the INM for noise modeling. The adjustments noted above have been incorporated into this model (with FAA approval) as in past EDRs and ESPRs.

Integrated Noise Model (INM)

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 *2015 EDR,* are discussed below.

- This year's modeling, using the Integrated Noise Model (INM) version 7.0d, continues to implement enhancements to the model approved by FAA to accommodate the Airport's unique water and terrain characteristics that have been shown through earlier technical studies to affect sound propagation into surrounding neighborhoods; the use of these FAA-approved adjustments yields more accurate modeling results. Logan Airport is the only airport in the world that incorporates these features into its approved modeling process.
- As with prior reports, the *2015 EDR* continues to utilize data from Massport's Noise and Operations Management System (NOMS), including all radar data and noise measurement data.[17]
- The flight operations data from the NOMS includes detailed information with each flight record, such as aircraft registration numbers, wherever possible which provides better INM aircraft type selection. This allows for the assignment of the modeled INM aircraft type based on the specific aircraft and engine combination used on each flight at Logan Airport during 2015.

17 The noise measurement data are only used for reporting and are not used to calibrate the model.

- The modeling process includes continued use of U.S. Geological Survey digital terrain data. INM uses the detailed terrain data to evaluate each receptor location at its proper elevation, which enhances the accuracy of the results.
- Inputs to the INM modeling process include use of automated altitude profile and noise contour generation software. Massport purchased licenses to run two additional software packages, RealProfiles™ and RealContours™.[18,19]
  - RealContoursTM automates the production of noise contours directly from each and every individual radar trace. In 2015, approximately 421,536 traces were collected and 370,014 retained enough information to be modeled in the RealContoursTM 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 of the 372,930 operations in 2015. This method also helps to develop more accurate noise contours by retaining the actual runway used and time of each operation.
  - RealProfilesTM analyzes each radar trace and automatically produces custom aircraft performance profiles using the INM aircraft database. The INM typically uses pre-defined profiles to "fly" each aircraft along the ground track. The custom profiles are designed to follow the actual flight of each aircraft allowing the INM to model each flight at its actual location on the ground and in the sky. For 2015, 208,506 flight tracks (56.3 percent) used these specially designed profiles of which 99,651 (53.2 percent) of the available departure profiles and 108,855 (59.5 percent) of the available arrival profiles were developed from the actual radar data.
  - RealContoursTM incorporates the FAA-approved INM as the computational engine for calculating noise, but provides greater detail through the uses of individual flight tracks taken directly from radar systems rather than relying on consolidated, representative flight tracks data.

RealContours™ improves the precision of modeling by:

- Directly converting the radar flight track for every identified aircraft operation to an INM 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; and
- Using each aircraft's actual performance and altitude profile to develop inputs to the model, which define the actual arrival, or departure profile.

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18 RealProfiles™ and RealContours™ are methods to provide more accurate inputs to the INM but do not change or modify the algorithms of the FAA-required INM.

19 The *2004 ESPR* included a comparative analysis of the results of the standard INM modeling approach with RealProfiles™ and RealContours™.

RealContours™ uses INM to produce computations for each day of radar data and then compiles annual average noise exposure contours and supplemental metrics from each of the 365 days of computations.

All of 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 2015.

Noise Model Inputs

For this *2015 EDR*, noise was modeled using the most recently available version of the FAA's Integrated Noise Model (INM) version 7.0d (INMv70d). 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 2015 inputs to the previous year's data (2014).

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 air carriers. 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 GA users, as well as the large passenger and cargo jets operated by air carriers.

For 2015, the aircraft types identified by the radar data were matched to the INMv7.0d 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.[20] For those aircraft recorded in radar data that are not in the INMv7.0d database, the radar type is paired with the best available alternative using a standard FAA-approved substitution list. The final list of modeled aircraft, used as an input to INMv7.0d, 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; Stage 2 or Stage 3&4 jet aircraft; and turboprop and propeller (non-jet) aircraft. The Stage 3&4 category includes 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 criteria if recertificated. FAA does not require aircraft to be recertified and the FAA has no plans at this time to restrict Stage 3 operations.[21] 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 calculation.

20 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.

21 Massport does not have the regulatory power to restrict aircraft using Logan Airport.

Table 6-1 summarizes the numbers of operations by categories of aircraft operating at Logan Airport in 2015 and includes similar data for 2014 and prior years back to 2011. Data for 2010 and 2000 are provided for comparison. Data for each year prior to 2010 are included in Appendix H, *Noise Abatement*.

The number of RJ operations decreased between 2014 and 2015 (by an average of 16 operations per day). Night operations by commercial operators increased in 2015 compared to 2014 by approximately seven operations per night. The majority 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-jet operations decreased slightly between 2014 and 2015 (dropped from 131 operations per day to 128 operations per day).

Table 6-1 Modeled Average Daily Operations by Commercial and General Aviation (GA) Aircraft[1]

		1990[6,7]	**1998**	**2000[3]**	**2010[2]**	**2011[2]**	**2012[2]**	**2013[2]**	**2014[2]**	**2015[2]**
		Commercial Aircraft (Passenger and Cargo)								
Stage 2 Jets[4]	Day	312.40	84.93	5.13	0.01	0.01	0.01	0.01	0.00	0.00
	Night[5]	19.99	5.92	0.26	0.01	0.00	0.00	0.00	0.00	0.00
	Total	**332.39**	**90.85**	**5.39**	**0.02**	**0.01**	**0.01**	**0.01**	**0.00**	**0.00**
Stage 3&4 Jets (All)	Day	288.89	541.43	727.09	674.25	684.19	649.22	667.65	670.00	685.92
	Night	57.25	95.54	103.66	107.92	109.38	106.55	115.91	123.60	130.96
	Total	**346.14**	**636.97**	**830.75**	**782.17**	**793.57**	**755.77**	**783.56**	**793.61**	**816.88**
Air Carrier Jets	Day	N/A[6]	N/A	648.95	521.64	540.75	530.76	546.27	556.59	585.55
	Night	N/A[6]	N/A	99.79	93.98	96.24	98.68	107.17	115.84	126.36
	Total	**N/A[6]**	**N/A**	**748.74**	**615.62**	**636.99**	**629.44**	**653.44**	**672.43**	**711.92**
Regional Jets	Day	N/A[6]	N/A	78.14	152.61	143.44	118.46	121.38	113.41	100.36
	Night	N/A[6]	N/A	3.87	13.94	13.14	7.87	8.74	7.77	4.60
	Total	**N/A[6]**	**N/A**	**82.01**	**166.55**	**156.58**	**126.33**	**130.12**	**121.18**	**104.96**
Non-Jet Aircraft	Day	444.41	552.56	409.62	138.53	135.18	133.92	132.33	128.45	125.27
	Night	11.72	21.86	21.58	5.21	4.73	3.06	3.21	2.28	2.41
	Total	**456.13**	**574.42**	**431.20**	**143.74**	**139.91**	**136.98**	**135.54**	**130.73**	**127.68**
Total Commercial Operations	Day	1,045.70	1,178.92	1,141.84	812.78	819.39	783.14	799.99	798.45	811.19
	Night	88.96	123.32	125.51	113.13	114.11	109.62	119.12	125.88	133.37
	Total	**1,134.60**	**1302.24**	**1,267.35**	**925.91**	**933.50**	**892.76**	**919.12**	**924.33**	**944.56**

Table 6-1 Modeled Average Daily Operations by Commercial and General Aviation (GA) Aircraft[1] (Continued)

		1990[6,7]	1998	2000[3]	2010[2]	2011[2]	2012[2]	2013[2]	2014[2]	2015[2]
					GA Aircraft					
Stage 2 Jets[4]	Day	N/A[7]	5.25	7.29	0.27	0.08	0.25	0.31	0.00	0.28
	Night	N/A[7]	0.40	0.64	0.04	0.00	0.04	0.02	0.00	0.02
	Total	**N/A[7]**	**5.65**	**7.93**	**0.30**	**0.08**	**0.29**	**0.33**	**0.00**	**0.30**
Stage 3&4 Jets	Day	N/A[7]	30.54	40.08	27.80	52.51	52.93	51.21	52.64	51.82
	Night	N/A[7]	4.21	3.21	3.21	5.35	7.20	5.10	4.65	4.28
	Total	**N/A[7]**	**34.75**	**43.29**	**31.01**	**57.87**	**60.13**	**56.31**	**57.29**	**56.10**
Non-Jets	Day	N/A[7]	37.29	34.57	8.19	18.18	15.16	13.06	13.95	19.31
	Night	N/A[7]	16.28	1.83	0.72	1.29	1.29	1.15	1.13	1.46
	Total	**N/A[7]**	**53.57**	**36.40**	**8.92**	**19.48**	**16.45**	**14.22**	**15.08**	**20.77**
Total GA Operations	Day	N/A[7]	73.08	81.94	36.26	70.78	68.35	64.58	66.59	71.40
	Night	N/A[7]	20.89	5.68	3.97	6.65	8.52	6.28	5.78	5.77
	Total	**N/A[7]**	**93.97**	**87.62**	**40.22**	**77.43**	**76.86**	**70.85**	**72.37**	**77.17**
Total (Commercial and GA)	Day	1,045.70	1,252.00	1,223.78	849.03	890.16	851.49	864.57	865.05	882.59
	Night	88.96	144.21	131.19	117.10	120.76	118.13	125.40	131.66	139.14
	Total[3]	**1,134.60**	**1,396.21**	**1,354.97**	**966.13**	**1,010.92**	**969.61**	**989.97**	**996.70**	**1,021.73**

Source: Massport's Noise Monitoring System, Revenue Office, HMMH 2016.

Notes:

1 Operations include scheduled and unscheduled operations. Data for years prior to 2010 are available in Appendix H, *Noise Abatement*.

2 After 2009, the split between air carrier jets and regional jets (RJs) is 90 seats with RJs having less than 90 seats.

3 Prior to 2010, the split between air carrier jets and RJs is 100 seats with RJs having less than 100 seats.

4 Stage 2 aircraft above 75,000 pounds were banned on December 31, 1999 and all Stage 2 aircraft were banned on December 31, 2015.

5 Nighttime operations occur between 10:00 PM and 7:00 AM.

6 RJs were not tracked separately prior to 1999.

7 Totals prior to 1998 do not include GA operations.

Commercial Operations

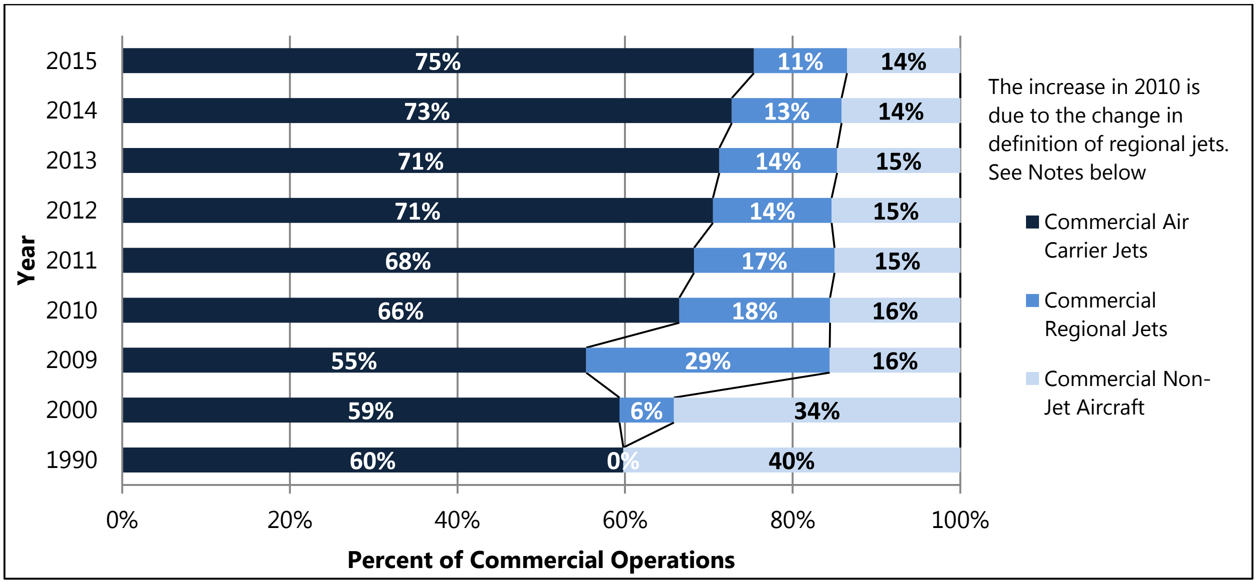
Regional jets (RJ) are defined as those aircraft with 90 or fewer seats, consistent with the categorization in Chapter 2, *Activity Levels*.[22] For years prior to 2010, the RJs in EDRs and ESPRs were classified as aircraft with fewer than 100 seats. When RJs first started gaining popularity, the aircraft 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. The majority of the newer types fall into two categories: the 70 to 75-seat category, which remain categorized as RJs, and the 91 to 99-seat category, which are categorized as air carrier jets.

The percent of RJs in the overall commercial fleet fell 2 percent between 2014 and 2015 from 44,176 to 38,310 operations, while non-jets remained the same percentage of the commercial fleet (**Figure 6-2**). In contrast, commercial air carrier operations increased their share by 2 percent, accounting for 75 percent of commercial operations in 2015 compared to 73 percent in 2014 (from 245,437 operations in 2014 to 259,843 operations in 2015).

Figure 6-2 presents the commercial operations groups in terms of percent of the total for each year from 2009 through 2015 and including 1990 and 2000 for historical context. **Figure 6-2** 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.

22 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 6-2 Fleet Mix of Commercial Operations (Passenger and Cargo) at Logan Airport



Source: HMMH, 2016.
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 2015 rose slightly compared to 2014, from 72 operations per day in 2014 to 77 operations per day in 2015 (**Table 6-1**). While no Stage 2 GA jets were recorded in 2014, these aircraft had 0.3 operations per day in 2015. Data prior to 2000 are included in Appendix H, *Noise Abatement*.

Stage 2, Stage 3, and Stage 4 Jet Aircraft

Jet aircraft currently operating at Logan Airport are categorized by FAA into the three groups: Stage 2, Stage 3, and Stage 4. 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.

All Stage 2 aircraft were banned from use in the contiguous United States as of December 31, 2015 and FAA is in the process of adopting a higher standard of noise classification called Stage 5, which if implemented, will be effective for new aircraft type certification after December 31, 2017 and December 31, 2020, depending on the weight of the aircraft.[23]

Because of the noise differences among Stage 2, recertificated Stage 3, Stage 3 aircraft, and aircraft that meet Stage 4 requirements, 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

23 The Notice of Proposed Rulemaking (NPRM) was published on January 14, 2016

historical context. As noted by **Table 6-2**, 97 percent of the commercial jet fleet at Logan Airport met Stage 4 requirements in 2014 and in 2015. The percent decreased slightly in 2015 (0.7 percent) due to increased use of Stage 3 only aircraft by Southwest and Aer Lingus.

Table 6-2 Percentage of Commercial Jet Operations by Part 36 Stage Category[1]

Year	Stage 4 Requirements[2]	Certificated Stage 3	Recertificated Stage 3[4]	Stage 2 Greater than 75,000	Total
1990	N/A	51.1%	0.0%	48.9%	100%
2000	N/A	70.0%	21.0%	9.0%	100%
2010	93.2%[3]	98.9%[3]	1.1%[5]	0.0%	100%
2011	95.5%[3]	99.5%[3]	0.5%[5]	0.0%	100%
2012	95.8%[3]	99.9%[3]	0.1%[5]	0.0%	100%
2013	97.4%[3]	100.0%[3]	0.0%	0.0%	100%
2014	97.4%[3]	100.0%[3]	0.0%	0.0%	100%
2015	96.7%[3]	100.0%[3]	0.0%	0.0%	100%

Source: Massport's Noise Monitoring System, Revenue Office numbers, HMMH 2016.

Notes:

1 Data for years prior to 2010 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 All aircraft listed as meeting Stage 4 requirements are also listed as Stage 3 aircraft.

4 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.

5 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.

Nighttime Operations

Although Stage 2 aircraft over 75,000 pounds have been banned since January 1, 2000, aircraft certificated as Stage 2, which weigh less than 75,000 pounds, have continued to operate in the U.S. The Stage 2 aircraft currently allowed to operate are small corporate jet aircraft that are primarily in the GA fleet. However, FAA has issued a final ruling[24] prohibiting these aircraft operations after December 31, 2015. Logan Airport's Noise Rules prohibit Stage 2 aircraft of less than 75,000 pounds from using the Airport between the hours of 11:00 PM and 7:00 AM. In 2015, only 109 GA Stage 2 jet operations were recorded for the entire year, the majority of these being Falcon 20, Gulfstream 2 and 3, and Lear 25 aircraft.

In addition, Massport monitors flights that operate between the broader DNL nighttime periods 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 operations increased nighttime flights by 6.0 percent between 2014 and 2015 and commercial non-jet operations also increased nighttime flights by 5.7 percent from 2014 to 2015. GA operations decreased nighttime flights slightly by 0.1 percent from 2014 to 2015. These changes resulted in an overall increase in nighttime operations of almost 6 percent in 2015. The

24 FAA Final Rule "Adoption of Statutory Prohibition on the Operation of Jets Weighing 75,000 Pounds or Less that Are Not Stage 3 Noise Compliant", issued July 2, 2013 Federal Register, Volume 78 Issue 127.

majority of nighttime operations (between 10:00 PM and 7:00 AM) occurred either before midnight or after 5:00 AM. These nighttime operations represent 13.6 percent of total operations for 2015 at Logan Airport and in 2015 there were an average of seven additional flights per night.

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	77.24	11.72	N/A[2]	88.96
1998	101.46	21.86	N/A[2]	123.32
2000	103.92	21.58	5.68	131.19
2010	107.93	5.21	3.97	117.10
2011	109.38	4.73	6.65	120.76
2012	106.55	3.06	8.52	118.13
2013	115.91	3.21	6.28	125.40
2014	123.6	2.28	5.78	131.66
2015	130.96	2.41	5.77	139.14
Change (2014 to 2015)	**7.36**	**0.13**	**0.01**	**7.48**
Percent Change	**5.96%**	**5.70%**	**0.17%**	**5.68%**

Source: Massport and Exelis radar data. HMMH, 2016.
Notes:
1 Data for years prior to 2010 are available in *Appendix H, Noise Abatement*.
2 Totals prior to 1998 do not include GA operations

Cargo operations accounted for 6.1 percent of all commercial nighttime operations in 2014 and 5.8 percent in 2015. Nighttime Cargo operations decreased slightly from 2014 to 2015 (reduced by less than 0.1 operations per night) but are a smaller percentage overall due to the larger increase of passenger aircraft operations in the nighttime period.

Similar to conditions reported in 2014, flights by cargo operators using recertificated Stage 3 aircraft made up almost no commercial nighttime activity in 2015. For comparison, in 2000, flights by cargo operators using recertificated Stage 3 aircraft accounted for 8.0 percent of the commercial nighttime activity. Though the International Civil Aviation Organization and the 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 remain at a minimum 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 2015 (similar to 2014) and also contributed to the overall increase in 2015 nighttime activity.

Runway Use

Logan Airport's runways are shown in **Figure 6-3**. Runway use refers to the frequency with which aircraft utilize each of these runways during the course of 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 is just over 10,000 feet in length.

In 2015, Runway 15R-33L was the preferred runway to use at night to reduce community noise, with arrivals to Runway 33L and departures from Runway 15R, (known as the head-to-head procedure) thus keeping flights over Boston Harbor (although these flights do eventually fly over South Shore communities). For over half of 2014 this procedure had been suspended by FAA but it was restored in January 2015.

During other periods of the day, Runway 9 is used primarily for departures, and Runway 4R is used primarily for arrivals. Runway 22R is primarily used for departures, and Runways 15R, 27, 22L and 33L are used for both arrivals and departures.

FAA suspended Converging Runway Operations (CRO) in January 2014, however modified use of these runways was restored in January 2015. Runway 27 and Runway 22R are known as CRO runways since their extended centerlines cross within a short distance. These operations were suspended due to safety concerns primarily when aircraft are departing Runway 22R and landing on Runway 27. While Runway 22R is in use for departing aircraft, arrivals that would typically be directed to Runway 27 were sent by the FAA Air Traffic Control to arrive on Runway 22L. In 2015, after an operational test by the FAA, modified CRO was restored and only during periods of high demand are arrivals sent to 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 the 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.

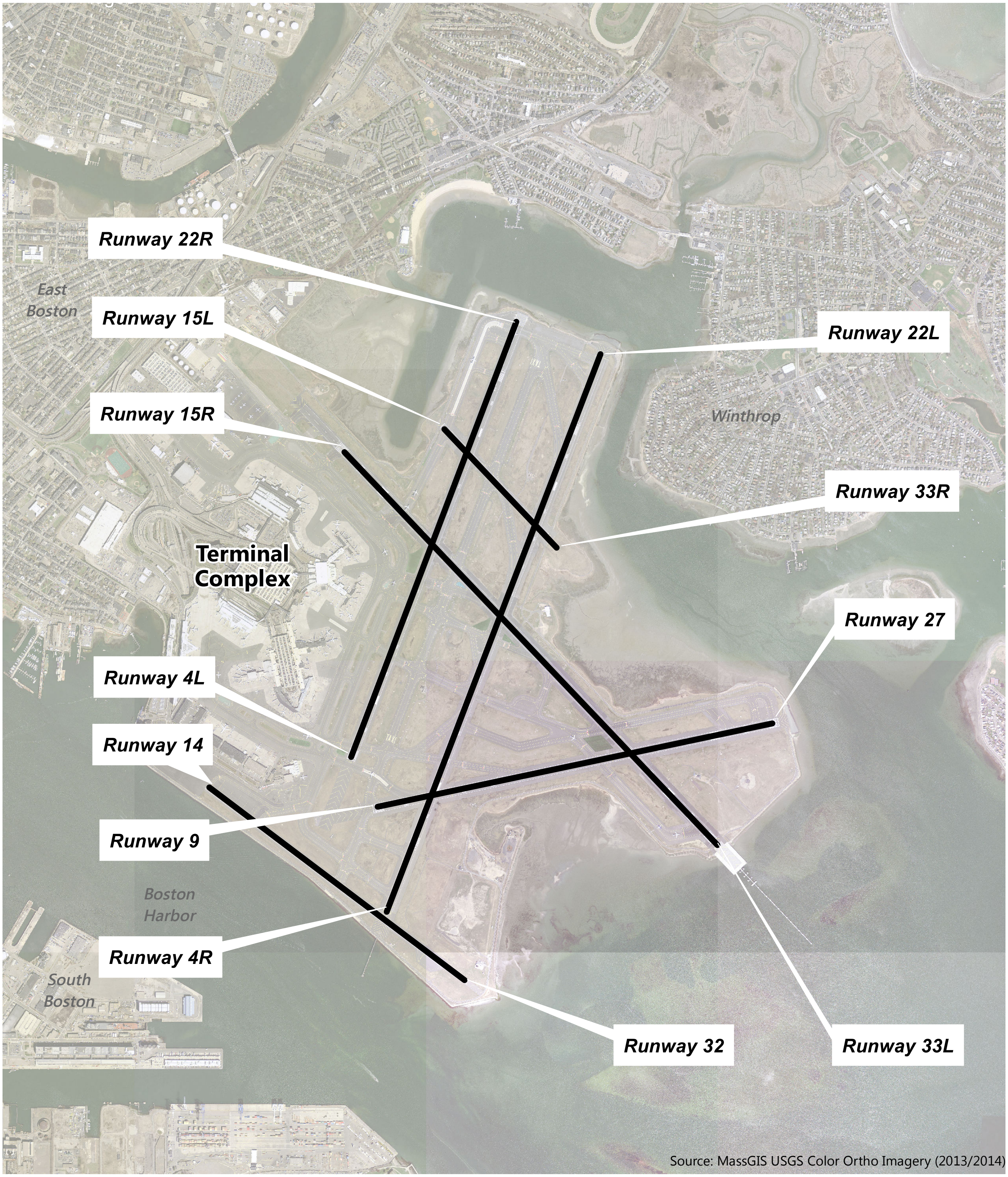
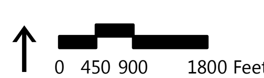


FIGURE 6-3 Logan Airport Runways | **2015 Environmental Data Report**



Jet runway use conditions in 2015 are summarized in **Table 6-4** and were as follows:

- Combined arrivals to Runways 4L and 4R dropped to 34 percent in 2015 from 35 percent in 2014. In 2015, departures from Runway 4R dropped to 4 percent from 5 percent in 2014.
- For 2015, arrivals to Runway 22L remained at 25 percent, with departures remaining at 2 percent compared to 2014. Runway 22R departures increased to 32 percent in 2015 from 28 percent in 2014. Runways 22R and 9 consistently remained the most used departure runways at Logan Airport.
- Departures from Runway 27 decreased to 12 percent in 2015 from 13 percent in 2014. Departures from Runway 9 decreased to 29 percent in 2015 from 31 percent in 2014. Arrivals to Runway 27 increased from 21 percent in 2014 to 23 percent in 2015.
- Since opening in late November 2006, Runway 14-32 has been used primarily for arrivals of RJs and turboprops over Boston Harbor, consistent with FAA operations restrictions based on wind direction (NW or SE) and speed (greater than 10 knots).
- Departures from Runway 33L decreased from 17 percent in 2014 to 15 percent in 2015 with arrivals remaining the same at 15 percent. Runway 15R usage remained the same as 2014 with 5 percent of departures and 2 percent of arrivals.

Runway use for all aircraft types (Jet and Non-Jet) for 2014 and 2015 is provided in Appendix H, *Noise Abatement*.

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%
2011										
Departures	0%	6%	36%	<1%	5%[3]	2%	36%	7%	-	7%[3]
Arrivals	7%	37%	0%	-	<1%[3]	16%	0%	28%	1%	11%[3]
2012										
Departures	<1%	6%	34%	<1%	4%[3]	3%	38%	6%	-	8%[3]
Arrivals	6%	34%	0%	-	1%[3]	16%	<1%	34%	<1%	9%[3]
2013										
Departures	<1%	5%	30%	<1%	5%	2%	35%	12%	-	12%
Arrivals	6%	29%	0%	-	1%	16%	<1%	32%	1%	15%
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%

Source: Massport Noise Office and HMMH, 2016.

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 years prior to 2010 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.)

3 Runway 15R-33L was closed for 3 months in 2011 and 2012.

Preferential Runway Advisory System (PRAS)

Developed by Massport in 1982 and enhanced in 1990 and in subsequent years, the Preferential Runway Advisory System (PRAS) is a set of short-term and long-term runway use goals that include the use of a computer program that provides recommendations to FAA air traffic controllers; the system recommends runway configurations that will meet weather and demand requirements while providing an equitable distribution of Logan Airport's noise impacts on surrounding communities. The two primary objectives of 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.

In February 2004, the PRAS system was suspended due to an upgrade of the FAA radar system during the consolidation of the Boston Terminal Control Center at the new facility in Merrimack, New Hampshire.

During Phase 2 of the on-going BLANS, the Logan Airport CAC voted to abandon PRAS because it had not achieved the intended noise abatement.[25] Phase 3 of the BLANS is focusing on the development of an updated Runway Use Program. Operational tests of a new program began in November 2014 and are planning to be continued through September 2016.

For this *2015 EDR*, Massport continues to present the annual comparison data 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[26] in 2015 to that of 2014, 2013, and to the PRAS goals. The 2015 utilizations shown in bold indicate improvements toward the goals for each runway compared to 2014. Three of the arrival percentages moved closer to the PRAS goals in 2015 compared to 2014 and two of the departure percentages moved toward the PRAS goals.

25 BLANS Level 3 Screening Analysis, FAA, December 2012, Page E-2.

26 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		2013 Effective Usage		2014 Effective Usage		2015 Effective Usage	
Runway End	**Arrivals**	**Departures**	**Arrivals**	**Departures**	**Arrivals**	**Departures**	**Arrivals**	**Departures**
4R/L	21.1%	5.6%	34.6%	4.6%	**28.1%**	**4.9%**	**25.1%**	4.1%
9	0.0%	13.3%	0.0%	29.9%	0.0%	**24.2%**	0.0%	**22.3%**
15R	8.4%	23.3%	**1.0%**	4.9%	**2.1%**	**11.6%**	1.9%	**13.1%**
22L/R	6.5%	28.0%	**16.0%**	**36.6%**	30.4%	**29.2%**	31.3%	30.8%
27	21.7%	17.9%	32.1%	**11.6%**	**15.4%**	**15.0%**	**16.6%**	14.6%
33L	42.3%	11.9%	**15.3%**	**12.4%**	**23.4%**	15.1%	**24.5%**	15.1%
14[1]	NA	NA	-	<0.1%	0.0%	<0.1%	0.0%	<0.1%
32[1]	NA	NA	0.9%	-	0.6%	0.0%	0.5%	0.0%

Source: Massport Noise Office and HMMH, 2015.
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.
PRAS goals have not yet been established for Runways 14 and 32.
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.)

Flight Tracks

As described in the *Methodology* section, Massport continued to use the software packages known as RealContours™ and RealProfiles™. Appendix H, *Noise Abatement* provides a summary discussion of these software packages. RealContours™ is used to develop the INM inputs based on available radar tracks. Instead of using representative model tracks, RealContours™ converts each radar track to an INM model track and then models the scaled operation on that track.[27] This allows Massport to take into account runway closures and/or temporary or permanent airspace changes which occur during the year.

For this *2015 EDR*, 370,014 flight tracks were modeled to calculate the noise levels surrounding Logan Airport for calendar year 2015. **Figures 6-4** through **6-10** provide examples of flight tracks used with RealContours™ to develop the 2015 contours.[28] The figures show arrivals and departures separately for each of three aircraft categories: air carrier jets, RJs, and non-jets. The following figures are from October 2015, when the runway use was similar to the 2015 yearly average presented previously.

27 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.

28 Runway use from each month was developed and compared to the annual runway use information. October 2015 provided the closest match to annual results.

Additional figures and associated text at the end of this chapter describe the RNAV[29] standard instrument departure procedure and any changes that were in effect during 2015. In addition to the RNAV procedures recommended from the BLANS study, other RNAV procedures implemented at Logan Airport (such as the RNAV arrivals into 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, Charlotte, Nashville, Houston, Dallas, Chicago Midway, and Seattle Airports.

- **Figure 6-4** displays air carrier jet departures following the recommended departure routes. The departure procedures reflect updated FAA RNAV routes implemented in 2015, shown in this graphic. The Runway 33L RNAV procedure was first implemented by the FAA in June 2013.
- **Figure 6-5** displays air carrier jet arrivals. The RNAV arrival procedures are very evident in the 2015-modeled data with a narrowing of the flight tracks into concentrated areas.
  - In the beginning of 2014, JetBlue Airways conducted a test of an RNAV visual approach procedure[30] which overlays the standard visual approach to Runway 4L. This procedure would give aircraft with advanced navigational capabilities a more stabilized approach to the visual Runway 4L. This procedure is still under evaluation.
- **Figure 6-6** displays the RJ departures following the RNAV departure routes with flights remaining north of the Hull peninsula and passing over the Nahant Causeway.
- **Figure 6-7** 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 6-8** 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 6-9** 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 6-10** displays the night jet arrivals using the Light Visual Approach[31] to Runway 33L during October 2015. 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.

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29 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.

30 Boston-Logan Runway 4 Left Area Navigation (RNAV) Visual Flight Procedure Test CATEX, approved 6/26/2013.

31 A Visual Approach procedure can only be used when weather conditions permit and the pilots follow visual landmarks to follow the procedure.

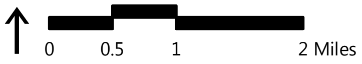
- In the fall of 2013, JetBlue Airways began a test of an RNAV visual approach procedure[32] which overlays the standard visual approach. This procedure would give aircraft with advanced navigational capabilities a more stabilized approach to the visual Runway 33L. This procedure is available to authorized airlines only and is seen in the concentrated approach path in **Figure 6-10**.

Meteorological Data

The INM 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 2015 from the National Climatic Data Center. Average daily values for each of the settings were used in the development of the 2015 INM noise conditions. The average conditions for each day allowed the modeling system used by Massport to develop performance profiles based on each day's conditions and allowed the INM model to use each day's conditions to assess the propagation of noise. The use of daily values allows the INM to better model aircraft profiles on days significantly different than the average, such as during the winter and summer months.

32 Boston-Logan Runway 33 Left Area Navigation (RNAV) Visual Flight Procedure Test CATEX, approved 6/26/2013.

FIGURE 6-4 Air Carrier Departure Flight Tracks (October 2015) | **2015 Environmental Data Report**



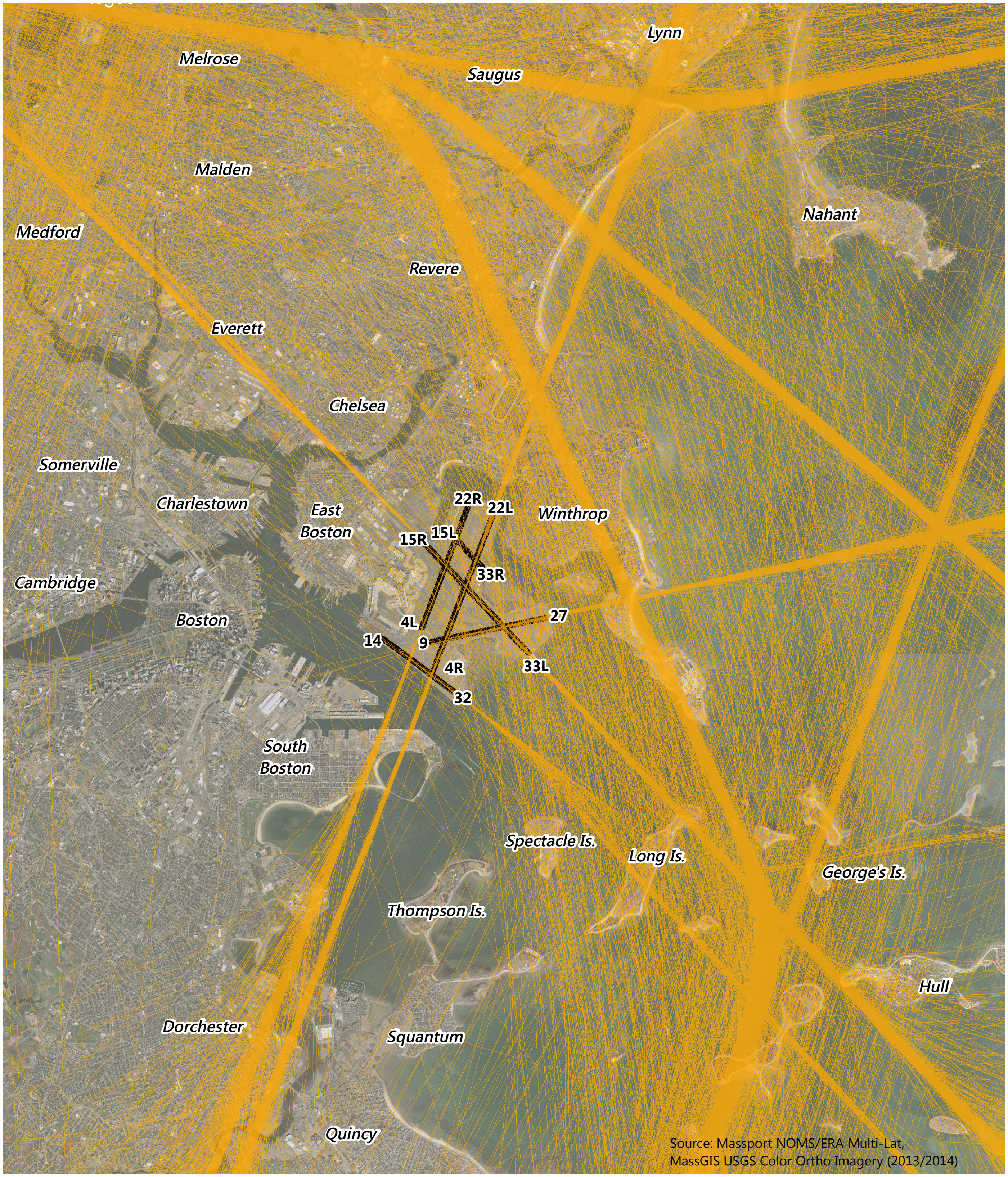


FIGURE 6-5 Air Carrier Arrival Flight Tracks (October 2015)

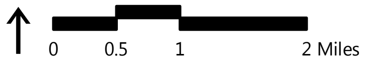
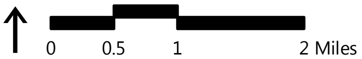


FIGURE 6-6 Regional Jet Departure Flight Tracks (October 2015) | **2015 Environmental Data Report**



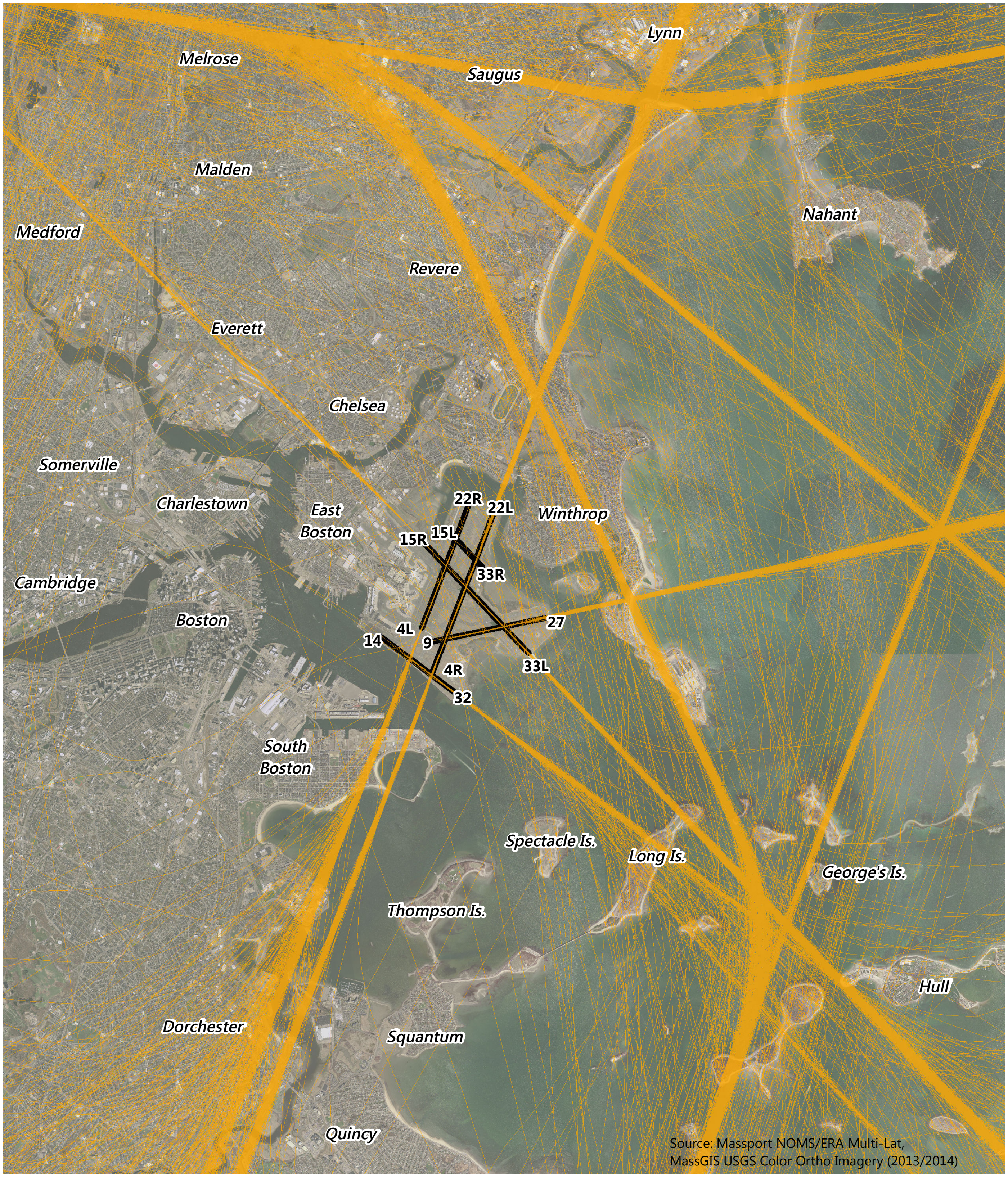


FIGURE 6-7 Regional Jet Arrival Flight Tracks (October 2015)

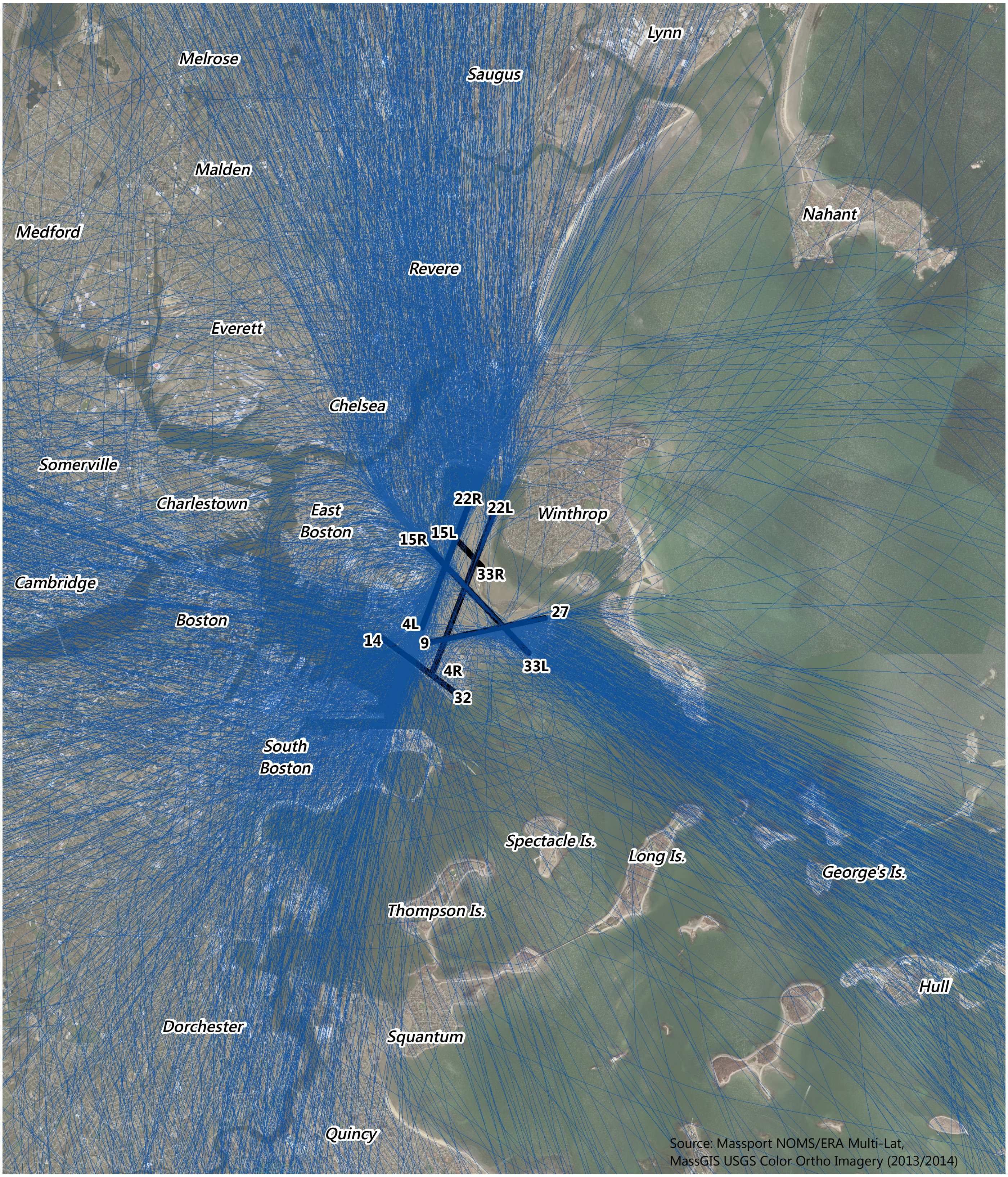
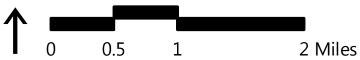


FIGURE 6-8 Non-Jet Departure Flight Tracks (October 2015) | **2015 Environmental Data Report**

Note: Non-jet tracks are non-RNAV.



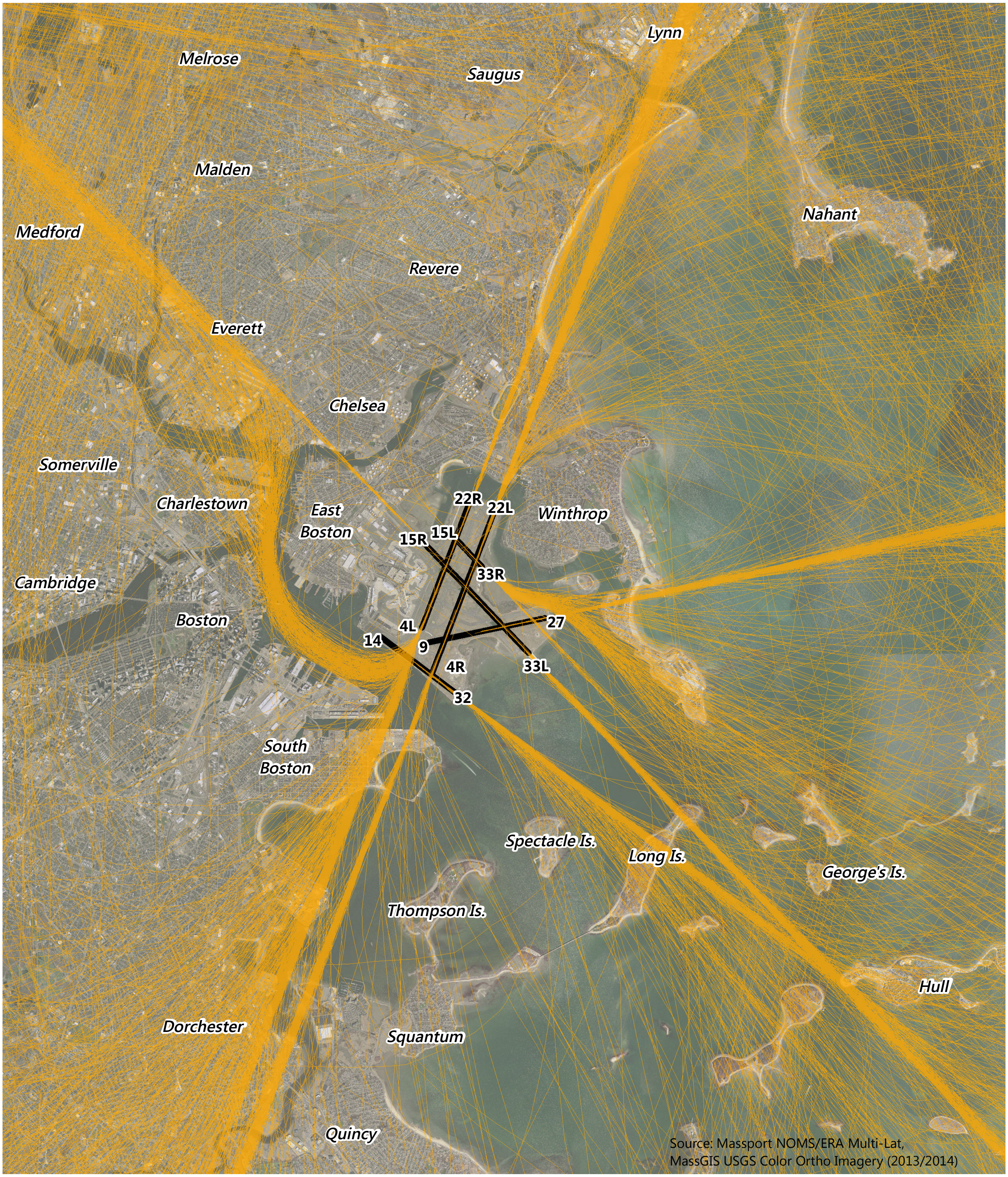


FIGURE 6-9 Non-Jet Arrival Flight Tracks (October 2015) | **2015 Environmental Data Report**

Note: Non-jet tracks are non-RNAV.

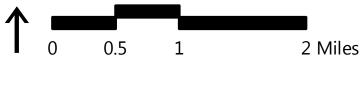


FIGURE 6-10 **Runway 33L Night (10PM - 7AM) Light Visual Approach Arrival Flight Tracks (October 2015)**

2015 Environmental Data Report

Noise Levels in 2015

The following section describes the results of noise modeling in INM for 2015. Population impacts are discussed and historical data are provided for context.

Day-Night Noise Contours for 2015

The 2015 DNL contours were prepared using the most recent version of the FAA's INM modeling software. **Figure 6-11** provides a comparison of the DNL 65 dB contours for 2015 and 2014. This provides context to the level of change in the noise environment between 2014 and 2015 due to operational changes, fleet mix, and runway use.

The FAA-required RNAV was in place for the second full year in 2015. RNAV was used on all of Logan Airport's runways and RNAV procedures continued to concentrate and elongate the annual noise contour. For the DNL 65 dB contour, this only applies to the contour lobe extending out over Boston Harbor from Runway 22L/R departures.

The DNL 65 dB contour increased in size over Revere primarily due to increases in arrivals to Runway 22L at night. Over Winthrop, a small increase in the use of Runway 22L for departures during the day and a large increase in departures from Runway 22R caused the DNL 65 dB contour to increase in extent. Over the Point Shirley section of Winthrop, the DNL contour remained similar in size, as arrivals to Runway 27 increased slightly but departures from Runway 9 during the day slightly decreased. Slight increases in arrivals to Runways 33L and 32 and departures from Runway 15R resulted in the DNL contour expanding out over Boston Harbor. Increased used of Runway 22R departures resulted in the DNL contour increasing slightly towards South Boston. Daytime decreases in departures from Runway 33L and arrivals to Runway 15R, combined with a small increase in departures at night from Runway 33L, resulted in a small increase in the contour lobe over East Boston that extends towards Chelsea. The areas of largest increases over East Boston are due to increased departures from Runway 15R and from increased departures from Runway 22R.

It is important to note that the majority of the 2015 DNL 65 dB contour is within populated areas already sound insulated by Massport (refer to the Noise Abatement discussion presented later on in this chapter) (see **Figure 6-13**).

Figure 6-12 displays the DNL values of 60, 65, 70, and 75 dB for 2015. **Figure 6-13** provides a comparison of the DNL 65 dB contours for 2015 and 2014 and how they compare to the historical 1990 and 2000 DNL 65 dB contours. Generally, contours at Logan Airport change slightly due to changes in runway use and fleet mix from one year to the next. Increased departures on Runway 15R and changes in the 2015 fleet mix resulted in expanded contours in East Boston due to the greater noise emissions to either side of the runway from start-of-takeoff roll noise at this runway end.

Both the 2015 and 2014 DNL contours in these figures include the FAA-approved adjustments to INM for over-water sound propagation and hill effects in Orient Heights; these adjustments are unique to Logan Airport, and not yet available in AEDT.

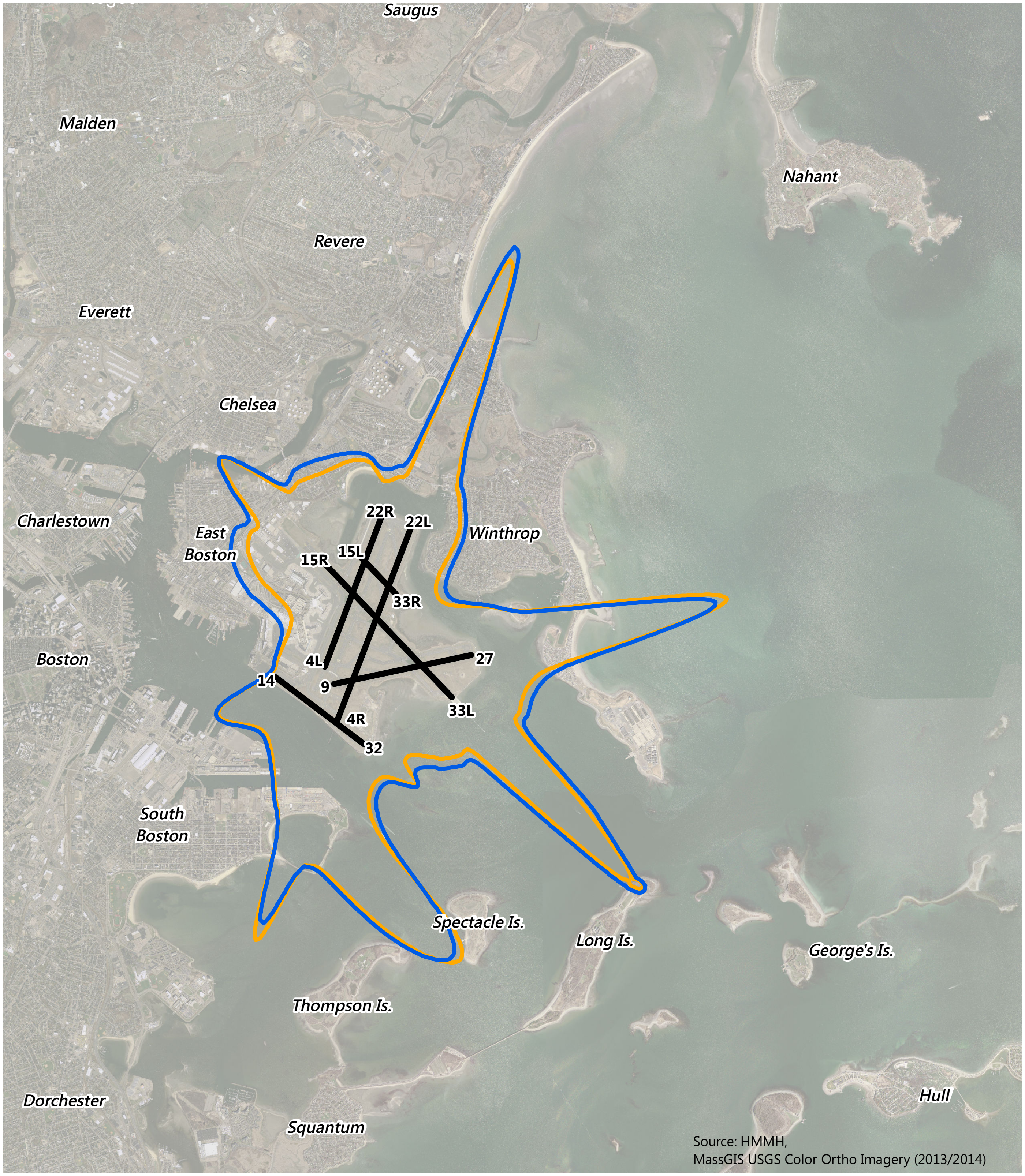


FIGURE 6-11 Comparison between 2014 and 2015 DNL 65 dB Contours

2015 Environmental Data Report

2015 DNL Contour (INM 7.0d)
2014 DNL Contour (INM 7.0d)

0 1750 3500 7000 Feet

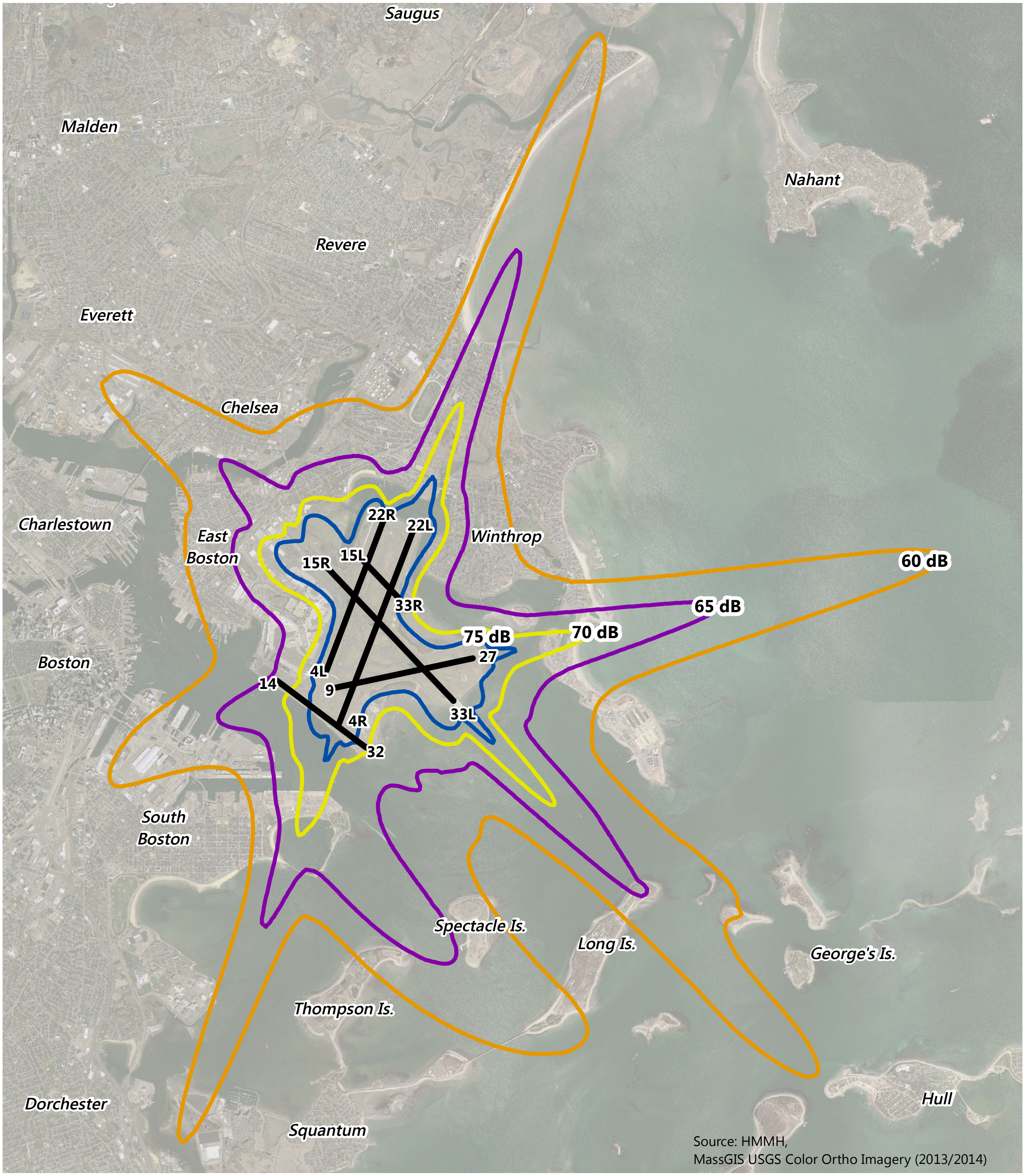


FIGURE 6-12 60-75 DNL Contours for 2015 Operations Using 7.0d

2015 Environmental Data Report

2015 DNL Contour (INM 7.0d)

- 60 dB
- 65 dB
- 70 dB
- 75 dB

0 1750 3500 7000 Feet

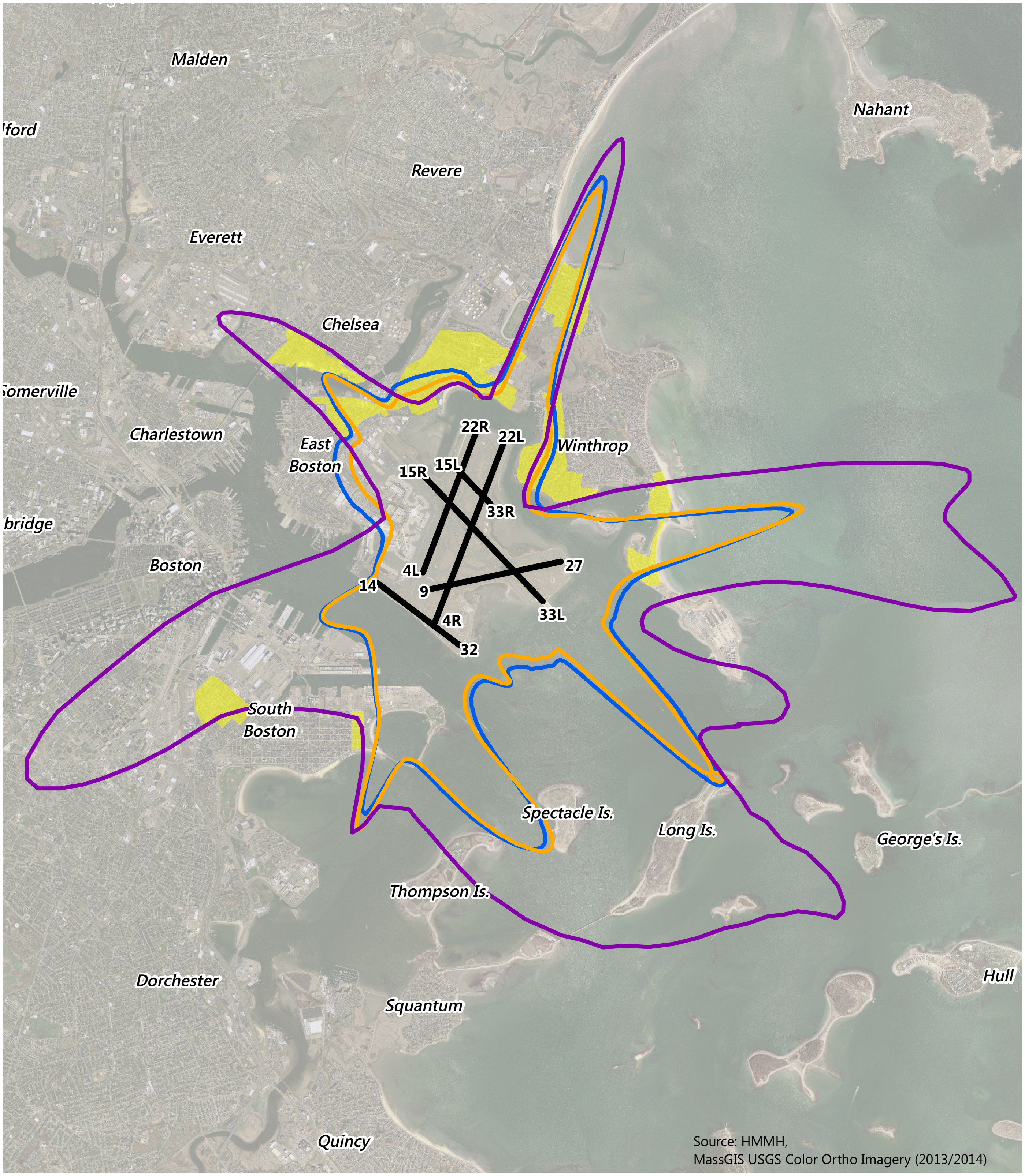
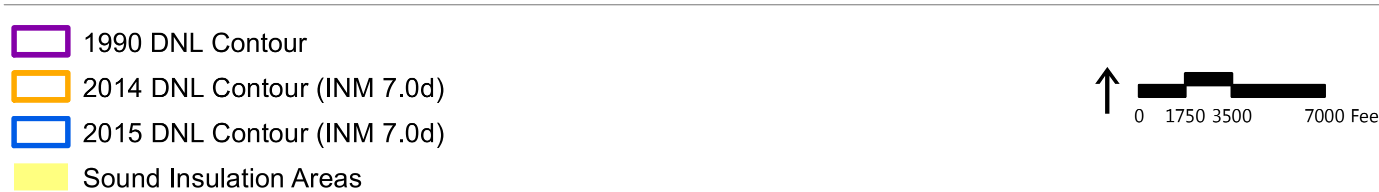


FIGURE 6-13 DNL 65 dB Contour Comparison with Historical Contour



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 2015 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 2010 Census data include updated population counts and can be used to demonstrate the changes in population in an area over a ten-year period.

Both the 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. The noise analysis is based upon the most recently FAA-approved INM model (Version 7.0d). **Table 6-7** provides an additional breakdown of the estimated population in East Boston and South Boston residing within the DNL 65 dB contour.

Due to the increase in operations in 2015 and changes in runway use, the total number of people exposed to DNL values equal to or greater than 65 dB increased to 14,097 people in 2015 from 8,922 people in 2014 (an increase of 5,175 people). The number of people residing within the DNL 70 dB contour increased from 164 people in 2014 to 430 people in 2015. The expansion of the DNL 70 dB contour occurred mainly in East Boston, with the remainder in Winthrop. These levels are still well 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. Almost all of the residences exposed to levels equal to or greater than DNL 65 dB in 2015 have been eligible to participate in Massport's RSIP.

Due in part to the additional number of operations and an increase in departures from Runway 15R in 2015, East Boston had an increase in the number of people exposed to noise levels of DNL 65 dB or greater, from 4,185 to 7,365 people. For historical context, in 2000, 8,979 people were exposed to levels DNL 65 dB or greater in East Boston and 269 people in South Boston. The area with the second largest increase in population, compared to 2014, is Winthrop. The number of people increased by over 1,000 between 2014 and 2015, from 1,905 to 2,943 people, primarily due to increased use of Runway 22R for departures and Runway 27 for arrivals. This reflects the FAA's relaxation of its converging runway operations (CRO) restriction, as these two operation types were not allowed in the same configuration for 2014 but were allowed for 2015. In 2015, no people were exposed to DNL levels greater than 65 dB in Chelsea or South Boston. The number of people exposed in Revere increased from 2,832 people in 2014 to 3,789 people in 2015. (See **Table 6-6** below.)

As noted, the total population exposed to noise levels between DNL 70 to 75 dB increased in 2015 to 430 people compared to 164 people in 2014, which is less than levels from 2000. In 2015, 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.

Table 6-6 Noise-exposed Population by Community[1]

Boston[3]

Year	Census	> 75 DNL	70-75 DNL	65[2]-70 DNL	Total (65+)[2] DNL
1990	1990	0	1,778	28,970	30,748
2000	2000	0	234	9,014	9,248
2010 (7.0b)	2010	0	0	689	689
2011 (7.0b)	2010	0	0	331	331
2011 (7.0c)	2010	0	0	331	331
2012 (7.0c)	2010	0	0	439	439
2012 (7.0d)	2010	0	0	421	421
2013 (7.0d)	2010	0	0	612	612
2014 (7.0d)	2010	0	34	4,151	4,185
2015 (7.0d)	2010	0	110	7,255	7,365

Revere

Year	Census	> 75 DNL	70-75 DNL	65[2]-70 DNL	Total (65+)[2] DNL
1990	1990	0	0	4,274	4,274
2000	2000	0	0	2,496	2,496
2010 (7.0b)	2010	0	0	2,413	2,413
2011 (7.0b)	2010	0	0	2,547	2,547
2011 (7.0c)	2010	0	0	2,547	2,547
2012 (7.0c)	2010	0	0	2,772	2,772
2012 (7.0d)	2010	0	0	2,762	2,762
2013 (7.0d)	2010	0	0	2,505	2,505
2014 (7.0d)	2010	0	0	2,832	2,832
2015 (7.0d)	2010	0	0	3,789	3,789

Chelsea

Year	Census	> 75 DNL	70-75 DNL	65[2]-70 DNL	Total (65+)[2] DNL
1990	1990	0	0	4,813	4,813
2000	2000	0	0	0	0
2010(7.0b)	2010	0	0	0	0
2011 (7.0b)	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

Winthrop

Year	Census	> 75 DNL	70-75 DNL	65[2]-70 DNL	Total (65+)[2] 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 (7.0b)	2010	0	130	939	1,069
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

Table 6-6 Noise-exposed Population by Community[1] (Continued)

Everett						**All Communities**					
Year	**Census**	**> 75 DNL**	**70-75 DNL**	**65[2]-70 DNL**	**Total (65+)[2] DNL**	**Year**	**Census**	**> 75 DNL**	**70-75 DNL**	**65[2]-70 DNL**	**Total (65+)[2] DNL**
1990	1980	0	0	0	0	1990	1980	676	2,989	40,477	44,142
2000	2000	0	0	0	0	2000	2000	247	1,304	16,194	17,745
2010 (7.0b)	2010	0	0	0	0	2010 (7.0b)	2010	0	130	3,700	3,830
2011 (7.0b)	2010	0	0	0	0	2011 (7.0b)	2010	0	130	3,817	3,947
2011 (7.0c)	2010	0	0	0	0	2011 (7.0c)	2010	0	130	3,817	3,947
2012 (7.0c)	2010	0	0	0	0	2012 (7.0c)	2010	0	200	4,536	4,736
2012 (7.0d)	2010	0	0	0	0	2012 (7.0d)	2010	0	200	4,369	4,569
2013 (7.0d)	2010	0	0	0	0	2013 (7.0d)	2010	0	130	4,177	4,307
2014 (7.0d)	2010	0	0	0	0	2014 (7.0d)	2010	0	164	8,758	8,922
2015 (7.0d)	2010	0	0	0	0	2015 (7.0d)	2010	0	430	13,667	14,097

Source: HMMH 2016, Massport.

Notes: Population counts for 2010 through 2015 are provided for the 2010 U.S. Census block data (as indicated) and the contours are from the RealContours™ system.

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.

2 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.

3 These values reflect the effect of the FAA-approved terrain adjustment in Orient Heights.

Table 6-7 Estimated Population within 65 dB[1] DNL Contour[2]

Year	Census Base	Boston: East Boston	Boston: South Boston	Boston: Total	Chelsea	Revere	Winthrop	Everett	All Communities
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
Change from 2014 to 2015		3,180	0	3,180	0	957	1,038	0	5,175

Source: HMMH 2016, Massport.

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 2015 are provided for the 2010 U.S. Census block data (as indicated) and the contours are from the RealContoursTM system.
Within the DNL 65 dB contour there was difference reduction in the number of people between the two 2011 INM model runs.

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.

Next-Generation Modeling - Aviation Environmental Design Tool (AEDT)

While using INM for modeling in the *2015 EDR*, Massport has begun testing the FAA's next-generation environmental modeling software, the Aviation Environmental Design Tool (AEDT). This is a unified system for modeling both noise and emissions from aircraft operations. Thus, it is intended to replace both INM and the legacy emissions model, the Emissions and Dispersion Modeling System (EDMS). By using common databases of aircraft, airport, and weather data, AEDT simplifies modeling of environmental effects and allows for the use of more current and consistent inputs. One of the goals of the AEDT model is to better understand the interrelationship between air quality and noise in the airport context.

For noise modeling, AEDT builds on the computational engine from INM. However, there are unique aspects to the way that INM has been used to model noise at Logan Airport; these adjustments to the INM model have been developed and implemented over the past several years to improve the results. As noted below in the section "*Comparing Modeled and Measured Noise Levels,*" these adjustments have led to the model more closely matching the noise levels measured by Logan Airport's noise monitoring system. Specific adjustments to account for the unique topography surrounding Logan Airport (approved for use by FAA with the INM) will need to be re-evaluated for AEDT. Massport is currently coordinating with the FAA to implement these adjustments (see the attached letter at the end of this chapter). Refinement of these customizations will continue and pending approval by FAA of Logan Airport-specific model changes, AEDT is expected to be the official model for next year's *2016 ESPR*.

The Logan Airport specific adjustments to INM that are not included in the AEDT modeling are:

- Custom flight profiles based on radar positioning data. This would allow the model to correct for deviations in aircraft weight, thrust, and elevation from standard flight profiles. AEDT does provide the ability to customize flight profiles above 500 feet in altitude and Massport is working with the FAA on the best method to implement this option.
- The acoustically reflective surface of the water in Boston Harbor surrounding the airport results in reflected noise that increases the noise level above the modeled values that assume an acoustically absorbing ground surface. An adjustment had been developed to correct for this in INM, but this correction could not be applied in AEDT. An alternative correction method will be developed and Massport will seek FAA approval for use in the *2016 ESPR*.
- The unique topography of Orient Heights results in residences that have direct line of sight to the runways. This was shown in earlier tests to result in higher noise levels due to the lack of ground absorption between the residences and the runway. The elevation corrections that have been developed for INM have not been implemented in AEDT; again, an alternative correction will be developed and Massport will discuss this adjustment with the FAA for use in the *2016 ESPR*.
- FAA requires the use of long term average weather data which is supplied with the model for each airport. The AEDT modeling includes the 30-year averages instead of daily average values for each set of flight tracks.
- The stagelength (or weight) of the aircraft in the AEDT modeling is assigned by the city-pair and not by the radar profile as done for the use of INM at Logan Airport.

Figure 6-14 Letter to Federal Aviation Administration – AEDT Adjustments

massport

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Telephone (617) 568-1003
www.massport.com

November 16, 2016

Richard Doucette
Airports Division
Federal Aviation Administration, New England Region
1200 District Avenue
Burlington, MA 01803

Dear Mr. Doucette:

Following up to our October 17th meeting where we discussed the FAA's new AEDT model for noise and air emissions, I am writing to you to request that FAA review the AEDT model results as applied to Boston Logan International Airport (Boston Logan) both related to noise and air quality. We also request that the FAA work with Massport and our consultants to develop Logan specific modification to the AEDT so that the model more accurately reflects the local noise and air quality environment.

As you are aware, Massport produces and circulates an annual environmental and planning report for Boston Logan to state officials and the interested public. FAA noise and air quality models form the basis of much of these reports. Massport also seeks to maintain with the FAA an updated Noise Exposure Map that supports our soundproofing efforts of eligible homes. As a result, Massport publishes annually Boston Logan specific noise and air quality data based on the latest FAA approved models (previously the INM and EDMS models). Overtime, Massport has worked closely with the FAA, and USDOT Volpe Center, to enhance the INM including, for example, Logan-specific modifications for "hill effects" and "over water propagation".

For the 2015 calendar year EDR, Massport's noise and air quality consultants utilized the FAA's new AEDT model (Version 2B Service Pack 2). Based on preliminary results, we have strong concerns on the general applicability of the noise module to accurately reflect Boston Logan's noise environment. To assist with the development of a Boston Logan specific modeling process, we have asked our consultant to put together a request (attached) to be sent to FAA AEE for review and approval of AEDT Non-standard modeling and methods. Finally, we also have a narrower concern on the AEDT's estimate of Particulate Matter (PM) which we would also like to discuss.

We look forward to working with you on reviewing and modifying the AEDT to better reflect Boston Logan's noise and air quality footprint.

Very truly yours,

Flavio Leo
Director, Aviation Planning & Strategy

CC: Mary Walsh (FAA), Gail Latrell (FAA), Stewart Dalzell (Massport)

Operating | Boston Logan International Airport • Port of Boston general cargo and passenger terminals • Hanscom Field • Boston Fish Pier • Commonwealth Pier (site of World Trade Center Boston) • Worcester Regional Airport

Comparing Measured and Modeled Noise Levels

When changes in noise exposure are predicted by INM, it is important to substantiate these modeled findings with actual noise measurements, such as those taken with Massport's permanent noise monitoring system. For 2014 and 2015, differences between measured and modeled values have narrowed even more than reported in previous EDRs and ESPRs.[33] This improved accuracy in modeled results corresponds with the Airport's noise measurement equipment and monitoring system and its ability to correlate measured noise events with individual flight tracks, combined with the improvements in the INM database.

Massport's system continuously measures the noise levels at each of the 30 microphone locations around the Airport and environs, as shown in **Figure 6-15**. 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 *2015 EDR* compares the measured annual average DNL values from the monitors to INM-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, particularly as adjustments were incorporated into the modeling process to account for the over-water sound propagation and hill effects. 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.

Aircraft altitude is a second factor that contributes to the differences between measured and modeled DNL values (especially at the more-distant noise monitoring sites). Typical noise modeling uses distance from origin to destination to determine the appropriate climb profile for an aircraft; however, many aircraft climb more slowly than the standard profiles would suggest, especially if the pilot must make a turn shortly after takeoff. By modeling the actual climb profile, instead of selecting the best fit among a standard set, better measured versus modeled results should be expected. This technique was applied and resulted in modeling lower altitudes over many of the farther out monitoring sites, which is a better reflection of reality, and further reduced the differences between measured and modeled sound levels at those locations. Finally, latitudes and longitudes of each measurement site were verified by survey and their exact coordinates entered into INM. These improvements in modeling techniques are now fully integrated into the measured-versus-modeled INM comparisons that follow.

33 Several factors have resulted in better agreement between measured versus modeled levels. Beginning with the *2009 EDR*, flight track data and measurement data have come from the new monitoring system. The more accurate flight track data are used for the modeling inputs and for the measured aircraft event correlation.

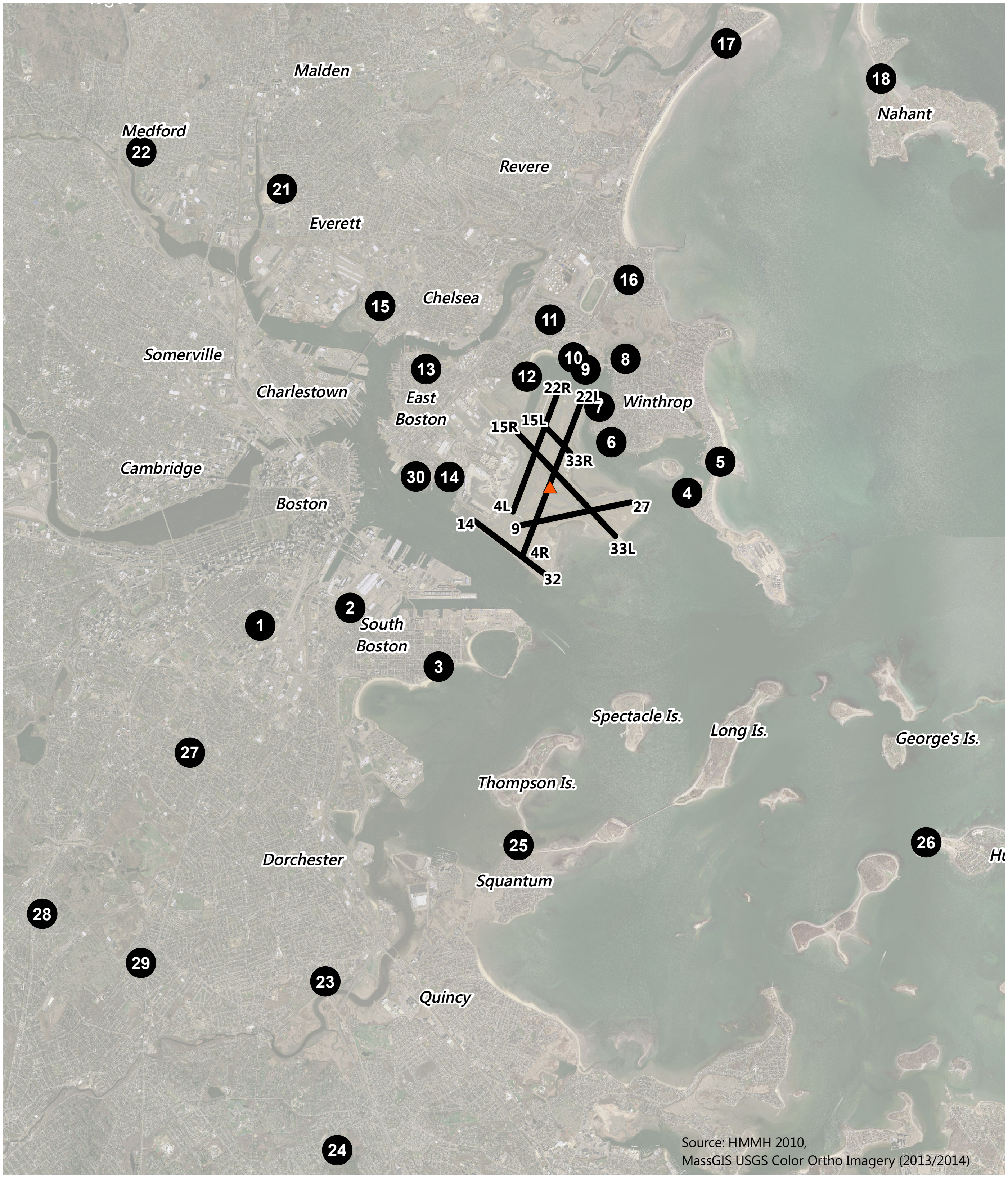


FIGURE 6-15 Noise Monitor Locations | **2015 Environmental Data Report**

Permanent Noise Monitor | Airport Reference Point

0 1750 3500 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 2014 DNL values to the measured 2015 DNL values at each location. On average, measured sound levels were unchanged between 2014 and 2015. In 2015, two locations had decreases of more than 2 dB while two had an increase 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 55.6 dB in 2015, slightly less than 2014. Sites 12 and 30 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 30 also had a technical problem during 2014 and which resulted in a recorded high DNL value. To keep the sites used for the averages consistent between the two years, Sites 12 and 30 were excluded from the computations.

Noise level changes at various sites typically follow changes in runway use. For example, an increase in departures on Runway 22R resulted in higher noise levels at Site 10 in East Boston due to start-of-takeoff roll.

Distances reported in **Tables 6-8** and **6-9** are computed from the Airport Reference Point which is located along Runway 4L-22R near the intersection with Runway 15R-33L. This location is shown on **Figure 6-15**.

The measured data are not used to calibrate the model but are shown here to compare to the modeled values and in general, they should reveal similar trends.

- The measured values at Sites 3 (South Boston), 23 (Dorchester), and 24 (Milton) decreased due to the decrease in arrivals to Runway 4R in 2015;
- The measured value at Site 10, which is behind the start of takeoff for Runway 22R departures, increased in 2015;
- Site 26, in Hull, increased due to the increase in Runway 22R departures and operations at night to Runway 15R-33L;
- Site 13, at the East Boston High School, decreased slightly; and
- The majority of the Winthrop sites remained the same as 2014 or reflected an increase (Site 6).

Table 6-8 Measured Versus Measured - Comparison of Measured DNL Values From 2014 to 2015

Location	Site	Distance from Logan Airport (miles)	2014 Measured Aircraft (DNL)	2015 Measured Aircraft (DNL)	Difference 2015 minus 2014
South End – Andrews Street	1	3.7	56.0	56.0	0.0
South Boston – B and Bolton	2	2.9	56.6	57.9	1.3
South Boston – Day Blvd. near Farragut	3	2.5	60.5	59.2	(1.3)
Winthrop – Bayview and Grandview	4	1.6	71.0	71.0	0.0
Winthrop – Harborview and Faun Bar	5	1.9	63.4	63.4	0.0
Winthrop – Somerset near Johnson	6	0.8	62.5	64.0	1.5
Winthrop – Loring Road near Court	7	1.0	65.7	65.6	(0.1)
Winthrop – Morton and Amelia	8	1.6	59.6	59.2	(0.4)
East Boston – Bayswater near Annavoy	9	1.3	67.3	67.1	(0.2)
East Boston – Bayswater near Shawsheen	10	1.3	55.2	58.1	2.9
East Boston – Selma and Orient	11	1.8	55.3	55.1	(0.2)
East Boston Yacht Club	12	1.2	N/A	N/A	N/A
East Boston High School	13	1.9	62.0	61.7	(0.3)
East Boston – Jeffries Point Yacht Club	14	1.2	55.8	54.9	(0.9)
Chelsea – Admiral's Hill	15	2.8	60.8	61.3	0.5
Revere – Bradstreet and Sales	16	2.4	68.6	67.9	(0.7)
Revere – Carey Circle	17	5.3	60.2	60.4	0.2
Nahant – U.S.C.G. Recreational Facility	18	5.9	39.2	37.3	(1.9)
Swampscott – Smith Lane	19	8.7	42.0	40.4	(1.6)
Lynn – Pond and Towns Court	20	8.4	52.7	49.7	(3.0)
Everett – Tremont near Prescott	21	4.5	51.7	51.6	(0.1)
Medford – Magoun near Thatcher	22	6.0	52.2	52.0	(0.2)
Dorchester – Myrtlebank near Hilltop	23	6.3	55.6	55.4	(0.2)
Milton – Cunningham Park near Fullers	24	8.1	49.0	48.7	(0.3)
Quincy – Squaw Rock Park	25	4.2	42.7	42.0	(0.7)
Hull – Hull High School near Channel Street	26	6.0	58.3	59.8	1.5
Roxbury – Boston Latin Academy	27	5.3	54.4	54.3	(0.1)
Jamaica Plain – Southbourne Road	28	7.7	45.4	45.0	(0.4)
Mattapan – Lewenburg School	29	7.3	35.3	38.9	3.6
East Boston – Piers Park	30	1.5	63.7	47.9	(15.8)
Arithmetic Average			55.7	55.6	

Source: HMMH.

Notes: Changes in ( ) represent a decrease in measured noise level.
Distance from Logan Airport calculated from the Airport Reference Point.
Site 12 (East Boston Yacht Club) is no longer operational. New monitor installation is underway at a different location.
Site 30 had interference from an outside source in 2014
Sites 12 and 30 are not included in the Average values.

The INM model was used to compute DNL noise levels at each noise monitoring site. **Table 6-9** compares the measured 2014 and 2015 DNL values at each measurement site to the modeled DNL values.

The average measured value for 28 of the sites is 55.6 dB in 2015 and the average modeled value is 58.3 dB in 2015 (Sites 12 and 30 are excluded from the averages due to issues at each site). The average of the difference between the measured versus modeled values for 2014 was 2.8 dB and 2.6 dB in 2015. 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 RealContours™, Massport is able to compute the modeled DNL for exactly 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 phenomenon and the influence such as shielding from local buildings and trees.

As shown in **Table 6-9**, ten of the sites in 2015 have a difference between measured and modeled less than 1 dB. In 2014 and 2015, 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 INM Modeled - Comparison of Measured DNL Values to RealContours™-modeled DNL Values, 2014 and 2015

	Site	Distance from Logan Airport (miles)	2014	2014	2015	2015	2014	2015
Location			**Measured Aircraft – Only DNL**	**Modeled RC Results INMv7.0d (DNL)[1]**	**Measured Aircraft – Only DNL**	**Modeled RC Results INMv7.0d (DNL)[1]**	**Difference Modeled minus Measured**	
South End – Andrews Street	1	3.7	56.0	55.1	56	54.2	(0.9)	(1.8)
South Boston – B and Bolton	2	2.9	56.6	59.3	57.9	59.1	2.7	1.2
South Boston – Day Blvd. near Farragut	3	2.5	60.5	60.6	59.2	60.5	0.1	1.3
Winthrop – Bayview and Grandview	4	1.6	71.0	72.0	71	72.1	1.0	1.1
Winthrop – Harborview and Faun Bar	5	1.9	63.4	64.1	63.4	63.5	0.7	0.1
Winthrop – Somerset near Johnson	6	0.8	62.5	63.7	64	64.1	1.2	0.1
Winthrop – Loring Road near Court	7	1.0	65.7	71.8	65.6	72.5	6.1	6.9
Winthrop – Morton and Amelia	8	1.6	59.6	63.5	59.2	63.9	3.9	4.7
East Boston – Bayswater near Annavoy	9	1.3	67.3	72.2	67.1	72.4	4.9	5.3
East Boston – Bayswater near Shawsheen	10	1.3	55.2	65.1	58.1	65.2	9.9	7.1
East Boston – Selma and Orient[2]	11[2]	1.8	55.3	57.7	55.1	57.8	2.4	2.7
East Boston Yacht Club	12	1.2		69.6		70.3		70.3
East Boston High School	13	1.9	62.0	62.0	61.7	62.6	0.0	0.9
East Boston – Jeffries Point Yacht Club	14	1.2	55.8	56.8	54.9	57.2	1.0	2.3
Chelsea – Admiral's Hill	15	2.8	60.8	61.2	61.3	61.2	0.4	(0.1)
Revere – Bradstreet and Sales	16	2.4	68.6	68.9	67.9	68.7	0.3	0.8
Revere – Carey Circle	17	5.3	60.2	60.6	60.4	60.5	0.4	0.1
Nahant – U.S.C.G. Recreational Facility	18	5.9	39.2	45.7	37.3	44.9	6.5	7.6

Table 6-9	Measured Versus INM Modeled - Comparison of Measured DNL Values to RealContours™-modeled DNL Values, 2014 and 2015 (Continued)

	Site	Distance from Logan Airport (miles)	2014	2014	2015	2015	2014	2015
Location			**Measured Aircraft – Only DNL**	**Modeled RC Results INMv7.0d (DNL)[1]**	**Measured Aircraft – Only DNL**	**Modeled RC Results INMv7.0d (DNL)[1]**	**Difference Modeled minus Measured**	
Swampscott – Smith Lane	19	8.7	42.0	46.3	40.4	45.3	4.3	4.9
Lynn – Pond and Towns Court	20	8.4	52.7	54.7	49.7	55.1	2.0	5.4
Everett – Tremont near Prescott	21	4.5	51.7	54.4	51.6	53.9	2.7	2.3
Medford – Magoun near Thatcher	22	6.0	52.2	53.4	52	52.5	1.2	0.5
Dorchester – Myrtlebank near Hilltop	23	6.3	55.6	54.3	55.4	54.4	(1.3)	(1.0)
Milton – Cunningham Park near Fullers	24	8.1	49.0	54.5	48.7	54	5.5	5.3
Quincy – Squaw Rock Park	25	4.2	42.7	47.8	42	47.8	5.1	5.8
Hull – Hull High School near Channel Street	26	6.0	58.3	58.6	59.8	58.8	0.3	(1.0)
Roxbury – Boston Latin Academy	27	5.3	54.4	54.3	54.3	53.4	(0.1)	(0.9)
Jamaica Plain – Southbourne Road	28	7.7	45.4	50.5	45	49.5	5.1	4.5
Mattapan – Lewenburg School	29	7.3	35.3	47.6	38.9	46.6	12.3	7.7
East Boston – Piers Park	30	1.5	63.7	54.3	47.9	54.8	(9.4)	6.9
Arithmetic Average [3]			55.7	58.5	55.6	58.3	2.8	2.6

Source: HMMH.
Note: 2014 and 2015 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 30 are not included in the average values.

Supplemental Metrics

To further describe the noise environment, this *2015 EDR* includes supplemental noise metrics: CNI, dwell and persistence, and times above a noise threshold.

Cumulative Noise Index (CNI)

Massport reports total annual fleet noise at Logan Airport, as defined in the Logan Airport Noise Rules by a metric referred to as the CNI. The CNI is a single number representing the sum of the entire set of single-event noise energy from each operation experienced at Logan Airport over a full year of operation. The CNI is weighted similarly to DNL so that activity occurring at night is penalized by adding an extra 10 dB to each 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[34] 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. Utilizing the expanded data available from the NOMS, all of the available aircraft registration data were used to select the proper noise certification levels from the latest aircraft noise registration database.[35]

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 dB. The CNI has increased slightly each year since 2010 primarily due to increases in commercial operations or night operations. In 2015, the CNI decreased to 152.7 EPNdB representing a 0.2-dB decrease from 2014, and remained well below the cap of 156.5 EPNdB. Even though operational levels and night operations increased, the CNI for 2015 decreased. This is the result of using quieter aircraft in 2015. The partial CNI decreased across all categories for 2015 when compared to 2014.

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 2015:

- The passenger jets' contribution decreased slightly in 2015 despite increased operations; and
- While daytime and nighttime CNI contributions both decreased, the decrease was smaller for nighttime CNI due to an increase in nighttime passenger operations.

34 EPNdB is the noise metric used to certify aircraft by the FAA.

35 Type-certificate data sheet for noise database available from the European Aviation Safety Agency; //easa.europa.eu/certification/type-certificates/noise.php.

Table 6-10 Cumulative Noise Index (EPNdB)[1]

	Logan Airport CNI Cap – 156.5 EPNdB								
	1990	**2000**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Change (2014-2015)**
Full CNI (Entire Commercial	**156.4**	**154.7**	**151.9**	**152.1**	**152.2**	**152.3**	**152.9**	**152.7**	**(0.2)**
Total Passenger Jets	155.2	153.6	150.9	150.6	151.3	151.4	152.2	152.0	(0.2)
Total Cargo Jets	150.1	148.2	145.1	146.7	144.9	145.1	144.5	144.2	(0.3)
Total Daytime	152.5	149.5	146.8	146.9	147.0	147.0	147.5	147.2	(0.3)
Total Nighttime	154.4	153.1	150.3	150.6	150.6	150.8	151.3	151.2	(0.1)
Total Stage 2 Jets	N/A	124.7	113.6	110.8[2]	104.9[2]	111.3	N/A	N/A	N/A
Total Stage 3 Jets	N/A	154.7	151.9	152.1	152.2	152.3	152.9	152.7	(0.2)
Daytime Stage 2	N/A	122.6	103.6	N/A	104.9	101.4	N/A	N/A	N/A
Nighttime Stage 2	N/A	120.5	113.1	110.8	N/A	110.8	N/A	N/A	N/A
Daytime Stage 3	N/A	149.5	146.8	146.9	147	147.0	147.5	147.2	(0.3)
Nighttime Stage 3	N/A	153.1	150.3	150.6	150.6	150.8	151.3	151.2	(0.1)
Passenger Jet Stage 2	N/A	124.2	N/A	N/A	104.9[2]	101.4	N/A	N/A	N/A
Passenger Jet Stage 3	N/A	153.6	150.9	150.6	151.3	151.4	152.2	152.0	(0.2)
Cargo Jet Stage 2	N/A	114.8	113.6	110.8[2]	N/A	110.8	N/A	N/A	N/A
Cargo Jet Stage 3	N/A	148.2	145.1	146.7	144.9	145.1	144.5	144.2	(0.3)
Daytime Passenger	N/A	149.3	146.6	146.5	146.8	146.8	147.3	147.0	(0.3)
Nighttime Passenger	N/A	151.6	149.0	148.5	149.4	149.6	150.5	150.3	(0.2)
Daytime Cargo	137.1	137.5	134.5	136.6	134	133.6	134.9	134.4	(0.5)
Nighttime Cargo	149.9	147.8	144.7	146.3	144.5	144.8	144.0	143.7	(0.3)
Daytime Passenger Stage 2	N/A	122.3	N/A	N/A	104.9[2]	101.4	N/A	N/A	N/A
Daytime Passenger Stage 3	N/A	149.2	146.6	146.5	146.8	146.8	147.3	147.0	(0.3)
Nighttime Passenger Stage 2	N/A	119.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nighttime Passenger Stage 3	N/A	151.6	149.0	148.5	149.4	149.6	150.5	150.3	(0.2)
Daytime Cargo Stage 2	N/A	111.1	103.6	N/A	N/A	N/A	N/A	N/A	N/A
Daytime Cargo Stage 3	N/A	137.5	134.4	136.6	134	133.6	134.9	134.4	(0.5)
Nighttime Cargo Stage 2	N/A	112.3	113.1	110.8[2]	N/A	110.8	N/A	N/A	N/A
Nighttime Cargo Stage 3	N/A	147.8	144.7	146.3	144.5	144.8	144.0	143.7	(0.3)

Source: HMMH 2015.

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*.

2 The Stage 2 results are from a Falcon 20 aircraft arrival and departure flown by a Charter Operator during 2012.

3 The Stage 2 results during 2013 are from a GII-B aircraft flown by a Charter Operator and a LEAR 25 flown by a Cargo Operator.

Table 6-11 provides the number of flight operations, the resulting CNI by airline for 2014 and 2015, and the partial CNI per operation for 2014 and 2015. 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 by operation for 2015 and shows the major cargo operators at the top of this list, since they operate primarily at night. JetBlue Airways, with the largest number of operations, has the highest CNI per airline at 145.7 EPNdB in 2014 and 146.1 EPNdB in 2015, 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 that JetBlue Airways has but its total CNI per airline is 143.2 EPNdB in 2014 and 142.9 EPNdB in 2015, only 3 dB below JetBlue Airways. The partial CNI by operation for FedEx is 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, 21.7 percent of its operations are at night as compared to JetBlue Airways, which had only 14.7 percent at night. Delta Air Lines only has 13.7 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 and Partial CNI by Airline and per Operation, 2014 and 2015

Airlines with more than 100 flights in 2015	2014 Operations[1]	2014 Total Airline CNI (EPNdB)	2015 Operations[1]	2015 Total Airline CNI (EPNdB)	Partial CNI (EPNdB) per Operation			Airline Category
					2013	2014	2015	
Federal Express	3,315	143.2	3,523	142.9	109.0	108.0	107.4	Cargo
El Al Israel Airlines	N/A	N/A	152	129.2	N/A	N/A	107.3	International
United Parcel Service	1,435	137.5	1,538	137.5	106.0	105.9	105.7	Cargo
Cathay Pacific	N/A	N/A	279	130.0	N/A	N/A	105.6	International
Atlas Air	489	132.7	218	128.6	107.8	105.8	105.2	Cargo
British Airways	2,678	138.2	2,575	138.7	103.2	104.0	104.6	International
Turkish Airlines	452	128.8	726	131.0	N/A	102.3	102.4	International
Lufthansa	1,714	134.1	1,687	134.5	100.2	101.8	102.2	International
Virgin Atlantic	716	129.5	702	130.5	97.2	100.9	102.0	International
Air France	899	131.8	910	131.2	101.2	102.3	101.6	International
Emirates Airlines	1,190	132.4	914	131.1	N/A	101.7	101.4	International
ATI	N/A	N/A	302	126.0	N/A	N/A	101.2	Cargo
Alitalia	550	128.1	562	127.9	97.9	100.7	100.4	International

Table 6-11 Annual Operations and Partial CNI by Airline and per Operation, 2014 and 2015 (Continued)

Airlines with more than 100 flights in 2015	2014 Operations[1]	2014 Total Airline CNI (EPNdB)	2015 Operations[1]	2015 Total Airline CNI (EPNdB)	Partial CNI (EPNdB) per Operation 2013	2014	2015	Airline Category
SATA Intl Airlines	533	127.3	542	127.4	99.7	100.1	100.0	International
Swiss Air	722	128.7	711	127.8	99.5	100.2	99.3	International
Sun Country Airlines	1,027	24.3	1,414	130.7	93.8	94.2	99.2	Regional
Southwest Airlines	18,525	142	21,514	142.5	98.2	98.6	99.1	Domestic
United Airlines	34,609	145	24,644	142.7	98.8	98.8	98.7	Domestic
Alaska Airlines	6,180	136	3,027	133.4	98.0	97.8	98.6	Domestic
Virgin America	3,198	132	3,426	133.1	97.8	98.6	97.8	Domestic
American Airlines	22,626	142	48,355	144.1	97.8	98.1	97.2	Domestic
Air Canada	1,112	127	1,718	129.5	95.3	95.1	97.1	International
Aer Lingus	2,964	132	1,973	129.9	97.1	97.0	97.0	International
Iberia Air Lines	332	123	336	122.2	97.0	96.8	97.0	International
Hainan Airlines	280	122	744	125.7	N/A	N/A	97.0	International
Japan Airlines	731	126	728	125.6	N/A	96.9	96.9	International
Delta Air Lines	29,557	142	33,909	142.1	96.8	96.6	96.8	Domestic
Jetblue Airways	82,595	146	85,852	146.1	96.9	97.1	96.7	Domestic
Spirit Airlines	2,945	132	4,896	133.0	97.4	97.4	96.1	Domestic
US Airways	35,993	141	8,843	135.5	95.8	95.4	96.0	Domestic
Compañía Panameña de Aviación S.A.	N/A	N/A	646	121.9	N/A	N/A	93.8	International
Shuttle America Corp	9,751	134	5,290	130.8	94.8	93.7	93.6	Regional
Mesa Airlines	1,404	124	437	120.0	95.3	93.3	93.5	Regional
Icelandair	1,227	124	1,365	124.8	93.4	93.0	93.5	International
Aeromexico	N/A	N/A	345	118.5	N/A	N/A	93.1	International
Sky Regional Airlines Inc.	3,981	130	3,784	128.8	N/A	N/A	93.0	International
Pinnacle Airlines	7,310	132	7,284	131.2	89.4	91.9	92.5	Regional
US Airways	3,290	128	4,669	129.0	93.2	92.8	92.3	Regional
WOW Air, LLC.	N/A	N/A	445	118.7	N/A	N/A	92.3	International
GoJet Airlines	476	121	1,309	123.3	N/A	N/A	92.2	Domestic
SkyWest Airlines	1,152	124	548	119.5	N/A	N/A	92.2	Domestic
AWAC - US Air Express	6,165	130	4,998	128.7	91.4	91.4	91.7	Regional
Delta	6,965	130	4,923	127.1	91.6	91.5	90.1	Domestic
Air Canada Jazz	14,353	131	5,037	127.1	90.2	89.9	90.0	Regional

Source: HMMH, Massport. 2015.

Notes: NA = 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**.

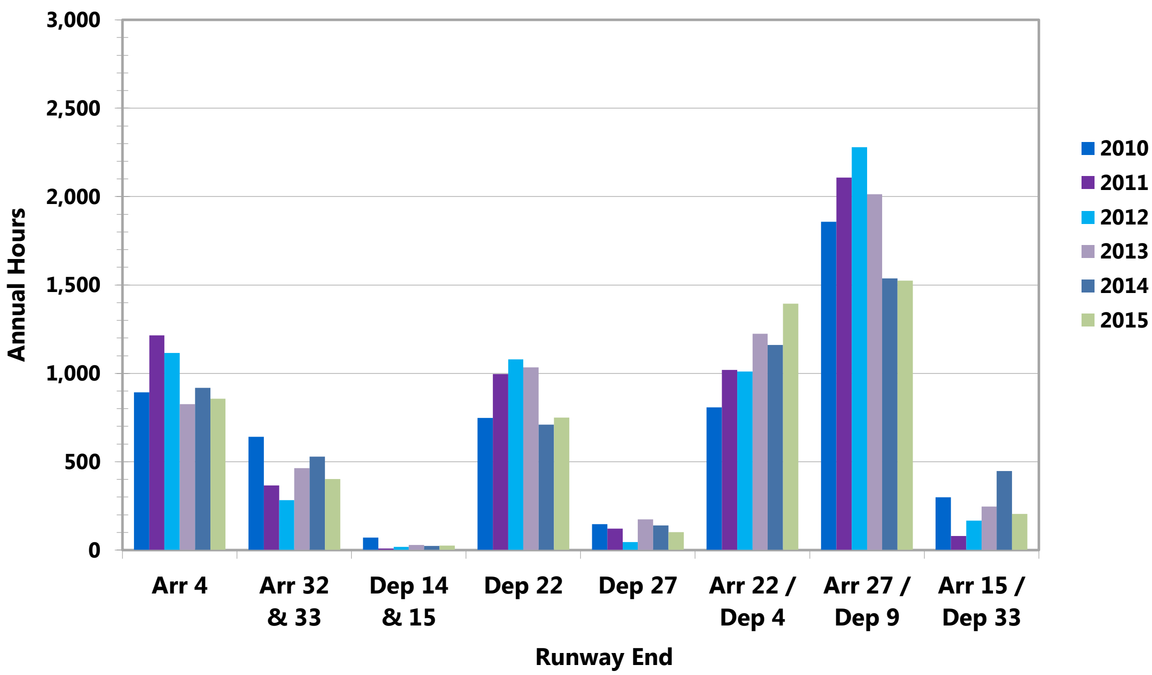
Table 6-12 Representative Neighborhoods near Logan Airport Affected by Runway Use

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,[36] this *2015 EDR* reports on noise dwell and persistence levels. Higher levels of dwell or persistence for overwater areas represent a benefit since this produces a corresponding decrease in total hours over populated areas. **Figures 6-16** and **6-17** illustrate the annual hours of dwell and persistence by runway end for 2010 through 2015. 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. As in 2014, the largest contributor to dwell and persistence in 2015 remained arrivals to Runway 27 and departures from Runway 9, although the hours of both dwell and persistence in this category fell by roughly half from previous years. Both metrics also decreased substantially for Runway 15R arrivals and Runway 33L departures and also for Runways 32 and 33L arrivals, following their increases in 2014.

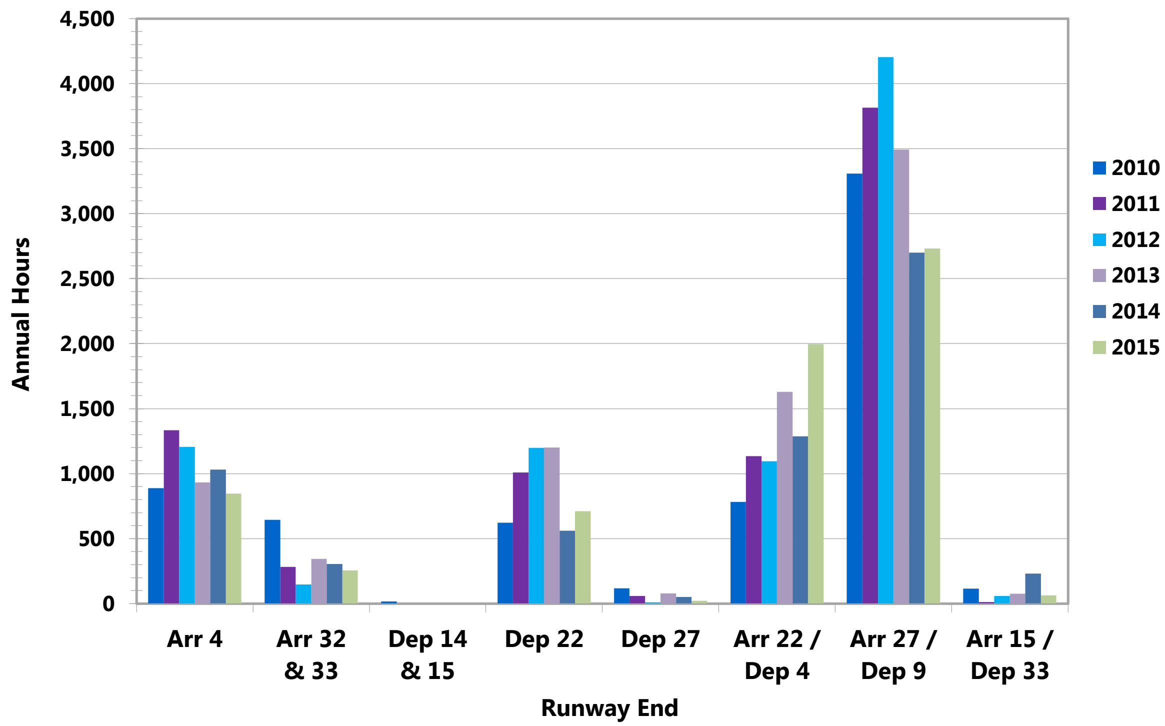
Figure 6-16 Comparison of Annual Hours of Dwell Exceedance by Runway End, 2010 to 2015



Note: The Dwell data in Figure 6-15 and the Persistence data in Figure 6-16 for 2014 were incorrectly reported in the *2014 EDR*. The correct values are presented in these figures.

36 *Logan Airside Improvements Planning Project Final EIS*. http://www.bostonoverflightnoisestudy.com/docs/2002_FAA_EIS_Executive%20Summary.pdf. Accessed November 17, 2015.

Figure 6-17 Comparison of Annual Hours of Persistence Exceedance by Runway End, 2010 to 2015



Time Above (TA)

The third supplemental noise metric reported in this *2015 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 (A-weighted dBs). Like DNL values, these times are computed using the FAA-approved INM as modified for Logan Airport. 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. Findings for 2015 include an increase in TA at Site 10 in East Boston, from 50.5 minutes in 2014 to 52.5 minutes in 2015 due to increased departures from Runway 22R.

Tables 6-13 and **6-14** present a summary of the calculated TA values for 2014 and 2015.

Table 6-13 Time Above (TA) dBA Thresholds in a 24 Hour Period for Average Day

Location	Site	Distance from Logan Airport (miles)	Minutes above Threshold 2014 85 dBA	2014 75 dBA	2014 65 dBA	Minutes above Threshold 2015 85 dBA	2015 75 dBA	2015 65 dBA	Modeled Day-Night Sound Levels 2014[1]	2015[1]
Winthrop – Bayview and Grandview	4	1.6	10.5	36.8	79.3	10.8	37.1	80.2	72.0	72.1
Winthrop – Harborview and Faun Bar	5	1.9	0.2	14.6	71.8	0.1	12.5	69.7	64.1	63.5
Winthrop – Somerset near Johnson	6	0.8	0.1	4.1	99.5	0.1	4.1	100.5	63.7	64.1
Winthrop – Loring Road near Court	7	1.0	2.4	24.2	149.1	2.5	25.5	156.4	71.8	72.5
Winthrop – Morton and Amelia	8	1.6	0.0	3.9	61.8	0.0	4.1	64.0	63.5	63.9
East Boston – Bayswater near Annavoy	9	1.3	2.2	29.6	82.9	2.4	30.1	85.6	72.2	72.4
East Boston – Bayswater near Shawsheen	10	1.3	0.3	6.6	50.5	0.2	6.6	52.5	65.1	65.2
East Boston – Selma and Orient	11	1.8	0.0	0.9	10.0	0.0	0.7	9.6	57.7	57.8
East Boston Yacht Club	12	1.2	1.3	34.8	156.6	1.3	35.1	164.3	69.6	70.3
East Boston High School	13	1.9	0.1	7.4	32.2	0.2	7.1	29.3	62.0	62.6
East Boston – Jeffries Point Yacht Club	14	1.2	0.0	0.7	11.0	0.0	0.6	10.5	56.8	57.2
East Boston – Piers Park	30	1.5	0.0	0.3	5.1	0.0	0.3	4.7	54.3	54.8
Chelsea – Admiral's Hill	15	2.8	0.1	6.3	29.6	0.1	5.4	25.4	61.2	61.2
Revere – Bradstreet and Sales	16	2.4	2.5	19.7	47.6	1.8	20.3	51.0	68.9	68.7
Revere – Carey Circle	17	5.3	0.0	1.5	36.7	0.0	1.2	35.8	60.6	60.5
Nahant – U.S.C.G. Recreational Facility	18	5.9	0.0	0.0	0.3	0.0	0.0	0.3	45.7	44.9
Everett – Tremont near Prescott	21	4.5	0.0	0.4	11.9	0.0	0.2	9.2	54.4	53.9

Table 6-13 Time Above (TA) dBA Thresholds in a 24 Hour Period for Average Day (Continued)

Location	Site	Distance from Logan Airport (miles)	Minutes above Threshold 2014 85 dBA	75 dBA	65 dBA	Minutes above Threshold 2015 85 dBA	75 dBA	65 dBA	Modeled Day-Night Sound Levels 2014[1]	2015[1]
Medford – Magoun near Thatcher	22	6.0	0.0	0.2	10.0	0.0	0.1	7.0	53.4	52.5
Swampscott – Smith Lane	19	8.7	0.0	0.0	1.1	0.0	0.0	0.8	46.3	45.3
Lynn - Pond and Towns Court	20	8.4	0.0	0.0	11.5	0.0	0.0	11.9	54.7	55.1
South End – Andrews Street	1	3.7	0.0	0.4	12.6	0.0	0.2	10.6	55.1	54.2
South Boston – B and Bolton	2	2.9	0.0	3.4	20.4	0.0	3.0	18.0	59.3	59.1
South Boston – Day Blvd. near Farragut	3	2.5	0.0	3.8	53.1	0.0	3.8	55.8	60.6	60.5
Roxbury – Boston Latin Academy	27	5.3	0.0	0.2	11.4	0.0	0.1	9.2	54.3	53.4
Jamaica Plain - Southbourne Road	28	7.7	0.0	0.0	4.2	0.0	0.0	2.8	50.5	49.5
Mattapan – Lewenburg School	29	7.3	0.0	0.0	0.8	0.0	0.0	0.5	47.6	46.6
Dorchester – Myrtlebank near Hilltop	23	6.3	0.0	0.0	12.7	0.0	0.0	14.5	54.3	54.4
Milton – Cunningham Park near Fullers	24	8.1	0.0	0.0	15.4	0.0	0.0	12.9	54.5	54.0
Quincy – Squaw Rock Park	25	4.2	0.0	0.0	0.4	0.0	0.0	0.4	47.8	47.8
Hull – Hull High School near Channel Street	26	6.0	0.0	0.3	26.3	0.0	0.2	25.9	58.6	58.8
Average TA Value			0.7	6.7	37.2	0.7	6.6	37.3	58.7[2]	58.6[2]

Source: HMMH 2015.
Notes: Distance from Logan Airport calculated from the Airport Reference Point.
dBA = A-weighted decibel
1 Modeled using RealContoursTM and RealProfilesTM using INM (v7.0d) for 2014 and 2015 (12 months) with adjusted database. (Database modifications as described in the Logan Airport *2004 ESPR*).
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]

Location	Site	Distance from Logan Airport (miles)	Minutes above Threshold During the Night 2014			Minutes above Threshold During the Night 2015			Modeled Day-Night Sound Levels	
			85 dBA	75 dBA	65 dBA	85 dBA	75 dBA	65 dBA	2014[2]	2015[2]
Winthrop – Bayview and Grandview	4	1.6	1.0	3.3	7.5	1.1	3.5	8.0	72.0	70.5
Winthrop – Harborview and Faun Bar	5	1.9	0.0	1.4	6.6	0.0	1.2	6.7	64.1	62.7
Winthrop – Somerset near Johnson	6	0.8	0.1	1.3	17.5	0.1	1.4	18.0	63.7	68.0
Winthrop – Loring Road near Court	7	1.0	0.6	4.5	25.9	0.6	4.6	27.4	71.8	73.5
Winthrop – Morton and Amelia	8	1.6	0.1	0.9	12.2	0.1	0.9	12.9	63.5	63.9
East Boston – Bayswater near Annavoy	9	1.3	0.5	5.9	16.8	0.5	6.3	17.9	72.2	70.2
East Boston – Bayswater near Shawsheen	10	1.3	0.1	1.3	11.0	0.1	1.3	12.1	65.1	65.2
East Boston – Selma and Orient	11	1.8	0.0	0.0	1.0	0.0	0.0	1.2	57.7	59.2
East Boston Yacht Club	12	1.2	0.6	6.9	27.8	0.6	7.2	30.3	69.6	72.6
East Boston High School	13	1.9	0.0	1.0	3.9	0.1	1.3	4.7	62.0	61.2
East Boston – Jeffries Point Yacht Club	14	1.2	0.0	0.0	1.7	0.0	0.0	2.4	56.8	61.4
East Boston – Piers Park	30	1.5	0.0	0.0	0.6	0.0	0.0	1.0	54.3	58.4
Chelsea – Admiral's Hill	15	2.8	0.0	0.9	3.7	0.0	1.0	4.1	61.2	59.2
Revere – Bradstreet and Sales	16	2.4	0.6	4.2	9.8	0.4	4.7	11.3	68.9	67.7
Revere – Carey Circle	17	5.3	0.0	0.3	8.0	0.0	0.2	8.5	60.6	60.4
Nahant – U.S.C.G. Recreational Facility	18	5.9	0.0	0.0	0.1	0.0	0.0	0.0	45.7	46.0
Everett – Tremont near Prescott	21	4.5	0.0	0.1	1.8	0.0	0.0	1.9	54.4	54.4

Table 6-14 Time Above (TA) dBA Thresholds in a Nine Hour Night Period for Average Day[1] (Continued)

Location	Site	Distance from Logan Airport (miles)	Minutes above Threshold During the Night 2014			Minutes above Threshold During the Night 2015			Modeled Day-Night Sound Levels	
			85 dBA	75 dBA	65 dBA	85 dBA	75 dBA	65 dBA	2014[2]	2015[2]
Medford – Magoun near Thatcher	22	6.0	0.0	0.0	1.3	0.0	0.0	1.3	53.4	52.2
Swampscott – Smith Lane	19	8.7	0.0	0.0	0.2	0.0	0.0	0.1	46.3	45.1
Lynn - Pond and Towns Court	20	8.4	0.0	0.0	2.8	0.0	0.0	3.2	54.7	54.8
South End – Andrews Street	1	3.7	0.0	0.1	2.3	0.0	0.0	2.1	55.1	55.3
South Boston – B and Bolton	2	2.9	0.0	0.7	3.5	0.0	0.7	3.3	59.3	58.3
South Boston – Day Blvd. near Farragut	3	2.5	0.0	0.2	6.1	0.0	0.2	6.0	60.6	61.2
Roxbury – Boston Latin Academy	27	5.3	0.0	0.1	2.1	0.0	0.0	1.8	54.3	53.5
Jamaica Plain - Southbourne Road	28	7.7	0.0	0.0	0.8	0.0	0.0	0.6	50.5	50.2
Mattapan – Lewenburg School	29	7.3	0.0	0.0	0.1	0.0	0.0	0.0	47.6	47.6
Dorchester – Myrtlebank near Hilltop	23	6.3	0.0	0.0	1.4	0.0	0.0	1.5	54.3	54.7
Milton – Cunningham Park near Fullers	24	8.1	0.0	0.0	2.0	0.0	0.0	1.6	54.5	53.2
Quincy – Squaw Rock Park	25	4.2	0.0	0.0	0.0	0.0	0.0	0.0	47.8	50.5
Hull – Hull High School near Channel Street	26	6.0	0.0	0.1	6.2	0.0	0.1	6.9	58.6	58.8
Average TA Value			0.1	1.1	6.2	0.1	1.2	6.6	58.7[3]	59.0[3]

Source: HMMH 2015.
Notes: Distance from Logan Airport calculated from the Airport Reference Point.
dBA = A-weighted decibel
1 Nine-hour nighttime period from 10 PM – 7 AM.
2 Modeled using RealContoursTM and RealProfilesTM using INM (v7.0d) for 2014 and 2015 (12 months) with adjusted database. (Database modifications as described in the Logan Airport *2004 ESPR*).
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 the 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 the FAA's NextGen radar feed. This has led to increased 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.[37] 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.
- Preferred runway use designed to optimize Boston Inner Harbor operations (especially during nighttime hours).
- 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 the FAA to soundproof eligible homes. Massport will apply to the 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.

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37 Logan Airport Noise Abatement Website. http://www.massport.com/environment/environmental-reporting/noise-abatement/. Accessed November 17, 2016.

- Development of annual noise contours (**Figure 6-11** compares the DNL 65 dB contours for 2014 INMv7.0d and 2015 INMv7.0d).
- A website that features an internet flight tracking system known as PublicVue.[38] 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 overwater visual approach at night to keep aircraft offshore as much as possible.
- 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 the 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 the major U.S. airlines at Logan Airport are using a fleet which is composed of 100 percent originally manufactured Stage 3 or Stage 4 aircraft. All of the new carriers at Logan Airport in 2015 are utilizing Stage 4 equivalent aircraft, with the exception of El Al Airlines.

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.

38 http://www.massport.com/environment/environmental-reporting/noise-abatement/flight-monitor/

Table 6-15 Airline Operations (percent) in Original Stage 3 or Equivalent Stage 4 Aircraft[1] (2014 to 2015)

	Number of Flights		Percentage of Original Stage 3 and 4 Operations[2]			
Airlines with more than 100 flights	**2014**	**2015**	**2014 Stage 3**	**2014 Stage 4 Equiv.**	**2015 Stage 3**	**2015 Stage 4 Equiv.**
JetBlue Airways	82,595	85,852	0%	100%	0%	100%
American Airlines	22,626	48,355	0%	100%	0%	100%
Delta Air Lines	29,557	33,909	13%	87%	7%	93%
United Airlines	34,609	24,644	0%	100%	0%	100%
Southwest Airlines	18,525	21,514	18%	82%	21%	79%
US Airways	35,993	8,843	0%	100%	0%	100%
Pinnacle Airlines	7,310	7,284	0%	100%	0%	100%
Shuttle America Corp	9,751	5,290	0%	100%	0%	100%
Air Canada Jazz	14,353	5,037	0%	100%	0%	100%
AWAC - US Air Express	6,165	4,998	0%	100%	0%	100%
Delta Connection/Atlantic SE	6,965	4,923	0%	100%	0%	100%
Spirit Airlines	2,945	4,896	0%	100%	0%	100%
US Airways Express/Republic	3,290	4,669	0%	100%	0%	100%
Sky Regional Airlines Inc	3,981	3,784	0%	100%	0%	100%
Federal Express	3,315	3,523	40%	60%	70%	30%
Virgin America	3,198	3,426	0%	100%	0%	100%
Alaska Airlines	6,180	3,027	0%	100%	0%	100%
British Airways	2,678	2,575	0%	100%	0%	100%
Aer Lingus	2,964	1,973	0%	100%	3%	97%
Air Canada	1,112	1,718	0%	100%	0%	100%
Lufthansa	1,714	1,687	0%	100%	0%	100%
United Parcel Service	1,435	1,538	0%	100%	0%	100%
Sun Country Airlines	1,027	1,414	0%	100%	0%	100%
Icelandair	1,227	1,365	0%	100%	0%	100%
GoJet Airlines	476	1,309	0%	100%	0%	100%
Emirates Airlines	1,190	914	0%	100%	0%	100%
Air France	899	910	0%	100%	0%	100%
Hainan Airlines Co. Ltd.	280	744	0%	100%	0%	100%
Japan Airlines	731	728	0%	100%	0%	100%
Turkish Airlines	452	726	0%	100%	0%	100%
Swiss Air	722	711	0%	100%	0%	100%

Table 6-15 Airline Operations (percent) in Original Stage 3 or Equivalent Stage 4 Aircraft[1] (2014 to 2015) (Continued)

	Number of Flights		Percentage of Original Stage 3 and 4 Operations[2]			
Airlines with more than 100 flights	**2014**	**2015**	**2014 Stage 3**	**2014 Stage 4 Equiv.**	**2015 Stage 3**	**2015 Stage 4 Equiv.**
Virgin Atlantic	716	702	0%	100%	0%	100%
Compañía Panameña de Aviación S.A.	730	646	0%	100%	0%	100%
Alitalia	550	562	0%	100%	0%	100%
SkyWest Airlines	1,152	548	0%	100%	0%	100%
SATA International Airlines	533	542	0%	100%	1%	99%
WOW Air, LLC.	N/A	445	N/A	N/A	0%	100%
Mesa Airlines	1,404	437	0%	100%	0%	100%
Aeromexico	N/A	345	N/A	N/A	0%	100%
Iberia Air Lines Of Spain	332	336	0%	100%	0%	100%
ATI	N/A	302	N/A	N/A	0%	100%
Cathay Pacific	N/A	279	N/A	N/A	0%	100%
Atlas Air	489	218	100%	0%	100%	0%
El Al Israel Airlines Ltd.	N/A	152	N/A	N/A	100%	0%

Source: Massport, 2015.
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 2015, Massport received 17,685 noise complaints from 82 communities, a substantial increase from 2014 which logged 12,855 noise complaints from 82 communities. The number of individual complainants, however, declined by 9 percent, indicating that noise annoyance is growing among a concentrated population rather than spreading to a larger population. This is consistent with a recent survey of U.S. airports that finds noise complaints concentrated among relatively small numbers of complainants[39] (see Appendix H, *Noise Abatement*). The increase in complaints continues to be primarily related to the FAA's RNAV departure procedures.

39 Dourado, E. and Russell, R. October 2016. *Airport Noise NIMBYism: An Empirical Investigation.* Mercatus Center at George Mason University. https://www.mercatus.org/system/files/dourado-airport-noise-mop-v1.pdf. Accessed December 10, 2016.

Table 6-16 is a summary of noise complaints from the Massport Noise Abatement Office. The summary table presents the top ten communities for both 2014 and 2015 in terms of the number of complaints and number of callers. The communities listed below represent 82 percent of the complaints in 2014 and 72 percent of the complaints in 2015. All of the 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

	2014		2015		Change
Town	**Calls**	**Callers**	**Calls**	**Callers**	**(2014 to 2015)**
Belmont	1,658	116	715	95	-943
Cambridge	585	71	1,697	136	1,112
East Boston	354	106	250	69	-104
Hull	1,855	332	1,136	152	-719
Hyde Park	50	16	28	7	-22
Lynn	482	5	424	13	-58
Medford	742	154	508	116	-234
Milton	2,669	189	4,991	343	2,322
Nahant	109	20	50	19	-59
Roxbury	113	9	129	11	16
Somerville	938	239	1,910	191	972
South Boston	67	26	263	48	196
Watertown	541	72	298	34	-243
Weymouth	83	7	41	6	-42
Winthrop	237	98	242	74	5
Total (Only for Towns listed above)	**10,483**	**1,460**	**12,682**	**1,314**	**2,199**
Total Complaints from Other Towns	**2,372**	**624**	**5,003**	**589**	**2,631**
Overall Totals	**12,855**	**2,084**	**17,685**	**1,903**	**4,830**

Source: Massport, 2016.
Note: 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

The FAA's ROD approving construction of the unidirectional Runway 14-32 required that the 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 the 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 Phoenix and Minneapolis-St. Paul. These noise studies were able to influence the design of these RNAV procedures for implementation at Logan Airport.

Phase 1

The FAA noise study is being 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 National Environmental Policy Act (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.[40]

The conventional and radar vectored[41] 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 back 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.

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40 FAA Documented Categorical Exclusion Record of Decision, October 16, 2007.

41 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 the 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 is the last RNAV departure procedure to be implemented at Logan Airport in June 2013. FAA completed a separate Environmental Assessment (EA) in January 2013. The 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. The FAA also committed to a six-month and 12-month post-implementation review of the RNAV procedure. The reviews were posted by the FAA in April 2014 and September 2014.[42] 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 the FAA previously and are in operation today. Since the modeling is based on the radar data tracks, all of these 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 the 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 CAC (the two ground movements and six flight procedures) and four flight procedures were rejected. The FAA and Massport reviewed the Logan Airport CAC recommendations and determined that the two ground measures would meet the criteria for implementation; however, the FAA determined that none of the flight procedures would meet the criteria for noise abatement under BLANS.

42 http://www.faa.gov/air_traffic/environmental_issues/ared_documentation/#Performance_Based_Navigation_PBN.

The two approved measures, with their status, are described below:[43]

- **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 the 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 the FAA. A hold pad will be studied as part of this multi-year effort.

In addition, Massport and the 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 (Massport CAC) that will meet on a regular basis to continue dialogue on Airport-related noise concerns.

Phase 3

Phase 3 began in August 2013 and is evaluating 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 CAC voted to abandon the PRAS in April 2012 with the goal of 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, the 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.

Results of these tests and development of a new runway use program is on-going.

FAA and Massport RNAV 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, the FAA signed a Memorandum of Understanding (MOU) with Massport[44] to frame the process for analyzing opportunities to reduce noise through changes or amendments to PBN. 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. To more clearly

43 BLANS Level Three Screening Analysis, FAA, December 2012, Page E-3.
44 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/. Accessed on October 31, 2016.

understand the implications of flight concentration, Massport has proposed several ideas for a test program with the FAA; this program will study possible strategies to address neighborhood concerns. The FAA has agreed to study Massport's ideas for a test program. This is a first-in-the-nation project between the FAA and an airport operator that includes analyzing the feasibility of changes to some RNAV approaches and departures from Logan Airport. The 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. Looking at 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. Analyze alternative RNAV designs that would bring aircraft over more compatible land use.
6. Use 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 the FAA and would better identify the community support, or opposition to proposed procedural changes. The proposed pilot testing will use these supplemental metrics.

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 2015 from Massport is published in Appendix L, *Reduced/Single Engine Taxiing at Logan Airport Memorandum*.

In 2009, the Massachusetts Institute of Technology (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.[45] 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 2015 exceeded 20 minutes only during the 7:00 to 8:00 AM and the 5:00 to 8:00 PM period and for 2014 only exceeded 20 minutes between the 7:00 to 8:00 AM and 5:00 to 6:00 PM periods. During 2014

45 **The full report was published in the 2009 EDR in Appendix L, Survey of Airline Pilots Regarding Fuel Conservation Procedures for Taxi Operations.**

and 2015, the average taxi-in time never exceeded 10 minutes. The total average departure taxi out time at Logan Airport for 2014 was 18.3 minutes and the average taxi-in time is 6.6 minutes (the total average taxi/delay time for 2014 is 12.5 minutes). The total average departure taxi out time at Logan Airport for 2015 decreased to 17.9 minutes and the average taxi-in time increased to 6.8 minutes (the total average taxi/delay time for 2015 is 12.3 minutes).[46] 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.

Logan Airport also encourages operators to use idle or reduced reserve thrust during landing, and to retrofit Airbus A320 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.

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.

Table 6-17 Noise Abatement Management Plan

Noise Abatement Goal	Plan Elements	2015 Progress Report
Limit total aircraft noise	Limit on Cumulative Noise Index (CNI)	The CNI value for 2015 was 152.7 EPNdB which is well below the cap of 156.5 EPNdB.
	Stage 3 percentage Requirement in Noise Rules	In 2015, Stage 3 and 4 operations represented almost 100 percent of Logan Airport's total commercial jet traffic.
Mitigate noise impacts	Residential Sound Insulation Program (RSIP)	No additional dwelling units were sound insulated in 2015, 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 2014 and 2015 Monitoring Report.
	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.

46 FAA Aviation System Performance Metrics: Avg. Taxi Time: Standard Report –accessed 09/20/2016.

Table 6-17 Noise Abatement Management Plan (Continued)

Noise Abatement Goal	**Plan Elements**	**2015 Progress Report**
	Reduced-Engine Taxiing	Voluntary use of reduced-engine taxiing is encouraged when appropriate and safe.
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	Prohibition on Stage 2 aircraft operations at Logan Airport between 11:00 PM and 7:00 AM was continued.
	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 APU Restrictions	Restriction on nighttime engine run-ups and use of auxiliary power units (APUs) was continued.
Address/respond to noise issues and complaints	Noise Complaint Line	Massport continued operation of Noise Complaint Line, (617) 561-3333. In 2015, Massport's Noise Abatement Office responded to 17,685 calls from callers living in 82 communities. (See Appendix H, *Noise Abatement.)*
	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 is underway and will evaluate and establish a runway use program. Massport and FAA have begun a RNAV evaluation project designed to identify ways to reduce noise from the RNAV procedure (which concentrates flights).

Source: Massport.

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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). 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. 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 emission reduction strategy is a comprehensive strategy to diversify and enhance ground transportation options for passengers and employees. The ground transportation strategy is designed to help reduce emissions and improve air quality by providing a broad range of high occupancy vehicle (HOV), transit, and shared-ride options for travel to and from Logan Airport. The strategy also aims to provide parking on-Airport for passengers choosing to drive or with limited HOV options. Continuing improvements to support HOV include: new Back Bay Logan Express service (since May 2014); free Massachusetts Bay Transportation Authority (MBTA) Silver Line outbound (from Logan Airport) boardings; 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 compressed natural gas (CNG) station, and provides electric plug-ins for ground service equipment (GSE), 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 building to 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 2015 and compares them to those in 2014.

2015 Air Quality Highlights and Key Findings

As reported in previous Environmental Data Reports (EDRs), total 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 fewer aircraft operations and reduced emissions. Massport is also committed to reducing

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.

vehicle miles traveled (VMT) and associated emissions on Massport-controlled ground transport facilities (such as, roadways and curbsides, parking facilities, and vehicle staging areas) as well as VMT for 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. When compared to 2014, the changes in air emissions in 2015 are well within expected values given the corresponding upturn in aircraft operations. 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;
- GSE usage (including aircraft auxiliary power units - or 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 *2015 EDR*:

- As of 2015, the Federal Aviation Administration (FAA) requires airports to use a new simulation tool for noise and air emissions, the Aviation Environmental Design Tool (AEDT), for National Environmental Policy Act (NEPA) projects and soundproofing eligibility. Massport undertook initial modeling of noise and air using AEDT; however, Massport has technical concerns related to the initial results at Logan Airport. Following a briefing with the FAA, it was decided that the initial AEDT results would not be published in the *2015 EDR* (pending further technical discussions with FAA's Office of Environment and Energy). Therefore, 2015 modeling for air quality was performed with the FAA's Emissions and Dispersion Modeling System (EDMS) to compute emissions from Logan Airport-specific aircraft, APUs, and GSE (the Integrated Noise Model [INM] was used for noise). Adjustments to be incorporated into AEDT are currently under review and, if completed in a timely fashion, AEDT is expected to be the official model for next year's *2016 Environmental Status and Planning Report (ESPR)*.
- Key inputs to the air emissions inventory include aircraft operations which increased by 2.5 percent in 2015 (there were 186,465 landing and take offs (LTOs)[2] in 2015 compared to 181,899 LTOs in 2014), and average aircraft taxi/delay times increased by about one minute (26 minutes in 2015 versus 25 minutes in 2014). Although there was an increase in LTOs in 2015, aircraft operations and taxi times remained well below 2000 historic peak levels. See Chapter 2, *Activity Levels* for additional information on aircraft operations in 2015 and long-term trends. There were 243,998 LTOs in 2000 and the corresponding aircraft taxi times were about 27 minutes. Another important model input parameter is on-Airport VMT, which increased by approximately 6.5 percent in 2015 compared to 2014. The increase in VMT is largely attributed to a shift in origin-destination patterns of vehicular traffic from the Ted Williams Tunnel to the Sumner/Callahan

2 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 372,930 operations in 2015 (186,465 LTOs) and 363,797 operations in 2014 (181,899 LTOs).

Tunnels and an increase in gateway traffic volumes during the evening peak hour in 2015 (see Chapter 5, *Ground Access to and from Logan Airport*, for additional information).

- Motor vehicle emission factors were obtained from the newest version of the U.S. Environmental Protection Agency's (EPA's) Motor Vehicle Emission Simulator model (MOVES2014a) and were combined with Massachusetts Department of Environmental Protection (MassDEP)-recommended motor vehicle fleet mix data, operating conditions, and other Massachusetts-specific input parameters. Importantly, MOVES reflects the continuous reduction in motor vehicle emission factors fleet-wide.
- GSE emission factors in the EDMS database (derived from EPA's OFFROAD model) decreased in 2015 when compared to 2014 as this model also takes into account fleet modernization from year to year.
- Natural gas usage by stationary sources (such as boilers and snow melters) increased by approximately 11 percent in 2015 when compared to 2014 (from 419 million cubic feet in 2014 to 463 million cubic feet in 2015). Diesel fuel usage by snow melters also increased in 2015 (from 124,480 gallons in 2014 to 381,581 gallons in 2015). These changes were largely attributable to the record-breaking snowfall experienced in January and February of 2015. In January 2015, Boston experienced 34.3 inches of snowfall and in February 2015, Boston experienced 64.8 inches of snowfall, making February 2015 the snowiest month on record in Boston.
- Fuel throughput of Jet A and gasoline increased by approximately 1 percent and 6 percent, respectively, in 2015 when compared to 2014. These changes were mostly due to the increase in the number of aircraft operations and motor vehicles trips/VMT in 2015.

Based upon these model input parameters, the outcomes of the 2015 air emissions inventory for Logan Airport are summarized below. All parameters continue to remain below 2000 levels. The increase in emissions for VOCs, NO_X, CO, and PM are primarily due to the corresponding increase in aircraft LTOs and airfield taxi times.

- Total emissions of VOCs increased by 1 percent in 2015 to 1,188 kilograms (kg)/day compared to 1,177 kg/day in 2014, which is still well below 1990 and 2000 levels.
- Total NO_x emissions increased by approximately 5 percent in 2015, to 4,262 kg/day compared to 2014 levels of 4,040 kg/day. To a lesser extent, this increase is also attributable to the increase in natural gas use by stationary sources. The increase in 2015 is still well below 1990 and 2000 levels.
- Total CO emissions increased by about 3.5 percent in 2015 to 7,243 kg/day, from 6,987 kg/day in 2014; emissions in 2015 were still well below 1990 and 2000 levels.
- Total PM_{10}/$PM_{2.5}$ emissions also increased by about 3 percent in 2015 to 98 kg/day, from 95 kg/day in 2014.
- For nine consecutive years, Massport has voluntarily prepared a GHG emissions inventory for the Logan Airport EDR. In 2015, total GHG emissions grew by 6 percent. As reported in past year EDRs, Logan Airport-related GHG emissions in 2015 comprised less than 1 percent of statewide totals.

- Massport's voluntary Air Quality Initiative (AQI)[3] has tracked NO_x emissions since the benchmark year of 1999. In the final year of this program (2015), total NO_x emissions were 632 tons per year (tpy) lower than the 1999 benchmark. This represents an overall decrease of 27 percent in NO_x emissions over the past 15 years. Massport will continue to report on NO_x emissions as part of the Logan Airport emissions inventory in future EDRs/ESPRs. Between 1999 and 2015, the greatest reductions of NO_X emissions were associated with aircraft, GSE, and on-Airport motor vehicles at 17 percent, 71 percent, and 87 percent reductions, respectively.

Regulatory Framework

The federal Clean Air Act (CAA), the National Ambient Air Quality Standards (NAAQS), and similar state laws govern air quality issues in Massachusetts. The NAAQS and the Massachusetts State Implementation Plan (SIP), 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)

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: CO, lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), 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 the CAA, all areas within Massachusetts are presently designated as either *attainment* and/or *maintenance* with respect to the NAAQS.[4,5] These regulatory designations for the Boston metropolitan area (including the area around Logan Airport) are listed in **Table 7-2**.

As shown, 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**). Importantly, this O_3

3 Massport adopted the AQI as a 15-year voluntary program with the overall goal to maintain NO_X emissions associated with Logan Airport at, or below, 1999 levels. This reporting year, 2015, marks the final year of the program's operation. However, NO_x will continue to be reported in future EDRs/ESPRs as part of the Logan Airport emissions inventory.

4 Environmental Protection Agency. *Nonattainment Areas for Criteria Pollutants (Green Book).* https://www.epa.gov/green-book. Accessed September 28, 2016.

5 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.

Nonattainment area encompassed 10 counties in Massachusetts (Barnstable, Bristol, Dukes, Essex, Middlesex, Nantucket, Norfolk, Plymouth, Suffolk, and Worcester).[6]

In May 2012, EPA issued a "Clean Data Finding" for the Boston area signifying that the area had attained the 1997 NAAQS for O_3. This redesignated 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 the CAA (a rule established to ensure that air quality is not deteriorated due changes in the NAAQS) still obligates 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 2015. 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 area is presently designated as "Attainment/Unclassifiable" with respect to the 2008 standard.

Finally, EPA has again revised (that is, made stricter) the O_3 standard which became effective in 2014. The new Attainment/Nonattainment designations for this standard will be made in 2017 based upon the previous three years of state-wide monitoring data. The status of the Boston area in terms of this pending designation will be reported in the *2016 ESPR*.

6 Logan Airport is located in Suffolk County.

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 ≤ 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 ≤ 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.
	Annual (Secondary)	—	15	The three-year average of the weighted annual mean from single or multiple monitors within an area is not to exceed this level.
Sulfur Dioxide (SO_2)	1 hour	0.075	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, 2016 (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, 2014 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, 2015 (www.epa.gov/air/oaqps/greenbk/).
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 in 2017.

State Implementation Plan (SIP)

A SIP is a state's regulatory plan for bringing nonattainment areas within that state 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 the 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 are 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**.

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 Massachusetts State Implementation Plan (SIP) under the Federal Clean Air Act.
1 In 2007, the EPA promulgated a new eight-hour NAAQS for ozone. Informally called the "2008 standard" to differentiate it from the former "1997 standard," this new standard is 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 2015. 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 following source categories, each of which has its own assessment methodology, database, and assumptions as described below. For this *2015 EDR*, Massport has used EDMS for air quality modeling. Massport is working with the FAA on adjustments to the new combined noise and air quality modeling tool, AEDT.

Aviation Environmental Design Tool (AEDT)

In 2015, the FAA introduced a new combined noise and air quality modeling tool, AEDT.[7] This new tool is a software system that dynamically models aircraft performance in space and time to produce fuel burn, emissions, and noise information. Based on Massport's proposed *2015 EDR* scope, the Secretary of the Executive Office of Energy and Environmental Affairs' (EEA) Certificate on the *2014 EDR* states that AEDT should be used and compared to EDMS for the 2015 air quality modeling. For the 2015 calendar year, Massport tested the new AEDT model for the first time and found that the AEDT modeled results for some air quality parameters, notably PM, are not consistent with EDMS model results. Massport is actively working with the FAA to review preliminary results. Assuming that these issues can be addressed, Massport would plan to use AEDT

7 **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/**

for the 2016 air quality analysis. As documented in Chapter 6, *Noise Abatement,* Massport has reached out to the FAA for consideration and approval of model adjustments and if completed in a timely fashion, AEDT is expected to be the official model for next year's *2016 ESPR*. Additional information on AEDT is provided later in this chapter.

2015 Assessment Methodology

- **Aircraft Emissions** – For consistency with prior EDRs, the FAA's EDMS was used for this analysis.

  As for past years, the actual 2015 aircraft fleet mix at Logan Airport was used as input to EDMS. In a few instances where the aircraft/engine type combinations operating at Logan Airport were not available in the EDMS database, per FAA, 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* contains the data that were used to program EDMS, including the aircraft and engine types, numbers of LTOs, and aircraft taxi/delay times for 2015. 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 2014 to 2015 total LTOs increased by 2.5 percent with air carrier LTOs increasing by 6 percent, commuter LTOs decreasing by 8 percent, air cargo LTOs increasing by about 6 percent, and GA increasing by 6.5 percent.

  Updated aircraft taxi/delay times are based on data obtained from the FAA Aviation System Performance Metrics (ASPM) database for 2015.[8] According to this database, the average aircraft taxi/delay times at Logan Airport increased from 25 to 26 minutes from 2014 to 2015 or about 4 percent.

- **Ground Service Equipment/Auxiliary Power Units** - Estimates of GSE emissions were based on EDMS emission factors and continue to reflect emission reductions attributable to Massport's Alternative Fuel Vehicle (AFV) 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 2015 when compared to 2014. Other EDMS input data are based on a Logan Airport-specific GSE time-in-mode survey conducted in 2012, 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.[9]

- **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.[10] In general, the emission factors obtained from MOVES2014a for 2015 were lower for VOCs, NO_x, CO, and PM when compared to 2014. 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 *2015 EDR* provides a discussion of the

8 FAA Aviation System Performance Metrics (ASPM) database for 2015 (aspm.faa.gov/).

9 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, etc.).

10 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.

on-Airport VMT data used for this analysis. On-Airport VMT and vehicle speed data were predicted by the traffic simulation model, VISSIM.[11] (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 2015, 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 2015 is compared to 2014, No. 2 fuel oil and natural gas usage from boiler usage increased approximately 2 percent and 10 percent, respectively, while diesel fuel from snow melters increased by approximately 207 percent due to record snow levels in early 2015. Emissions from Other Sources represent approximately 31 percent of total VOC emissions and 5 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 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 *2015 EDR*.

- **Greenhouse Gases** - GHG emissions are calculated in much the same way the criteria pollutants (and their precursors) are calculated through 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 EDMS. Emission factors were obtained from the U.S. Energy Information Administration, the International Panel on Climate Change (IPCC), and the EPA.

  Consistent with prior EDR years, the voluntary 2015 GHG emissions inventory includes aircraft operations within the taxi-idle/delay mode and up to the top of the 3,000–foot LTO cycle.[12] Again, GHG emissions associated with GSE, APUs, motor vehicles, a variety of stationary sources, and electricity usage were also included.

  Of note, Massport has direct ownership or control over a very small percentage (approximately 13 percent in 2015) of Logan Airport-related GHG emissions and their sources (these are 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).

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

12 Following the guidance issued by the Airport Cooperative Research Program, ACRP Report 11, *Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories*.

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 2015

This section provides the results of the 2015 Logan Airport emissions inventory for the pollutants CO, NO_x, $PM_{10}/PM_{2.5}$, and VOCs using the EDMS and MOVES2014a models and standard emission factors for stationary sources. The following section reports on aircraft-related emissions using the EDMS model. 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 2015. 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 preceding EDRs, the 2015 emissions inventory for Logan Airport is used for short-term comparisons to the *2014 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 2015 results also show the results for 1990 and 2000 and then annually for 2011 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.

For the AQI, estimates of NO_x emissions are provided as a way of tracking the progress of this voluntary emission management program. In this case, the results for the intervening years (1995, 1996, 1997, etc.) are shown in previous EDRs and, for ease of reference, are also contained in Appendix I, *Air Quality/Emissions Reduction*.

Volatile Organic Compounds

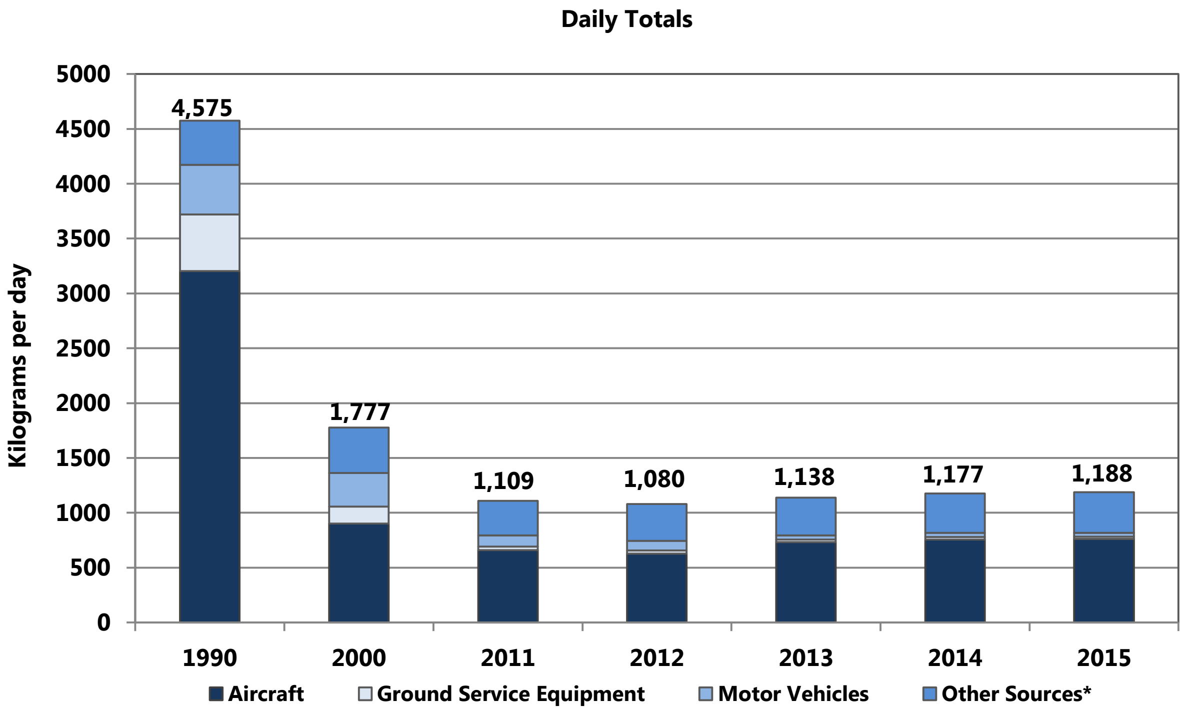
In 2015, total VOC emissions at Logan Airport were 478 tpy (1,188 kg/day) – an increase of approximately 1 percent from 2014 levels. This change is due mostly to the increase in VOC emissions associated with more aircraft operations at the Airport during this time period. The long-term trend for VOC emissions over the past two decades reveals a substantial and continuous 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 2015. Similarly, **Table 7-4** shows the computed VOC emissions in kg/day for each emission source from 1990, 2000, and 2011 to 2015. Other key findings from this analysis include the following:

- Total aircraft-related VOC emissions were approximately 1 percent higher in 2015, when compared to 2014. This increase was mostly due to the increase in aircraft LTOs and taxi times.

- GSE-related VOC emissions were approximately 9 percent lower in 2015 than in 2014. This decrease was largely due to the decrease in fleet-wide GSE emission factors.
- VOC emissions from motor vehicles in 2015 decreased by about 11 percent from 2014 levels, despite an increase in on-Airport VMT. This decrease is 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 4 percent from 2014 to 2015. This change was mostly due to the increase in evaporative emissions from refueling activities.

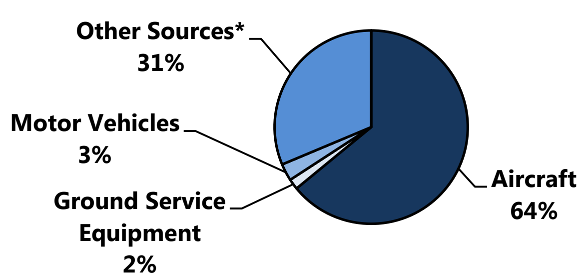
As shown in **Figure 7-2**, in 2015 aircraft continued to represent the largest source (64 percent) of VOC emissions associated with Logan Airport, followed by stationary sources (31 percent), motor vehicles (3 percent), and GSE (2 percent).

Figure 7-1 Modeled Emissions of VOCs at Logan Airport, 1990, 2000, and 2011-2015



Source: Massport and KBE 2015.
Note: * Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.) and fueling sources.

Figure 7-2 Sources of VOC Emissions, 2015



Source: Massport and KBE 2015.
Note: * Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.) and fueling sources.

Table 7-4	Estimated VOC Emissions (in kg/day) at Logan Airport, 1990, 2000, and 2011-2015[1]								
Aircraft/GSE Model:	**Logan Dispersion Modeling System (LDMS)**	**EDMS v4.03**	**EDMS v5.1.3**			**EDMS v5.1.4.1**			
Motor Vehicle Model:	**MOBILE 5a**	**MOBILE 6.0**	**MOBILE 6.2.03**			**MOVES 2010b**		**MOVES 2014**	**MOVES 2014a**
Year:	**1990**	**2000**	**2011**	**2012**	**2013**		**2014**		**2015**
Aircraft Sources									
Air carriers	2,175	514	305	378	448	447	480	480	491
Commuter aircraft	681	140	110	91	91	91	85	85	87
Cargo aircraft	303	207	69	63	44	44	48	48	47
General aviation	44	42	176	93	149	149	144	144	135
Total aircraft sources	3,203	903	660	626	732	731	757	757	761
Ground Service Equipment[2]	518	153	33	30	26	26	23	23	21
Motor Vehicles									
Ted Williams Tunnel through-traffic	N/A	12	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]
Parking/curbside[4]	192	89	20	18	17	5	3	4	4
On-airport vehicles	258	206	81	70	67	31	16	34	30
Total motor vehicle sources	450	307	101	88	84	36	19	38	34
Other Sources									
Fuel storage/handling	400	412	311	332	340	340	354	354	366
Miscellaneous sources[5]	4	2	4	4	5	5	5	5	6
Total other sources	404	414	315	336	345	345	359	359	372
Total Airport Sources	4,575	1,777	1,109	1,080	1,187	1,138	1,158	1,177	1,188

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 equivalent to approximately 0.40234 tons per year (tpy).

N/A Not Available.

1 See Appendix I, *Air Quality/Emissions Reduction* for 1993 to 2010 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 2015, total NO_x emissions from all Airport-related sources were estimated to be 1,715 tpy (4,262 kg/day), which represents an increase of about 5 percent from 2014 levels. However, this occurrence should also be taken within the context of an overall, and long-term, decrease of 27 percent from 1999 levels. (As discussed later in this chapter, the year 1999 is the benchmark of the AQI for NO_x emissions at Logan Airport.) **Figure 7-3** illustrates these short- and long-term trends in NO_x emissions and **Table 7-5** shows the NO_x contribution for each emission source in 1990, 2000, and 2011 through 2015.

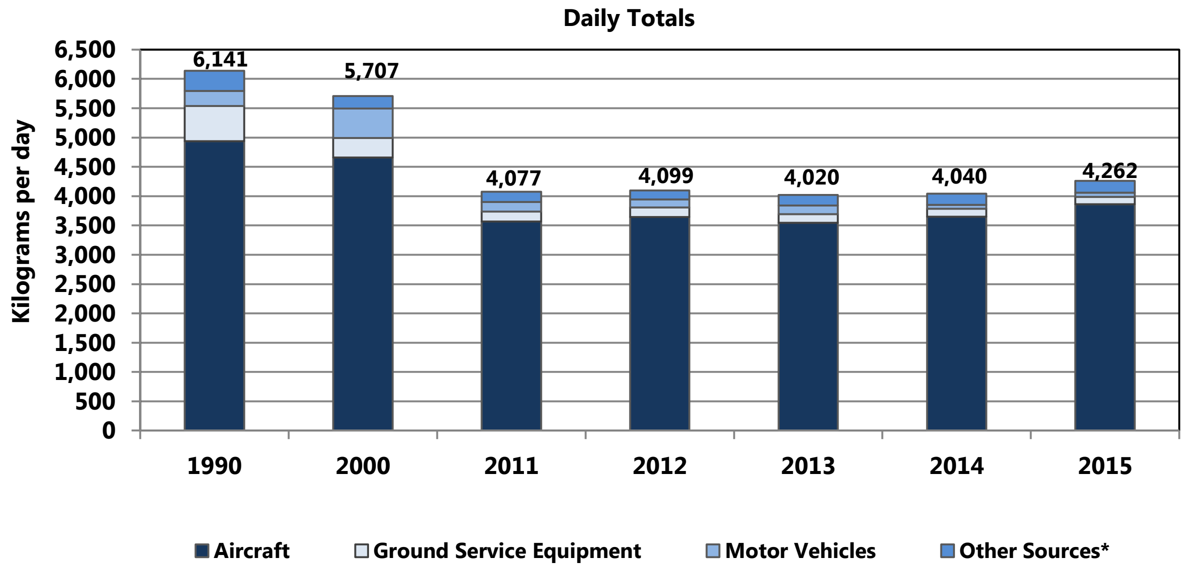
Other findings related to the 2015 NO_X emissions inventory results include the following:

- When compared to 2014 values, total aircraft-related NO_X emissions were 6 percent higher in 2015. This increase is largely due to the corresponding increase in aircraft operations and taxi times.
- GSE emissions of NO_X decreased by 4 percent in 2015 compared to 2014, due mostly to the decrease in GSE emission factors.
- NO_X emissions from motor vehicles in 2015 decreased by approximately 3 percent from 2014 levels. This reduction is also largely attributable to lower NO_X motor vehicle emission factors.
- Stationary sources show an increase of approximately 10 percent in NO_X emissions in 2015 compared to 2014. This is due to the higher usage of the Massport boilers during this period due to unusually heavy snowfall as well as sustained cold weather causing 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.

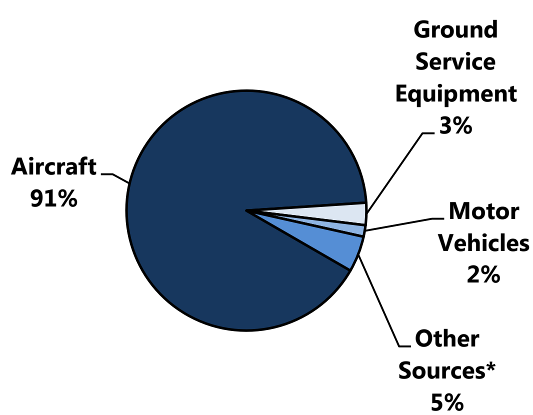
As shown in **Figure 7-4**, aircraft continued to represent the largest source (91 percent) of NO_X at Logan Airport, followed by stationary sources (5 percent), GSE (3 percent), and motor vehicles (2 percent).

Figure 7-3 Modeled Emissions of NO_X at Logan Airport, 1990, 2000, and 2011 to 2015



Source: Massport and KBE 2015
Note: * Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, firefighter training, etc.).

Figure 7-4 Sources of NO_X Emissions, 2015



Source: Massport and KBE 2015.
Note * Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.).

Table 7-5 Estimated NOx Emissions (in kg/day) at Logan Airport, 1990, 2000, and 2011-2015[1]

Aircraft/GSE Model:	**Logan Dispersion Modeling System (LDMS)**	**EDMS v4.03**	**EDMS v5.1.3**			**EDMS v5.1.4.1**			
Motor Vehicle Model:	**MOBILE 5a**	**MOBILE 6.0**	**MOBILE 6.2.03**			**MOVES 2010b**		**MOVES 2014**	**MOVES 2014a**
Year:	**1990**	**2000**	**2011**	**2012**	**2013**		**2014**		**2015**
Aircraft Sources									
Air carriers	4,554	4,202	3,128	3,154	3,090	3,158	3,245	3,245	3470
Commuter aircraft	133	125	199	182	168	152	155	155	139
Cargo aircraft	237	284	196	192	188	188	203	203	201
General aviation	13	49	43	115	46	48	48	48	53
Total aircraft sources	4,937	4,660	3,566	3,644	3,492	3,546	3,651	3,651	3,862
Ground Service Equipment[2]	603	333	173	164	145	145	134	134	128
Motor Vehicles									
Ted Williams Tunnel through-traffic	N/A	26	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]
Parking/curbside[4]	25	52	11	10	9	16	11	6	7
On-airport vehicles	232	425	148	128	117	131	90	62	59
Total motor vehicle sources	257	503	159	137	126	147	101	68	66
Other Sources									
Fuel storage/handling[5]	0	0	0	0	0	0	0	0	0
Miscellaneous sources[6]	344	211	179	154	182	182	187	187	206
Total other sources	344	211	179	154	182	182	187	187	206
Total Airport Sources	6,141	5,707	4,077	4,099	3,945	4,020	4,073	4,040	4,262

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).

N/A Not Available

1 See Appendix I, *Air Quality/Emissions Reduction* for 1993 to 2010 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 NO_x emissions.

6 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

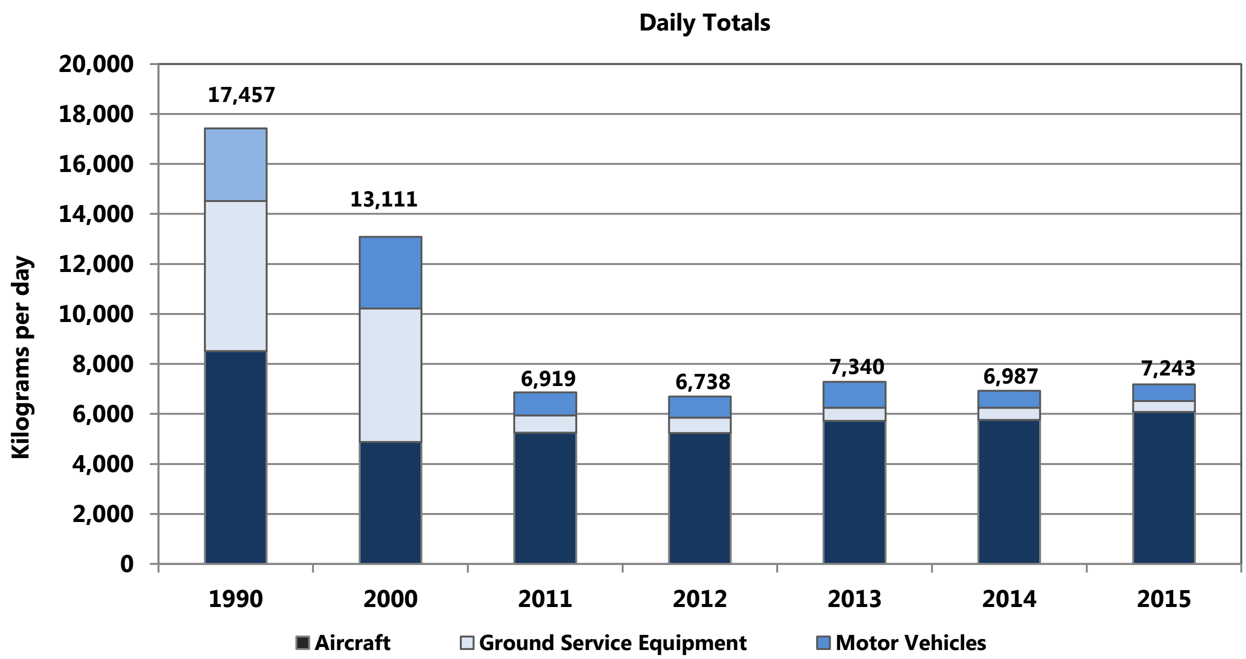
Carbon Monoxide

Total CO emissions at Logan Airport in 2015 were 2,914 tpy (7,243 kg/day) or 3.5 percent higher than 2014 levels. However, and consistent with VOCs and NOx, **Figure 7-5** shows the continued long-term downward trend (59 percent overall reduction from 1990 to 2015) in CO emissions associated with Airport activities. **Table 7-6** also shows the breakdown of these emissions, by source category for the years 1990, 2000, and 2011 to 2015. Other notable findings of the CO emissions inventory include:

- Aircraft-related CO emissions increased in 2015 by 5 percent compared to 2014 levels, due mostly to the increase in aircraft LTOs and taxi times.
- GSE CO emissions decreased by approximately 9 percent in 2015 compared to 2014, again due mostly to the decrease in GSE emission factors.
- CO emissions from motor vehicles declined in 2015 by approximately 3 percent from 2014 levels. This reduction is attributable mostly to the lower CO emission factors of the motor vehicle fleet.
- Stationary sources show an increase of approximately 17 percent in CO emissions in 2015 compared to 2014, largely due to the higher usage of the boilers and snow melters due to unusually heavy snowfall.

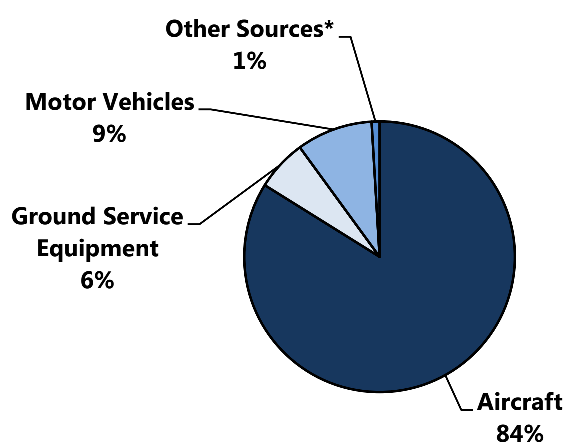
As shown in **Figure 7-6**, for 2015, aircraft emissions continued to represent the largest source (84 percent) of CO at Logan Airport, followed by motor vehicles (9 percent), GSE (6 percent), and stationary sources (less than 1 percent).

Figure 7-5 Modeled Emissions of CO at Logan Airport, 1990, 2000, and 2011 to 2015



Source: Massport and KBE 2015.
Note: Other stationary sources not shown (this source made up less than 1 percent of the total).

Figure 7-6 Sources of CO Emissions, 2015



Source: Massport and KBE 2015.
Note: * Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.).

Table 7-6 Estimated CO Emissions (in kg/day) at Logan Airport, 1990, 2000, and 2011-2015[1]

Aircraft/GSE Model:	**Logan Dispersion Modeling System (LDMS)**	**EDMS v4.03**	**EDMS v5.1.3**			**EDMS v5.1.4.1**			
Motor Vehicle Model:	**MOBILE 5a**	**MOBILE 6.0**	**MOBILE 6.2.03**			**MOVES 2010b**		**MOVES 2014**	**MOVES 2014a**
Year:	**1990**	**2000**	**2011**	**2012**	**2013**		**2014**		**2015**
Aircraft Sources									
Air carriers	6,613	2,994	2,592	2,816	3,320	3,323	3,486	3,486	3,729
Commuter aircraft	977	1,188	2,042	1,928	1,978	1,907	1,795	1,795	1,826
Cargo aircraft	576	400	246	183	155	155	164	164	167
General aviation	352	295	370	304	345	334	319	319	353
Total aircraft sources	8,518	4,876	5,250	5,232	5,798	5,719	5,764	5,764	6,075
Ground Service Equipment[2]	6,001	5,335	694	618	533	533	484	484	442
Motor Vehicles									
Ted Williams Tunnel through-traffic	N/A	133	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]	–[3]
Parking/curbside[4]	1,218	495	110	104	104	94	57	51	28
On-airport vehicles	1,689	2,245	806	737	742	935	591	630	630
Total motor vehicle sources	2,907	2,873	916	840	846	1,029	648	681	658
Other Sources									
Fuel storage/handling[5]	0	0	0	0	0	0	0	0	0
Miscellaneous sources[6]	31	27	59	48	59	59	58	58	68
Total other sources	31	27	59	48	59	59	58	58	68
Total Airport Sources	17,457	13,111	6,919	6,738	7,236	7,340	6,954	6,987	7,243

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 2010 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.

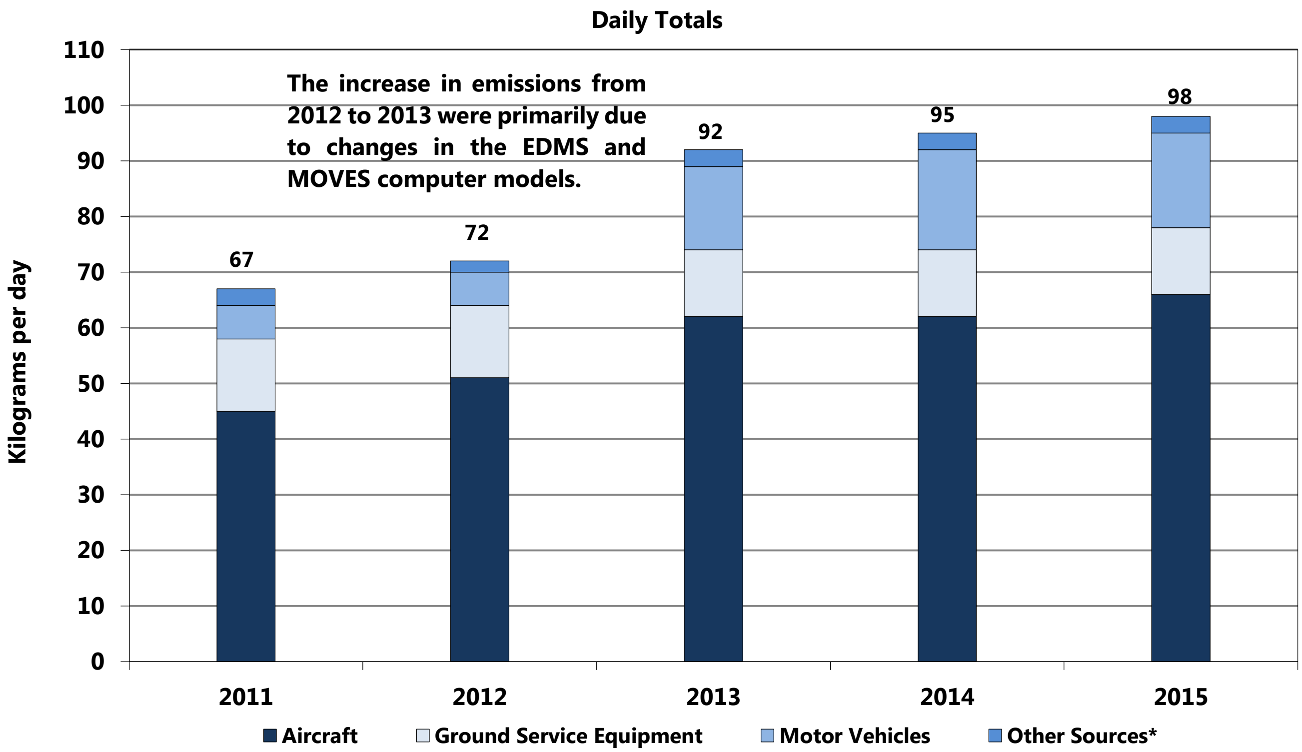
Particulate Matter

Estimated $PM_{10}/PM_{2.5}$ emissions at Logan Airport in 2015 are presented in **Table 7-7**. These results show total emissions of 39 tpy (98 kg/day), or approximately 3 percent higher than 2014 levels. Explanations of these results and other key findings include the following:

- Estimated aircraft-related $PM_{10}/PM_{2.5}$ emissions increased by approximately 6 percent in 2015 compared to 2014 levels - due mostly to the increase in aircraft LTOs and taxi times.
- $PM_{10}/PM_{2.5}$ associated with GSE/APU emissions remained approximately the same in 2015 when compared to 2014.
- $PM_{10}/PM_{2.5}$ emissions from motor vehicles decreased by 5.5 percent in 2015 when compared to 2014 levels, primarily attributable to the lower motor vehicle emission factors.
- Stationary source emissions of $PM_{10}/PM_{2.5}$ also remained about the same in 2015 compared with 2014.

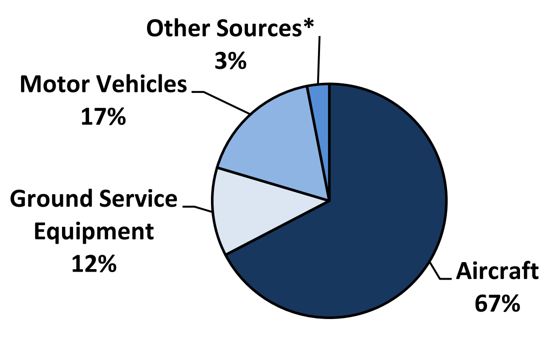
As shown in **Figures 7-7** and **7-8**, aircraft represent the largest (67 percent) source of $PM_{10}/PM_{2.5}$ followed by motor vehicles (17 percent), GSE (12 percent), and stationary sources, such as the Central Heating and Cooling Plant, snow melter usage, and fire training (3 percent).

Figure 7-7 Modeled Emissions of $PM_{10}/PM_{2.5}$ at Logan Airport, 2011-2015



Source: Massport and KBE 2015.
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.
* 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, 2015



Source: Massport and KBE 2015.
Note: * Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.

Table 7-7 Estimated $PM_{10}/PM_{2.5}$ Emissions (in kg/day) at Logan Airport, 2011-2015[1]							
Aircraft/GSE Model:	**EDMS v5.1.3**			**EDMS v5.1.4.1**			
Motor Vehicle Model:	**MOBILE 6.2.03**			**MOVES 2010b**		**MOVES 2014**	**MOVES 2014a**
Year:	**2011**	**2012**	**2013**		**2014**		**2015**
Aircraft Sources							
Air carriers	35	43	41	48	48	48	53
Commuter aircraft	3	2	2	7	7	7	7
Cargo aircraft	3	3	2	3	3	3	3
General aviation	4	3	3	4	4	4	4
Total aircraft sources	45	51	48	62	62	62	66
Ground Service Equipment[2]	13	13	12	12	12	12	12
Motor Vehicles							
Parking/curbside[3]	<1	<1	<1	<1	<1	<1	<1
On-airport vehicles	6	6	6	14	14	18	16
Total motor vehicle sources	6	6	6	15	14	18	17
Other Sources							
Fuel storage/handling[4]	0	0	0	0	0	0	0
Miscellaneous sources[5]	3	2	3	3	3	3	3
Total other sources	3	2	3	3	3	3	3
Total Airport Sources	67	72	69	92	91	95	98

Source: Massport

Notes: The year 2013 was 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 2010 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.

Next-Generation Modeling - Aviation Environmental Design Tool (AEDT)

Massport has begun testing of the FAA's next-generation environmental modeling software, the Aviation Environmental Design Tool (AEDT).[13] This is a unified system for modeling both noise and emissions from aircraft operations. Thus, it is intended to replace both the Integrated Noise Model (INM) and EDMS. By using common databases of aircraft, airport, and weather data, AEDT simplifies modeling of environmental effects and allows for the use of more current and consistent inputs. One of the goals of the AEDT model is to better understand the interrelationship between air quality and noise in the airport context.

With respect to computing air emissions, AEDT has many of the same, or similar, attributes and functions as EDMS. These include (1.) the preparation of emission inventories and (2.) conducting atmospheric dispersion modeling. In both cases, the types of pollutants analyzed mainly comprise the EPA Criteria Pollutants (and their precursors) and GHGs.

There are also important differences between AEDT and EDMS when it comes to estimating airport emissions in general, and aircraft engine emissions, in particular. A sampling of these differences between the two models are briefly described below:

- **Input Data** – Aircraft take-off weights in EDMS are easily adjustable when compared to AEDT. The result of unmatched aircraft weights between the two models has an effect on aircraft performance characteristics and a difference in emissions.
- **Aircraft Operational Modes** – In EDMS, the four primary operational modes within the LTO are (1) Take-off, (2) Climbout, (3) Cruise, and (4) Taxi/Idle. In AEDT, the operating modes are more numerous and include (1) Startup, (2) Climb Taxi, (3) Climb Ground, (4) Climb Below 1000 feet, (5) Climb Below Mixing Height, (6) Climb Below 10,000 feet, (7) Cruise Above 10,000 feet, (8) Descend Below 10,000 feet, (9) Descend Below Atmospheric Mixing Height, (10) Descend Below 1,000 feet, (11) Descend to Ground, (12) Descend Taxi, and (13) Full Flight. The consequences of this difference in aircraft operational modes is a variance in aircraft operational characteristics and a resultant difference in emissions.
- **Times-In-Modes** – Due in part to the variances in operational modes described above, combined with the changes in how the aircraft climbout and cruise times are calculated, there are differences in the times-in-modes between the two models. This is particularly applicable to the airborne flight segments of the LTO cycle. This times-in-modes difference between EDMS and AEDT has a subsequent effect on total emissions over the LTO.
- **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. For example, the emission factors for TIO-540-J2B2 engine of the Cessna 402 is different between the two models. Although a small

13 The FAA's AEDT version 2b was released for general use on May 29, 2015 with a service pack SP2 released on December 22, 2015.

difference, when these aircraft are a large proportion of the overall fleet combined with numerous LTOs, the resultant differences in emissions are compounded and can vary between the two models.

- **Missing Emission Factors** - In some instances, there are emission factors for a particular aircraft/engine combination contained in EDMS that are omitted in the AEDT database (and vice versa). This results in differences in PM emissions – particularly for small jets and GA aircraft, which has influenced the results of Massport's preliminary AEDT model findings.

Since its release in March 2016, FAA continues to advance AEDT by expanding its capabilities, correcting computational errors, and making it more "user-friendly." These improvements are reflected in periodic releases of the model that are expected to continue for the foreseeable future. In the meantime, Massport is currently coordinating with the FAA to aid in the application of AEDT and will plan to use it in the *2016 ESPR*.

Greenhouse Gas (GHG) Assessment

GHGs are known to contribute to climate change (also known as global warming), although there is still some uncertainty regarding the global magnitude of this impact and the associated short- and long-term remedies. In April 2009, the 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 the CAA, although currently there are no specific U.S. laws or regulations that call for the regulation of GHGs for airports directly.[14] 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.[15,16]

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*.[17] Under the revised policy, certain projects subject to review under MEPA (though not these annual EDR/ESPR filings) are required to:

- Quantify the GHG emissions generated by a proposed project; and
- Identify measures to avoid, minimize, or mitigate such emissions.[18]

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14 GHG emission reduction measures have been adopted by the EPA for new aircraft engines, but these regulations do not apply directly to airports.

15 Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, New York City, NY. November 2014.

16 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.

17 Revised MEPA Greenhouse Gas Emissions Policy and Protocol, Massachusetts Executive Office of Energy and Environmental Affairs, effective May 5, 2010.

18 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.

With respect to this *2015 EDR* GHG emissions inventory[19] the following information is noteworthy:

- Even though the *2015 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*.
- Consistent with previous years, the 2015 GHG emissions inventory was prepared following methodological guidance by the Transportation Research Board's (TRB) Airport Cooperative Research Program (ACRP).[20] 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 2015 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. 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 2015 GHG emissions inventory for the MassDEP GHG Emissions Reporting Program for those sources meeting the criteria for Category 1 and Scope 1 (i.e., only those sources under the direct ownership and control of Massport);[21] and
    - The EPA Greenhouse Gas Summary Report.[22]

This EDR analysis followed the 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 the ACRP guidance.

For consistency and comparative purposes, GHG emissions are segregated by ownership and control into Categories. These three categories (listed in **Table 7-9**) 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 (e.g., boilers, generators, etc.), fleet vehicles, and purchased electricity. On-airport ground

19 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.

20 Transportation Research Board, Airport Cooperative Research Program, ACRP Report 11, Project 02-06, Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories. See http://onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_011.pdf for the full report.

21 Boston Logan International Airport, Massachusetts Department of Environmental Protection GHG Emissions Reporting Program, April 13, 2015.

22 U.S. EPA Greenhouse Gas Summary Report for Boston Logan International Airport for calendar year 2015.

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 (i.e., 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 generally comprises GHG emissions associated with passenger ground access vehicles. These include private automobiles, taxis, limousines, buses, and shuttle vans (among others) operating on the off-airport roadway network.

Consistent with the ACRP guidelines, the operational boundaries of the GHG emissions are also delineated, reflecting the scope of the emission source (again refer to **Table 7-8**) 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 *2015 EDR* is consistent with the data provided by Massport for the MassDEP and EPA GHG inventories for Logan Airport. However, the *2015 EDR* emissions inventory is more comprehensive, as it covers all three scopes of GHG emissions including those from tenants and the public.[23] By comparison, the EPA GHG Reporting Program covers only stationary sources (that is, Category 1 and Scope 1).

Table 7-9 presents the 2015 GHG emissions inventory, reported in CO_2 equivalent values.[24] As shown, Massport-controlled emissions represent only 13 percent of total GHG emissions at the Airport. By comparison, aircraft, GSE, and other tenant-based emissions represent 69 percent, purchased electricity represents 9.5 percent, and passenger ground access vehicle emissions represents 8.5 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 77 percent, with electrical consumption (Scope 2) at 10 percent, and Massport-controlled sources (Scope 1) at 13 percent (refer to **Figure 7-9**).

23 However, aircraft cruise mode emissions above the 3,000-foot LTO cycle were not included.

24 CO_2 equivalent values are based upon the Global Warming Potential values of 1 for CO_2, 25 for CH_4, and 298 for N_2O (based on a 100-year period) as presented in the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report, 2007.

Overall, total GHG emissions in 2015 increased by 6 percent from 2014 levels due to the increase in aircraft operations and taxi times. Total Logan 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.

Table 7-8 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 Airport Cooperative Research Program (ACRP) guidance.
LTO Landing and Takeoff.

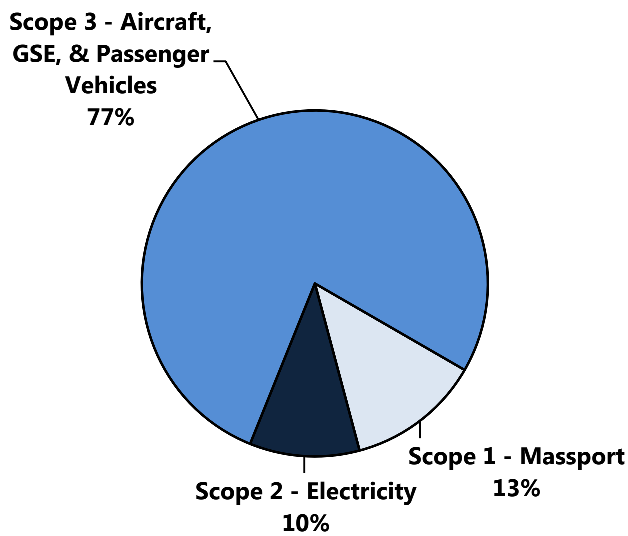
Table 7-9 Estimated Greenhouse Gas Emissions Inventory (in MMT of CO_2eq) at Logan Airport, 2015[1]

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 (13.0%)			**0.08**	**<0.01**	**<0.01**	**0.08**
Tenant Emissions						
Aircraft – Ground[6]	2	3	0.21	<0.01	<-[11]	0.21
Aircraft – Ground to 3000 feet[7]	2	3	0.18	<0.01	<0.01	0.18
Aircraft Engine Startup	2	3	<0.01	<0.01	<0.01	<0.01
Ground Support Equipment	2	3	0.02	<0.01	<0.01	0.02
Auxiliary Power Units	2	3	0.01	<0.01	-[11]	0.01
Off-Airport Roadways (Employees)[4]	2	3	0.02	<0.01	<0.01	0.02
Total Tenant Emissions (69.0%)			**0.43**	**<0.01**	**<0.01**	**0.44**
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	0.06
Total Purchased Electricity Emissions (9.5%)			**0.06**	**<0.01**	**<0.01**	**0.06**
Passenger Vehicle Emissions						
Off-Airport Roadways[4]	3	3	0.05	<0.01	<0.01	0.05
Total Passenger Vehicle Emissions (8.5%)			**0.05**	**<0.01**	**<0.01**	**0.05**
Total Logan Airport Emissions[9]			**0.63**	**<0.01**	**<0.01**	**0.63**
Percent of Statewide Totals[10]			<1.0%	<1.0%	<1.0%	<1.0%

Source: Massport

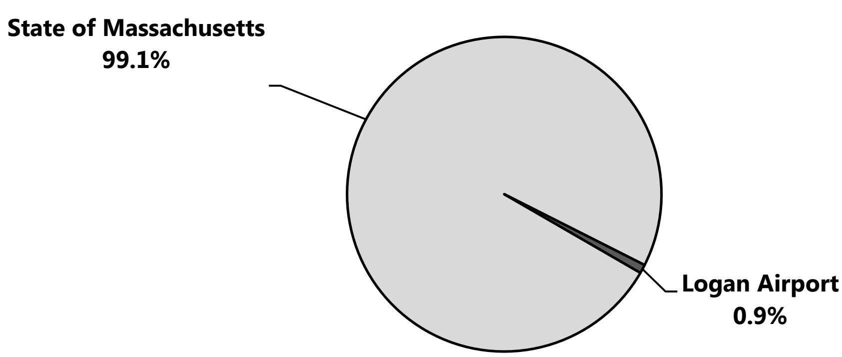
1 MMT - million metric tons of CO_2 equivalents (1 MMT = 1.1M Short Tons). CO_2 equivalents (CO_2eq) are bases for reporting the three primary GHGs (e.g., CO_2, N_2O, and CH_4) in common units. Quantities are reported as "rounded" and truncated values for ease of addition.
2 Ground Support Equipment 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.
7 Aircraft – Ground to 3,000 feet include takeoff, climbout, and approach emissions up to a height of 3,000 feet (as specified by the ACRP guidance).
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), the 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, 2015



Source: Massport and KBE 2015.
Note: 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 2015.

Table 7-10 provides GHG data for Logan Airport from 2007 through 2015, by source and by comparison to statewide totals.

Table 7-10 Comparison of Estimated Total Greenhouse Gas (GHG) Emissions (MMT of CO2eq) at Logan Airport – 2007 through 2015

Source	2007	2008	2009	2010	2011	2012	2013	2014	2015
Direct Emissions[2]									
Aircraft[3]	0.22	0.21	0.19	0.18	0.19	0.19	0.19	0.20	0.21
GSE/APUs	0.08	0.08	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Motor vehicles[4]	0.03	0.03	0.03	0.03	0.04	0.03	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
Total Direct Emissions	0.37	0.35	0.27	0.27	0.28	0.26	0.29	0.29	0.32
Indirect Emissions[6]									
Aircraft[7]	0.18	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.18
Motor vehicles[8]	0.05	0.05	0.05	0.05	0.06	0.05	0.08	0.07	0.08
Electrical consumption[9]	0.09	0.08	0.07	0.07	0.08	0.08	0.06	0.06	0.06
Total Indirect Emissions	0.32	0.30	0.29	0.29	0.30	0.30	0.31	0.30	0.32
Total Emissions[10]	0.69	0.65	0.56	0.56	0.58	0.57	0.60	0.60	0.63
Percent of State Totals[11]	<1	<1	<1	<1	<1	<1	<1	<1	<1

Sources: Massport and KBE.

1 MMT – million metric tons of CO_2 equivalents (1 MMT = 1.1M Short Tons). CO_2 equivalents (CO_2eq) are bases for reporting the three primary GHGs (e.g., CO_2, N_2O and CH_4) in common units. Quantities are reported as "rounded" and truncated values for ease of addition.

2 Direct emissions are those that occur in areas located within the Airport's geographic boundaries.

3 Direct aircraft emissions based engine start-up, taxi-in, taxi-out and ground-based delay emissions.

4 Direct motor vehicle emissions based on on-site vehicle miles traveled (VMT).

5 Other sources include Central Heating and Cooling Plant, emergency generators, snow melters and live fire training facility.

6 Indirect emissions are those that occur off the Airport site.

7 Indirect aircraft emissions are based on take-off, climb-out and landing emissions which occur up to an altitude of 3,000 ft., the limits of the 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)

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 AQI and the reduction of GSE and Massport vehicle fleet emissions. This section presents an update on the AQI and these other initiatives at Logan Airport.

Air Quality Initiative (AQI)

Massport developed the AQI as a 15-year voluntary program with the overall goal to maintain NO_x emissions associated with Logan Airport at, or below, 1999 levels. This *2015 EDR* presents the results of the final year of this program. The AQI has four primary commitments, shown below, along with Massport's progress in meeting the AQI commitments.

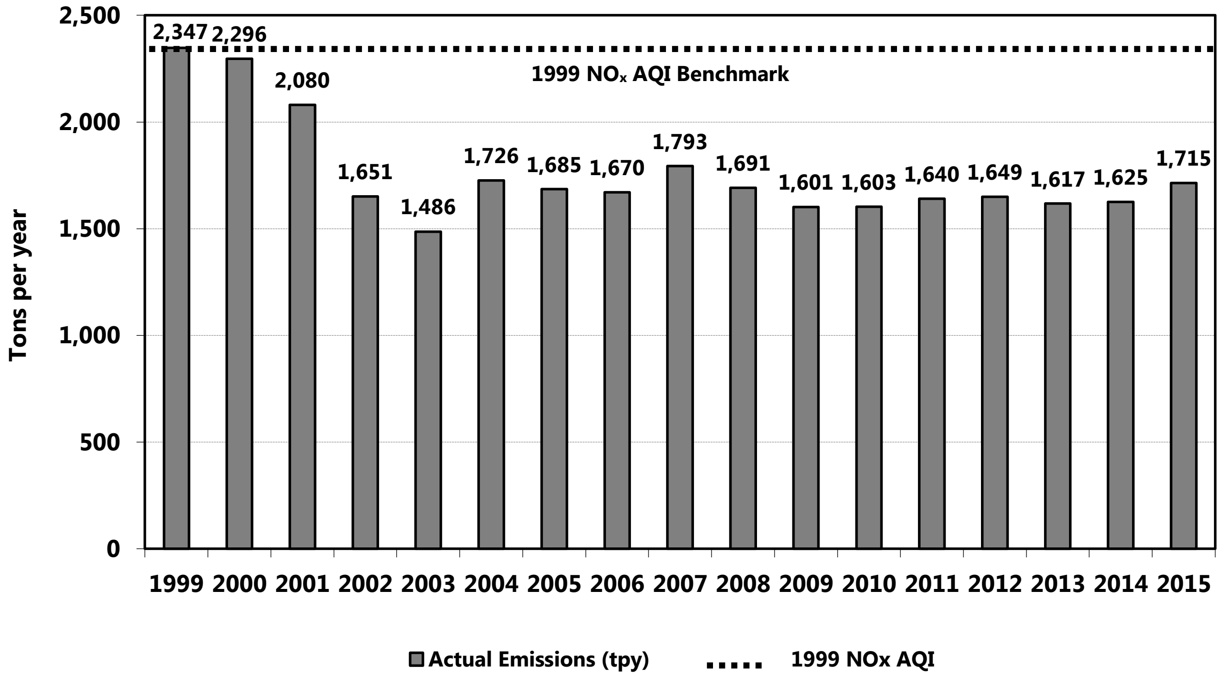
- **Expand on the air quality initiatives already in-place at Logan Airport.** See **Table 7-14** for the initiatives in place at the time the AQI was developed.
- **As necessary to maintain NO_x emissions at or below 1999 levels, retire emissions credits, giving priority to mobile sources.** Massport updates the AQI inventory of NO_x emissions annually to reflect new information and changing conditions associated with the Airport's operations. **Table 7-11** presents the updated NO_x emissions inventory and shows that, in 2015, again it was not necessary to purchase and retire mobile source emission credits to maintain NO_x emissions at, or below, 1999 levels.
- **Report the status and progress of the AQI in the ESPR or EDR.** Massport reports on the status of the AQI in the Logan Airport EDRs and ESPRs and has done so since 2001 (**Table 7-11**).
- **Continue to work at international and national levels to decrease air emissions from aviation sources.** Massport maintains memberships and active participation in a number of organizations involved in addressing aviation-related environmental issues, including air quality. These include serving on Environmental Committees of the American Association of Airport Executives (AAAE) and Airports Council International–North America (ACI-NA).

As shown in **Table 7-11**, NO_x emissions at Logan Airport in 2015 (net total with reductions) were approximately 632 tpy lower than the 1999 AQI benchmark. Since 1999, this trend represents a 27 percent decrease by 2015. Between 1999 and 2015, the greatest reductions of NO_x emissions were associated with aircraft, GSE, and on-Airport motor vehicles at 17 percent, 71 percent, and 87 percent reductions, respectively.

For ease of review, **Figure 7-11** also compares the 1999 AQI threshold level of 2,347 tpy of NO_x emissions to NO_x emissions for 2001 through 2015. Cumulatively, and as of December 31, 2015, NO_x emissions at Logan Airport were approximately 10,049 tons below the benchmark set by the AQI.

Based upon these results, the 1999 threshold of NO_x emissions at Logan Airport was never surpassed and thus full compliance with the AQI was achieved. However, NO_x will continue to be reported in future EDRs/ESPRs as part of the Logan Airport emissions inventory.

Figure 7-11 Modeled NO_X Emissions Compared to AQI[1]



Source: Massport
1 Includes emission reductions from the use of alternative fuel vehicles, shuttle buses, and ground service equipment. See **Table 7-11**.

As part of the reporting process, the AQI also calls for an itemization of NO_x emissions generated by activities at Logan Airport according to the individual airline operator. **Table 7-12** shows the estimated amounts of NO_x air emissions in 2015 generated by each airline in units of tpy and tons per LTO.

Based on **Table 7-12**, international carriers are the higher NO_x emitters per LTO because their longer stage lengths require aircraft equipped with larger and/or additional engines and heavier takeoff weights. Overall, international carriers emitted 20 percent of the total aircraft NO_x emissions at Logan Airport in 2015. Other notable findings include:

- Carriers with the greatest number of flights tended to generate the highest percentage of total NO_X emissions;
- Combined, the four largest air carriers (by LTO), emitted 49 percent of the total aircraft NO_X emissions in 2015;
- Commercial airlines (excludes cargo and GA) accounted for 93 percent of total aircraft NO_X emissions in 2015;
- Cargo aircraft operators accounted for 5 percent of total aircraft NO_X emissions in 2015; and
- GA aircraft accounted for 1 percent of total aircraft NO_X emissions in 2015.

Table 7-11 AQI Inventory Tracking of Modeled NOx Emissions (in tpy)[1] for Logan Airport

	Actual Conditions[2]								
	1999[3]	**2000**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Total Annual Emissions	2,347	2,315	1,609	1,608	1,647	1,654	1,627	1,628	1,605
Above (Below) 1999 Levels Before Reductions	N/A	(32)	(738)	(739)	(700)	(693)	(720)	(719)	(628)
Potential Reductions/ Increases[4]									
Alternative Fuel Vehicles/Shuttle Bus	(11)	(4)	(4)	(2)	(1)	0	(6)	0	0
Alternate Fuel Ground Service Equipment[5]	(14)	(14)	(4)	(3)	(6)	(5)	(4)	(3)	(4)
Total Potential Reductions	(25)	(19)	(8)	(5)	(7)	(5)	(10)	(3)	(4)
Above (Below) 1999 Levels After Reduction	(25)	(51)	(746)	(744)	(707)	(698)	(730)	(722)	(632)
Credit Trading[6]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Net Total w/Reductions and Credits	2,322	2,296	1,601	1,603	1,640	1,649	1,617	1,625	1,715

Source: Massport

Notes: Values in parentheses, such as "(250)" are negative values. Values without parentheses are positive values.

N/A Not available.

1 For consistency with the AQI, the NO_x emission values in this table are reported in tpy. The EDR/ESPR Emissions Inventory values are reported in kg/day. A conversion factor of 0.40234 is used to convert kg/day to tpy.

2 The 2009 analysis was completed using EDMS v5.1.2 and MOBILE6.2.03. The 2010 through 2012 analysis was completed using EDMS v5.1.3 and MOBILE6.2.03. The 2013 analysis was completed using EDMS v5.1.4.1 and MOVES2010b. The 2014 analysis was completed using EDMS v5.1.4.1 and MOVES2014. The 2015 analysis was completed using EDMS v5.1.4.1 and MOVES2014a.

3 The year 1999 is the "baseline" year for the AQI. Thus, 2,347 tpy is considered the AQI threshold for NO_x emissions.

4 Other initiatives that Massport and Logan Airport tenants may use for possible emission reductions include: Central Heating and Cooling Plant boilers, 400-Hz power at gates, and low NO_x fuels in Logan Express buses.

5 Massport's current plan for the conversion of GSE to alternative fuels is being re-evaluated based on the new diesel rule (2007). GSE AFV credits were based on fuel type data obtained from the aerodrome vehicle permit applications beginning in 2007.

6 Since the AQI threshold is not exceeded in 2015, nor are the emissions expected to exceed the threshold in the near future, no credits will need to be purchased.

Table 7-12 Contribution of NO_x Air Emissions by Airline in 2015 (Estimated)

	Total Emissions (tons/year)		Normalized Emissions (tons/lto)		Total Emissions (tons/year)		Normalized Emissions (tons/lto)
Air Carrier, by Airline	**NO_x**	**LTOs**	**NO_x per LTO**	**Air Carrier, by Airline**	**NO_x**	**LTOs**	**NO_x per LTO**
ABX Air	0.07	3	0.023	Miami Air International	0.27	25	0.011
Aer Lingus	27.32	987	0.028	Mountain Air Cargo	0	5	<0.001
Aeromexico	1.71	172	0.01	Netjets	3.62	2,349	0.002
Air Canada[1]	7.29	3,978	0.003	No Airline	16.75	8,693	0.002
Air France	23.71	455	0.052	Norwegian	0.22	18	0.012
Air Transport International	2.88	151	0.019	PenAir	0.97	1,874	0.001
Air Wisconsin / US Airways Express	4.38	2,499	0.002	Piedmont Airlines	0.33	390	0.001
AirTran Airways	0.1	14	0.007	Pinnacle Airlines	16.73	3,642	0.005
Alaska Airlines	18.44	1,514	0.012	Porter Airlines	1.77	2,046	0.001
Alitalia	7.44	281	0.026	PSA Airlines	0.01	3	0.003
American Airlines	261.57	24,177	0.011	Republic Airlines	6.35	2,502	0.003
Angel Flight America	0.01	275	<0.001	Royal Air	0.01	14	0.001
Atlantic Southeast Airlines	7.63	2,461	0.003	SATA International	4.67	271	0.017
Atlas Air	3.03	109	0.028	Shuttle America	7.24	2,645	0.003
Bombardier Business Jet Solutions	0.5	340	0.001	Sky Regional / Air Canada Express	4.99	1,892	0.003
British Airways	93.46	1,289	0.073	SkyWest Airlines	0.74	274	0.003
Cape Air	0.48	17,997	<0.001	Southwest Airlines	101.82	10,757	0.009
Cathay Pacific	5.55	139	0.04	Spirit Airlines	24.87	2,448	0.01
Cobalt Air	0.21	876	<0.001	Sun Country Airlines	8.15	707	0.012
Copa Airlines	3.53	323	0.011	Swift Air	0.19	23	0.008
Delta Air Lines	190.7	16,956	0.011	Swiss International Air Lines	11.28	355	0.032
El Al	2.25	76	0.03	TACV - Cabo Verde Airlines	0.53	30	0.018
Emirates Airline	18.56	458	0.041	Talon Air	0.4	191	0.002
Executive Jet Management	0.64	242	0.003	Tradewind Aviation	0.04	173	<0.001
FedEx Express	60.41	1,762	0.034	Travel Management Company	0.66	533	0.001
Flight Options	0.32	256	0.001	Turkish Airlines	12.18	364	0.033
Go! Hawaii	0.73	219	0.003	United Airlines	151.93	12,322	0.012
GoJet Airlines	2.61	655	0.004	UPS Airlines	19.55	769	0.025
Hainan Airlines	9.94	372	0.027	US Airways	38.43	4,422	0.009

Table 7-12 Contribution of NO_x Air Emissions by Airline in 2015 (Estimated) (Continued)

	Total Emissions (tons/year)		Normalized Emissions (tons/lto)		Total Emissions (tons/year)		Normalized Emissions (tons/lto)
Air Carrier, by Airline	**NO_x**	**LTOs**	**NOx per LTO**	**Air Carrier, by Airline**	**NO_x**	**LTOs**	**NO_x per LTO**
Iberia	5.79	168	0.034	Virgin America	17.5	1,713	0.01
Icelandair	14.5	683	0.021	Virgin Atlantic Airways	15.24	351	0.043
Japan Airlines	9.72	364	0.027	Wiggins Airways	0.03	222	<0.001
JetBlue Airways	311.73	42,918	0.007	WOW Air	3.8	223	0.017
Lufthansa	36.32	844	0.043	Xojet	0.47	209	0.002
				Total	**1,605.29**	**186,468**	**0.00914**

Source: Massport and KBE.
Notes: Other International may include: AeroMexico, Saudi Arabian Airlines, etc.
The "Other" Categories may include airlines with less than 10 operations.
Normalized emissions are based on a Landing and Takeoff Cycle (LTO).
This list combines the major airlines with their commuters (i.e., Jazz with Air Canada).
Cargo carriers include: ABX, Atlas, FedEx, Mountain Air Cargo, UPS, and Wiggins.
GA – General Aviation
1 Includes Jazz.

Alternative Fuel Vehicles (AFV) 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 104 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 2015, three additional pick-up trucks powered by E85 flex fuel were acquired, three additional CNG NABI buses were put into service, and one gasoline/electric hybrid Ford Escape was retired. **Table 7-13** shows the number of Massport AFVs by vehicle type in 2015. 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 53 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 the FAA's Voluntary Airport Low Emissions (VALE) Program grant, three additional CNG buses were also put into service in September 2015.
- Operation for almost two decades of one of the largest privately operated, publicly-accessible, CNG stations in New England. In 2015, the station dispensed approximately 21,900 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.

- 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.
- Renovation to the existing gas station in the North Cargo Area in 2008, which included the installation of an E85 (first-generation biofuel) fuel dispensing tank.
- 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 new 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	2015
Diesel/Electric Hybrid	Shuttle Bus[1]	32
Compressed Natural Gas (CNG)	Van	3
	Pick-Up Truck	5
	Honda Civic	9
	CNG NABI Bus[2]	21
Gasoline/Electric Hybrid	Ford Escape	7
Propane	Non-Road Vehicles (Forklifts)	2
E85 Flex Fuel	Pick-Up Truck	21
	Van	2
	Ford Escape	2
	Total	**104**

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 2015 milestones are listed in **Table 7-14**.

Massport continues to comply with the Logan Airport Parking Freeze,[25] in accordance with 10 CMR 7.30 and 40 CFR 52.1135. For a 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, see Chapter 5, *Ground Access to and from Logan Airport*.

25 310 Code of Massachusetts Regulations 7.30 and 40 Code of Federal Regulations 52.1120.

Table 7-14 Air Quality Management Strategy Status

Air Quality Emissions Reduction Goals	Plan Elements	2015 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 Massport's Alternative Fuel Vehicle (AFV)/Alternative Power Vehicle (APV) program. In 2015, three additional pick-up trucks powered by E85 flex fuel and three additional CNG NABI buses were 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 2015, the CNG station pumped approximately 21,900 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.
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.

Table 7-14 Air Quality Management Strategy Status (Continued)

Air Quality Emissions Reduction Goals	Plan Elements	2015 Status
Minimize emissions from Construction Equipment	Incorporate Clean Air Construction Initiative (CACI) into major earthwork construction projects.	For all 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*. Tank management focuses on proper maintenance.
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.
	Incorporate green building technologies and energy use reduction strategies.	Logan Airport has four U.S. Green Building Council 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 certified). Additionally, Terminal E features green building elements. 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 the 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.

Table 7-14 Air Quality Management Strategy Status (Continued)

Air Quality Emissions Reduction Goals	Plan Elements	2015 Status
Reduce aircraft emissions	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.
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.

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 2015.

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 consists 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 the 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.
- Massport entered into an agreement with the MA 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 the 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: https://www.massport.com/environment/environmental-reporting/air-quality/centerfield-taxiway-study/

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.[26,27,28] 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

26 A Survey of Airline Pilots Regarding Fuel Conservation Procedures for Taxi Operations, Massachusetts Institute of Technology.

27 Opportunities for Reducing Surface Emissions through Airport Surface Movement Optimization, Massachusetts Institute of Technology, 2008.

28 Analysis of Emissions Inventory for Single Engine Taxi-out Operations, Center for Air Transportation Systems Research.

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., 2015), the results show a savings of approximately 1,400,000 gallons of jet fuel and the reduction of approximately 13,900 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.

Logan Airport Energy Planning

In 2009, Massport began preparing an Energy Master Plan for all Massport facilities. The planning process involved data collection and establishing regulatory targets and baselines. The Energy Master Plan will provide Massport with a comprehensive strategy to reduce energy use using a portfolio of achievable measures that will result in quantifiable energy savings and cost reduction. In 2010, the Massport Board approved the Energy Master Plan and approved funding to implement energy efficiency improvements.

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 the Transportation Research Board, American Association of Airport Executives, and ACI-NA.

Ultrafine Particles (UFP)

To date, there are no state or federal air quality standards for outdoor levels of UFP.[29] Moreover, UFP monitoring programs near airports are sparse and the findings inconclusive with respect to source apportionment and community exposures. For its part, Massport actively participates in organizations and initiatives to advance what is known about this pollutant – including staff involvement with the Transportation Research Board ACRP and the ACI-NA Environmental Committee as the work applies to airport-related UFP. Massport will continue to report on the emerging research on this topic.

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

29 National Ambient Air Quality Standards for Particulate Matter, Final Rule, "Federal Register 78:10 (15 January 2013) p. 3122.

were also conducted at various locations to advance what is known about ambient ("outdoor") 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 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., 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 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. 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:
    - Include energy use and GHG emissions as criteria in transportation decisions;
    - Maintain and update public transit systems;
    - Expand programs to promote efficient travel;
    - Seek opportunities to reduce emissions at Logan Airport;
    - Improve aircraft movement efficiency;
    - Promote the use of cleaner vehicles and fuels in public transit fleets;
    - Continue to promote the use of clean diesel equipment on publicly-funded construction projects;
    - Eliminate unnecessary idling of buses; and
    - Advocate for aircraft efficiency at regional and national levels.

8

Water Quality/Environmental Compliance and Management

Introduction

The Massachusetts Port Authority's (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 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 an Authority-wide Environmental Management Policy, which articulates Massport'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 water resources (Boston Harbor);
- Minimize air quality impacts;[1]
- Protect resources during construction;
- Mitigate construction impacts;
- Reduce occurrences of fuel leaks and spills; and
- Preserve coastal resources adjacent to the Airport.

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.

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]).

2015 Water Quality/Environmental Compliance Highlights and Key Findings

This section following summarizes the key water quality and compliance findings for 2015, with **Table 8-1** providing a progress report of environmental compliance and management efforts in 2015. The progress report summarizes Massport's mechanisms for implementing its environmental management goals and details where changes to these efforts occurred in 2015.

- The most recent International Standard for Organization (ISO) 14001 EMS certification audit took place in June 2014, and a certificate was issued in July 2014; and is valid through July 2017. Massport holds regular meetings to meet regulatory requirements and improve environmental performance beyond compliance.
- Massport completed its first SMP for Logan Airport in April 2015. The SMP is intended to guide Massport's sustainability practices over the next decade and supports the Authority's ongoing commitment to environmental stewardship. Most recently, in April 2016, Massport released the first *Logan Airport Annual Sustainability Report (*http://massport.com/environment/sustainability-management-plan).
- Massport's Stormwater Pollution Prevention Plan (SWPPP) addresses stormwater pollutants in general and also addresses deicing and anti-icing chemicals, potential bacteria, fuel and oil, and other potential sources of stormwater pollutants.[2]
- In 2015, approximately 99 percent of samples were in compliance with standards (**Table J-15**). 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.

2 The 2015 Annual Certificates of Compliance were submitted to EPA and MassDEP on December 17, 2015, for Massport and each co-permittee.

- Out of 160 samples (inclusive of oil and grease, total suspended solids [TSS], and pH at North, West, Porter Street, and Maverick Street Outfalls), 158 were at or below National Pollutant Discharge Elimination System (NPDES) permit limits.
    - One outfall sample out of a total of 20 samples at the North Outfall and one sample out of a total of 19 samples at the West Outfall exceeded the regulatory limits of the NPDES permit for oil and grease and TSS, respectively. The oil and grease exceedance at the North Outfall was reported in February 2015 and the TSS exceedance at the West Outfall was reported in September 2015, as required.
- In 2015, there were 16 oil and hazardous material spills that required reporting to Massachusetts Department of Environmental Protection (MassDEP), seven of which involved a storm drainage system.[3] All spills were adequately addressed with no adverse impacts to water quality.
- In accordance with the 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. Progress has been made for all MCP sites with updates included in **Table 8-4**.

Table 8-1 Progress Report for Environmental Compliance and Management

Plan Elements	Progress Report for 2015
Environmental Compliance Inspections	In 2015, Massport performed tenant inspections at a number of its National Pollutant Discharge Elimination System (NPDES) co-permittees' (Logan Airport tenants) leaseholds and made recommendations suggesting 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), Facilities II 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 certificate expires in July 2017.
Tenant Technical Assistance	Massport continued publication of *EnviroNews*, a quarterly newsletter that 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 (2015 newsletters are provided in Appendix J, *Water Quality/Environmental Compliance and Management)*.

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

Table 8-1 Progress Report for Environmental Compliance and Management (Continued)

Plan Elements	Progress Report for 2015
Stormwater Pollution Prevention Plan (SWPPP)	In accordance with the requirements of the current stormwater outfall NPDES permit for Logan Airport that was issued on July 31, 2007, Massport and 25 other co-permittees were required to develop SWPPPs. Massport completed its SWPPP in December of 2007. An update to the SWPPP was completed in December 2014 and distributed to Massport and all stormwater co-permittees. Massport's SWPPP addresses stormwater pollutants in general, and also addresses 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 is required to conduct training for personnel responsible for implementing activities identified in the SWPPP. The 2015 Annual Certificates of Compliance were submitted to Environmental Protection Agency (EPA) and Massachusetts Department of Environmental Protection (MassDEP) in December 2015 for Massport and each of its co-permittees.
Design and Construction	Massport developed Sustainable Design Standards and Guidelines (SDSG) for use by architects, engineers, and planners for capital improvement projects for Massport (more information on SDSGs is provided in Chapter 1, *Introduction/Executive Summary*). 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 Leadership in Energy and Environmental Design (LEED®) Silver or above. Massport provides a generic SWPPP to contractors for all Logan Airport construction projects, which provides guidance in preparing project-specific SWPPPs and BMPs to control sedimentation and other pollutants from construction projects. Massport monitors construction projects at Logan Airport for compliance with project SWPPPs and regulatory requirements. 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)[1] Plans	Tenants meeting certain thresholds are required to prepare their own SPCC plans for their facilities. Massport checks for SPCC plans during its environmental compliance inspections. Additionally, tenants receive information on Massport BMPs, which focus on spill management and prevention.

1 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. The ISO 14001 certified EMS is a systematic approach that 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 (SMP)

In 2013, Massport was awarded a grant by the 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 the Authority'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 its first *Logan Airport Annual Sustainability Report* in April of 2016. The report highlights progress towards Massport's sustainability goals and targets since the release of the 2015 SMP. Also in 2016, Massport published the 2nd annual *Sustainable Massport Calendar*, which highlights sustainability successes. The *SMP Highlights Report*, *Logan Airport Annual Sustainability Report,* and *2016 Sustainable Massport Calendar* can be viewed on Massport's website at the following address: http://massport.com/environment/sustainability-management-plan.

Water Quality and Stormwater Management in 2015

Massport's primary water quality goal is to prevent or minimize pollutant discharges, thus limiting adverse water quality impacts associated with Airport activities. Massport employs several programs to promote awareness of Massport and tenant activities 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; and a comprehensive SWPPP.

The federal Clean Water Act 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 NPDES Program. The NPDES permit covers Massport and its co-permittees at Logan Airport. It establishes effluent limitations and monitoring requirements for discharges from specified stormwater outfalls.

On July 31, 2007, EPA and MassDEP issued an individual NPDES Stormwater permit for Logan International 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. 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 2015.

Outfalls Subject to the NPDES Permit

The 2007 NPDES permit regulates stormwater discharges from the North, West, Northwest, Porter Street, and Maverick Street Outfalls, and all of the airfield outfalls. The areas drained by the outfalls are the North Drainage Area (152 acres); West Drainage Area (449 acres); Northwest Drainage Area (23 acres); Porter Street Drainage Area (182 acres); Maverick Street Drainage Area (34 acres); and the 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 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.

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 all appropriate corrective actions.

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[2]	Bird Island Flats	Taxiways, terminal areas, aprons, cargo areas, runways, and roadways
Porter Street (003)	182[2]	Bird Island Flats	Hangars, vehicle maintenance facilities, cargo areas, and car rental facilities
Maverick Street (004)	34[2]	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

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.

2 Drainage areas have been corrected since the publication of the *2014 Environmental Data Report (EDR)*. The drainage areas presented here align with Massport's revised 2015 Stormwater Pollution Prevention Plan.

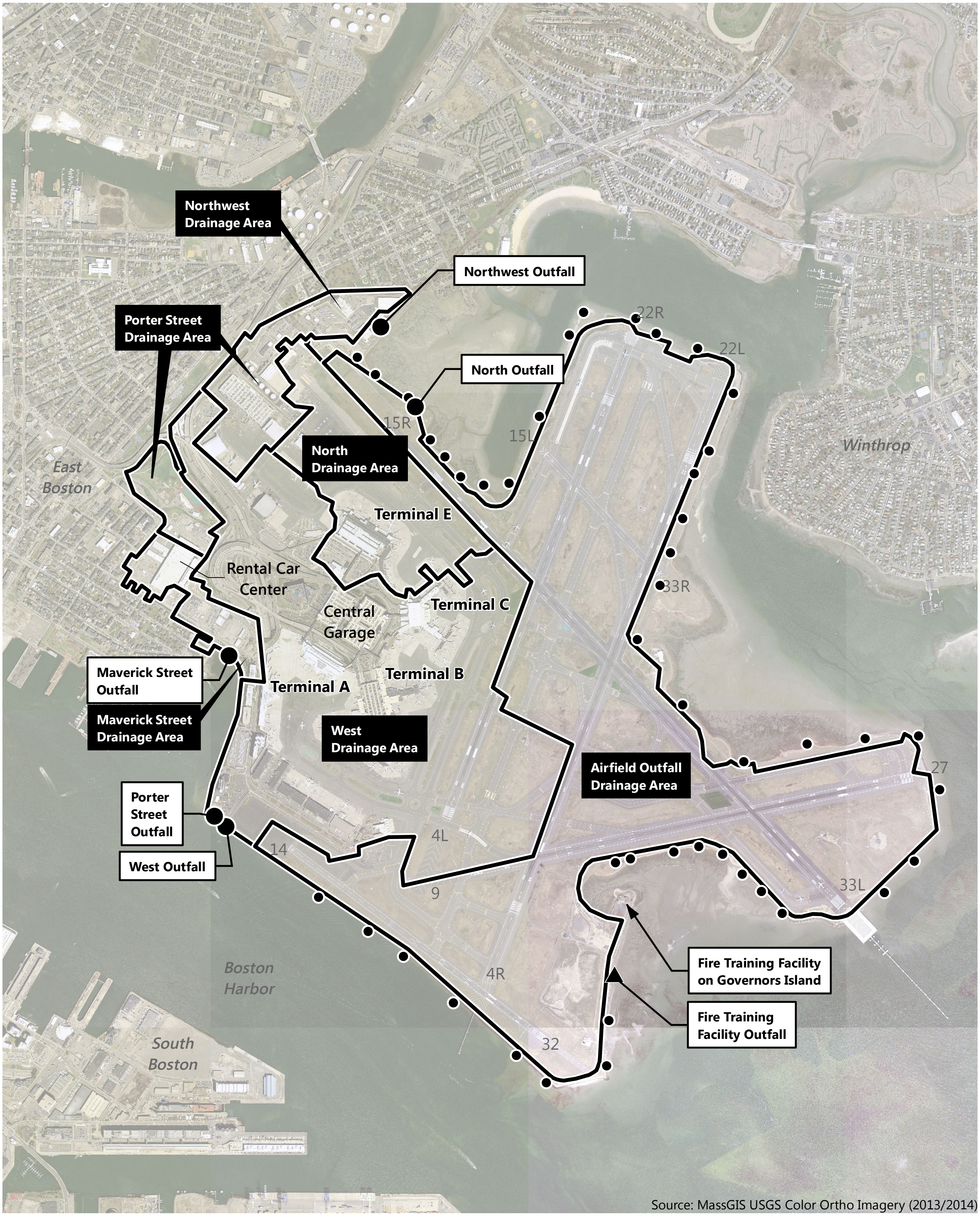


FIGURE 8-1 Logan Airport Outfalls | **2015 Environmental Data Report**

▲ Fire Training Facility Outfall

● Airfield Stormwater Outfalls

▭ Drainage Area

0 450 900 1800 Feet

Monitoring Requirements

The 2007 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, 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 sampling requirements of the NPDES permit include sampling for deicing compounds twice during the 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.

2015 Monitoring Results

During 2015, one out of 12 dry weather event stormwater samples collected from the North Outfall exceeded the oil and grease limit with a concentration of 18 mg/l on February 3, 2015. The oil and grease permit limit is 15 mg/L. There was no discernable source of the oil and grease exceedance.

One out of eight wet weather event stormwater samples collected from the West Outfall exceeded the limit for TSS established in the NPDES permit with a concentration of 120 mg/L on September 30, 2015. The TSS permit limit is 100 mg/L. There were 16 days of dry weather which preceded an intense storm event on September 30, 2015 (2.46 inches of rain were reported on this date) that likely contributed to the TSS exceedance.

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 in 2015.

The NPDES permit requires only that sampling results be reported for the Porter Street, Northwest Outfall and airfield outfalls, and the permit does not contain discharge limits for these outfalls, with the exception of pH. In 2015, the highest average concentrations observed at the Porter Street Outfalls were 328 mg/L of TSS (March 26, 2015) and 18.1 mg/L of oil and grease (March 11, 2015). In 2015, the highest concentration of TSS observed at the Northwest Outfall was 11 mg/L (December 15, 2015). Oil and grease was not measured above the laboratory detection limit (<4.0 mg/L) in any of the samples collected from the Northwest Outfall in 2015. The highest average concentrations observed at the airfield outfalls were 22 mg/L of TSS (August 11, 2015) and 0 mg/L of oil and grease (all samples below laboratory detection limit of <4.0 mg/L).[4]

4 The 2007 NPDES permit does not set maximum daily discharge limitations for the Runway/Perimeter Stormwater Outfalls.

The NPDES water quality monitoring results are posted on Massport's website (http://www.massport.com/environment/environmental-reporting/water-quality/monitoring-results), and Massport provides copies of the monitoring results to EPA and MassDEP. The 2015 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 that dates 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 conducting deicing at Logan Airport to develop tailored plans to reduce deicer usage. Massport and its co-permittees are actively engaged in a Deicing Management Feasibility Study to evaluate various technologies to reduce aircraft deicing fluid discharges to Boston Harbor. Massport will be submitting 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 January 30 and April 9, 2015. Massport conducted additional deicing discharge event sampling in 2015 in response to an EPA Clean Water Act 308 Information Collection Request (ICR) dated December 16, 2014. While this additional sampling was not required by the NPDES permit, Massport is required to report the results of sampling for any parameter above its required frequency.

Sampling results are reported as required by the EPA and MassDEP Appendix J, *Water Quality/ Environmental Compliance and Management* (see **Tables J-3 through J-17**).[5]

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) completed replacement of sections of the sanitary sewer during 2009 and 2010.

The sanitary sewer inspections identified deficiencies in the sewer maintained by Massport at several locations throughout the Airport. Massport retained the engineering services of a consulting engineer to review the sewer investigation report, supplement the investigations, design sewer line repairs to address the deficiencies, and prepare construction documents. In 2012, the consultant completed cleaning and camera inspection of the system and identified additional sections of sewer line that required repair.

Construction bid documents for the sewer repair work were completed in July 2013. The work was completed in November 2013 at a total cost of approximately $550,000, which includes engineering and construction costs.

5 Wet weather deicing monitoring was only required during the first and third year of the NPDES permit.

In 2014, Massport's Facilities Department conducted inspections and cleaning of manhole and catch basin structures at locations throughout the Airport. In accordance with Part I.B.10.h of the Logan Airport NPDES Permit, the inspection and cleaning activities focused on structures within 100 yards of aircraft, vehicle, and equipment maintenance facilities. A total of 300 manhole and catch basin structures were inspected in 2014.

Due to the extensive inspection work completed in 2014, the stormwater drainage system maintenance program was scaled-back in 2015. A total of 40 drainage structures were inspected, and were cleaned as necessary. A total of approximately 12 cubic yards of sediment and debris were removed during cleaning of the structures. In addition to the 40 structures, catch basins along the Airport roadways underwent routine cleaning in the spring of 2015.

During June 2015, a total of 56 Stormceptor units were inspected. The maximum depth of sediment measured in the units was 12 inches and none of the Stormceptor units were found to contain sediment depths that required cleaning. However, sediment was removed from 26 of the Stormceptor units. A total of less than five cubic yards of sediment was removed from the units.

Bacteria Source Tracking

Massport continues to monitor bacteria levels at stormwater outfalls by obtaining samples during wet weather and dry weather sampling 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*.

Massport has continued to track the development of bacteria source tracking technologies and evaluate the appropriateness of additional testing. As reported in previous EDRs, Massport implemented a comprehensive program to investigate potential sources of bacteria in accordance with PART I. B. 9. of the 2007 NPDES permit. The program included an extensive inspection of the sanitary sewer system and correction of identified deficiencies. Massport also worked closely with MassDEP's William X. Wall Experiment Station to investigate specific markers in outfall discharges that could identify potential human or wildlife sources of bacteria. To date, the results of the investigation have been inconclusive.

Fire Training Facility NPDES Permit Requirements and Compliance

NPDES Permit No. MA0032751[6] regulates treated wastewater from the Fire Training Facility on Governors Island (**Figure 8-1**). 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. 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 2015, Massport reused all wastewater generated at the Fire Training Facility. Thus, there were no discharges into Boston Harbor nor were there any shipments of wastewater off-site.

6 NPDES Permit No. MA0032751 - *Logan International Airport Fire Training Facility*. Issued November 1, 2006.

Fuel Use and Spills in 2015

Management of fueling operations at Logan Airport is designed to minimize impacts on water quality by implementing stormwater pollution prevention 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 a single party, BOSFUEL, 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 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 2015, seven of the fuel spills entered the storm drainage system. Massport keeps records of all spills, including those less than the reporting threshold. In 2015, of the oil and hazardous material spills reported to the Massport Fire Rescue Department, 16 spills (8.2 percent) were reportable, due to their volume. Of the 16 reportable spills in 2015, commercial airlines were responsible for 44 percent of the spills; Massport was responsible for 6 percent of the spills; operator error accounted for 13 percent of the spills; ground support equipment accounted for 19 percent of the spills; 6 percent were the result of aircraft fueling; private aircraft were responsible for 6 percent of the spills; and 6 percent of the spills were the result of construction. By volume, jet fuel spills accounted for 71 percent of total fuel spilled; hydraulic oil accounted for 12 percent; diesel fuel accounted for 12 percent; gasoline accounted for 4 percent; and 1 percent other.

A summary of Logan Airport jet fuel usage and spill records from 1990 to 2015, and greater detail 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[1] and Jet Fuel Handling**

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)
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

Source: Massport Fire Rescue Department and Massport Environmental Management Department.
Notes: Oil and hazardous material spills and jet fuel handling data from 1990 through 2015 is provided in Appendix J, *Water Quality/Environmental Compliance and Management*.
1 Materials 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 2015, Massport and its tenant tank owners continued to comply with new state storage tank regulations.[7] 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 glycol. The third tank is located at the Central Heating Plant and is used for storage of heating oil**.** Compliance with the new tank regulations included:

- Re-permitting all ASTs using a newly created Massport Fire Department tank permit;[8] and
- Updating and tracking AST permit status, using the Massport AST database.

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7 310 Code of Massachusetts Regulations (CMR) 80.00.

8 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.

Massport is also implementing a successful tank release prevention strategy, which includes:

- A continuing program of monthly inspections, testing, and minor repairs of all Massport-owned tanks, related piping, and tank monitoring systems. Annual Stage I Vapor Recovery testing was conducted in May 2015, for Massport's USTs and piping systems at the Airport. 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 to MA Department of Fire Services.
- Review of all proposed tenant tank upgrades, installations, and tank removals (under Massport's Tenant Alteration Application[9] process) 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.
- Massport also provides tenants with information regarding the revised storage tank regulatory requirements and offers 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 a number of phases for the investigation of 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 2015 in achieving regulatory closure of the MCP sites identified in **Figure 8-2**.

9 **Tenant Alternation Application is a Massport internal process for tenants who want to make modifications to their leasehold.**

FIGURE 8-2 Massachusetts Contingency Plan Sites | **2015 Environmental Data Report**

Note: Refer to Table 8-4 for the numbered projects.

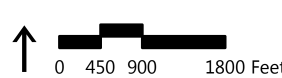

Table 8-4 MCP Activities Status of Massport Sites at Logan Airport

Location (Release Tracking Number) and MassDEP Reporting Status	Action/Status
1. 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.
2. North Outfall (3-4837)	
2011	No change in status. Massport provided updated data for the Massachusetts Department of Environmental Protection (MassDEP) website.
2012	Response Action Outcome submitted to DEP on December 27, 2012. No further MCP response action is required.
3. Former Robie Park (3-10027)	
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. A Permanent Solution Statement is currently being prepared and will be submitted in 2016.
4. Former Robie Property (3-23493)	
2011	A RAM Completion Statement was submitted on March 15, 2011. Regulatory closure has been achieved. No further response actions are required.
5. Tomahawk Drive (3-27068)	
2011	No further response actions required.

Table 8-4 MCP Activities Status of Massport Sites at Logan Airport (Continued)

Location (Release Tracking Number) and MassDEP Reporting Status	Action/Status
6. Fire Training Facility (3-28199)	
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.
7. Southwest Service Area (3-28792)	
2011	No further response actions required.
8. Airfield Duct Bank Site (3-29716)	
2011	A Class A-1 RAO was submitted on December 23, 2011. No further response actions required.
9. West Outfall Release (3-29792)	
2011	Release notification form was submitted on April 8, 2011. Two IRA Status Reports were submitted to MassDEP on June 9 and December 5, 2011. An RAO was submitted on February 13, 2012. No further response actions required.
10. Hertz Parking Lot Site (3-30260)	
2011	Release notification form was submitted on August 29, 2011. A RAM Plan was submitted to MassDEP on September 1, 2011.
2012	A Class A-2 RAO was submitted on September 10, 2012. No further response actions required.
11. Former Butler Aviation Hangar (3-30654)	
2012	Verbal notification of a release was provided to MassDEP on February 14, 2012, when Rental Car Center construction encountered an unidentified underground storage, and a Release Notification Form was submitted on April 23, 2012. An IRA Plan was submitted on May 21, 2012 and IRA Status Reports were submitted on June 18 and December 26, 2012.
2013	Phase I Report and Tier Classification submitted February 21, 2013 and IRA Completion Report submitted on July 11, 2013.
2014	A Permanent Solution Statement was submitted in October 2014. No further response actions required.

Table 8-4 MCP Activities Status of Massport Sites at Logan Airport (Continued)

Location (Release Tracking Number) and MassDEP Reporting Status	Action/Status
12. Taxi Pool Site (3-32022)	
2014	MassDEP notified of 72-hour Reportable Condition on March 10, 2014.
2015	Phase I Report and Tier Classification submitted March 9, 2015.
13. Hangar 16 (3-32351)	
2014	Release Notification Form submitted August 4, 2014.
2015	A RAM Plan was submitted on January 29, 2015; a Phase I Report and Tier Classification were submitted on August 3, 2015; a RAM Completion Report was submitted November 16, 2015; and a Permanent Solution Statement was submitted on January 21, 2016. No further response action are required.

Source: Massport

Notes: This list includes Massport MCP sites only. Additional sites are the responsibility of Logan Airport tenants. Refer to **Figure 8-2** 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 Actions
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
Phase IV Implementation of Selected Remediation Action
Phase V Operation, Maintenance and/or Monitoring

9

Project Mitigation Tracking

Introduction

This *2015 Environmental Data Report (EDR)* provides an update on the Massachusetts Port Authority's (Massport's) mitigation commitments under the Massachusetts Environmental Policy Act (MEPA) for Boston-Logan International Airport (Logan Airport) projects where 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 according to 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 Section 61 mitigation commitment updates in 2015 for projects with ongoing or upcoming mitigation, as documented in **Tables 9-1** through **9-7**. 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 requirements is documented.
- **International Gateway Project**, EEA #9791: Phase I was completed in 2004, Phase II was completed in 2007, and the final phase has been converted to a new project (the Terminal E Modernization Project, EEA #15434). The status of continuing requirements for Phases I and II are documented. The Terminal E Modernization 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 West Concourse Project in 1996 (but never constructed), and four additional new aircraft contact gates. An Environmental Notification Form (ENF) for the Terminal E Modernization Project was filed in October 2015, the Draft Environmental Assessment (EA)/EIR was filed in May 2016, and on September 16, 2016, the Secretary of the EEA issued a Certificate on the Draft EA/EIR noting that the project adequately and properly complies with MEPA. Massport filed the Final EA/EIR on September 30, 2016 and on November 10, 2016, the 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. The project is in the conceptual design phase and initial construction will likely begin in 2018 (see Chapter 3, *Airport*

1 Massachusetts General Law, Chapter 30, Section 61 (M.G.L. c. 30, § 61).

Planning for additional information). This project will be included as a new project in the *2016 ESPR* once the Final Section 61 Findings are issued.

- **Replacement Terminal A Project**, EEA #12096: Terminal A opened March 16, 2005. The status of continuing mitigation requirements is documented.
- **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.
- **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 of 2013. Other phases of the project were completed in 2014. The status of ongoing mitigation requirements is documented.
- **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. The status of ongoing project mitigation requirements is documented.

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 Runway Safety Area Improvement Project, which recently completed its final phase. 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 – EOEA #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, Massport recently 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.[2] On March 20, 2014, the EEA issued an Advisory Opinion confirming that no MEPA review was required for this consolidation of existing on-Airport parking spaces. The project 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

2015 Environmental Data Report

◆ West Garage Project EOEA #9790

Phase I West Garage Construction
Phase II Addition to Central Garage

0 450 900 1800 Feet

Table 9-1 West Garage Project Status Report (EOEA #9790) Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2015)

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 March 2012 and 2014 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. Historically, Massport's Parking Pricing Policy encouraged long-term parking over short-term parking. That was accomplished 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 EDR/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 (EOEA #9790) Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2015) (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.	**Implemented.** Massport assists the Logan TMA in providing services and by periodically conducting the Logan Airport Employee Survey (a survey was conducted in 2010). Results of the 2010 survey are summarized in Chapter 5, *Ground Access to and from Logan Airport*. The most recent survey was conducted in the spring of 2016 and will be reported in the *2016 Environmental Status and Planning Report (ESPR)*.
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 service is still operating at the time of this document filing.

Table 9-1 West Garage Project Status Report (EOEA #9790) Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2015) (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 *2015 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 https://www.massport.com/logan-airport/to-and-from-logan/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 (EOEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2015) (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 went into effect on March 1, 2012 and are still in effect today (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 explored, 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.
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 (EOEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2015) (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 the Water Taxi 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 (EOEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2015) (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.
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 *2015 EDR* details Massport's progress in achieving these measures.
Massport will assess progress towards the achievement of HOV goals using on-Airport Automated Traffic Monitoring Systems (ATMS).	**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 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.

Table 9-1 West Garage Project Status Report (EOEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2015) (Continued)

Mitigation Measure	Status
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) is the command center for all transportation information in and around Logan Airport. Staff at GTOC monitor up to the minute traffic information to ensure Logan Airport bus services are running efficiently. The GTOC is staffed 24 hours per day.
Monitor passenger activity and employee modes of transportation.	**Implemented.** The 2013 air passenger survey was conducted in the spring of 2013 and is summarized in Chapter 5, *Ground Access to and from Logan Airport*. The most recent survey was conducted in the spring of 2016 and results of this survey will be reported on in the next ESPR.
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 Rental Car Center (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 2015 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, 2015)

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 2015, the station pumped approximately 32,176 gallon equivalents per month. Sixty-seven percent of the fuel is purchased by Massport and 33 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 will continue 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 additional CNG buses were added to the fleet in 2015, increasing the total from 18 to 21.
Purchase four electric vans	Summer 1995	**Implemented.**
Install quick-charge kiosks for electric vehicles	Summer 1995	**Implemented.**
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 new electric vehicle (EV) charging stations to accommodate a total of 26 vehicles in the Central and Terminal B parking areas. The new Framingham Logan Express Garage also has two EV charging stations.

Source: Massport

International Gateway Project (Terminal E) – EOEA #9791

Permitting History:

- Certificate on the Final EIR issued on December 2, 1996.
- Section 61 Findings submitted to EEA 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 with 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 never constructed. These three gates are proposed as part of the upcoming Terminal E Modernization Project.

Construction 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 never built. Additional information on the status of this project is available in Chapter 3, *Airport Planning*.

As part of a separate new project, Massport is planning further modernization of the existing International 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 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. On November 10, 2016, FAA issued a FONSI and on November 14, 2016 a ROD for the project (see Chapter 3, *Airport Planning,* for additional information).

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 2015. 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

2015 Environmental Data Report

Note: Runway 14-32 construction completed in November 2006

◆ International Gateway Project (Terminal E) - EOEA #9791

0 450 900 1800 Feet

Table 9-3 International Gateway Project Status Report (EOEA #9791) Section 61 Mitigation Measures (as of December 31, 2015)

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.** Massport continues to work cooperatively with Eversource, Alternative Vehicle Service Group (AVSG), the City of Boston, and the Massachusetts Clean Cities Coalition to promote the implementation and integration of Alternative Fuel Vehicles (AFVs) into local private and public fleets. In May 2007, Massport adopted two new policies to promote alternative fuel and hybrid vehicle usage at Logan Airport by others: 1) limited front-of-line taxi pool privileges; and 2) preferred parking locations in the Central Garage and the Economy Garage. These policies remain in effect.
High Occupancy Vehicle (HOV) Promotion	
Massport will reserve terminal space for ground transportation ticket sales, reservations, and information.	**Implemented.** This space has been provided in a staffed information area in the arrivals area of the new terminal. 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 2015.
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 has been 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 – EOEA #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**) involved the complete demolition of the pre-existing Terminal A and construction of a new facility by Delta Air Lines, consisting of a main terminal linked to a satellite concourse. The old Terminal A was closed in May 2002 and demolition commenced shortly thereafter. The project was designed to be constructed in five phases. However, as a result of September 11, 2001, air traffic at Logan Airport reduced dramatically allowing Massport to relocate the airlines at Terminal A to other terminals with minimal impact, and to shut down Terminal A entirely rather than having to phase construction concurrent with passenger activity. As a result, construction progressed ahead of schedule in 2003 and 2004. 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 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 in proximity to bus and subway systems.

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 2015.

FIGURE 9-3 Replacement Terminal A Project | **2015 Environmental Data Report**

◆ Terminal A Replacement Project - EOEA #12096

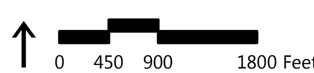

Table 9-4 Replacement Terminal A Project Status Report (EOEA #12096) Section 61 Mitigation Measures (as of December 31, 2015)

Mitigation Measure	Status
Project Design Mitigation	
Logan Transportation Management Association (TMA) Participation	
Delta Air Lines, Inc. has joined Massport's Logan TMA. Delta Air Lines will designate an Employee Transportation Advisor at Terminal A to be the conduit between the Logan TMA Coordinator and Delta Air Lines employees.	**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 within 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, Silver Line, and Logan Express buses.

Table 9-4 Replacement Terminal A Project Status Report (EOEA #12096) Section 61 Mitigation Measures (as of December 31, 2015) (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 (EOEA #12096)
Section 61 Mitigation Measures (as of December 31, 2015) (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 2015, 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 *2015 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 will be 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 – EOEA #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, the Federal Aviation Administration (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 the 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 MEPA Certificate on the Final EIR and the 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 the FAA's ROD.
- In April 2007, the 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 is anticipated to commence after 2015.
- 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 contained in previous EDRs.

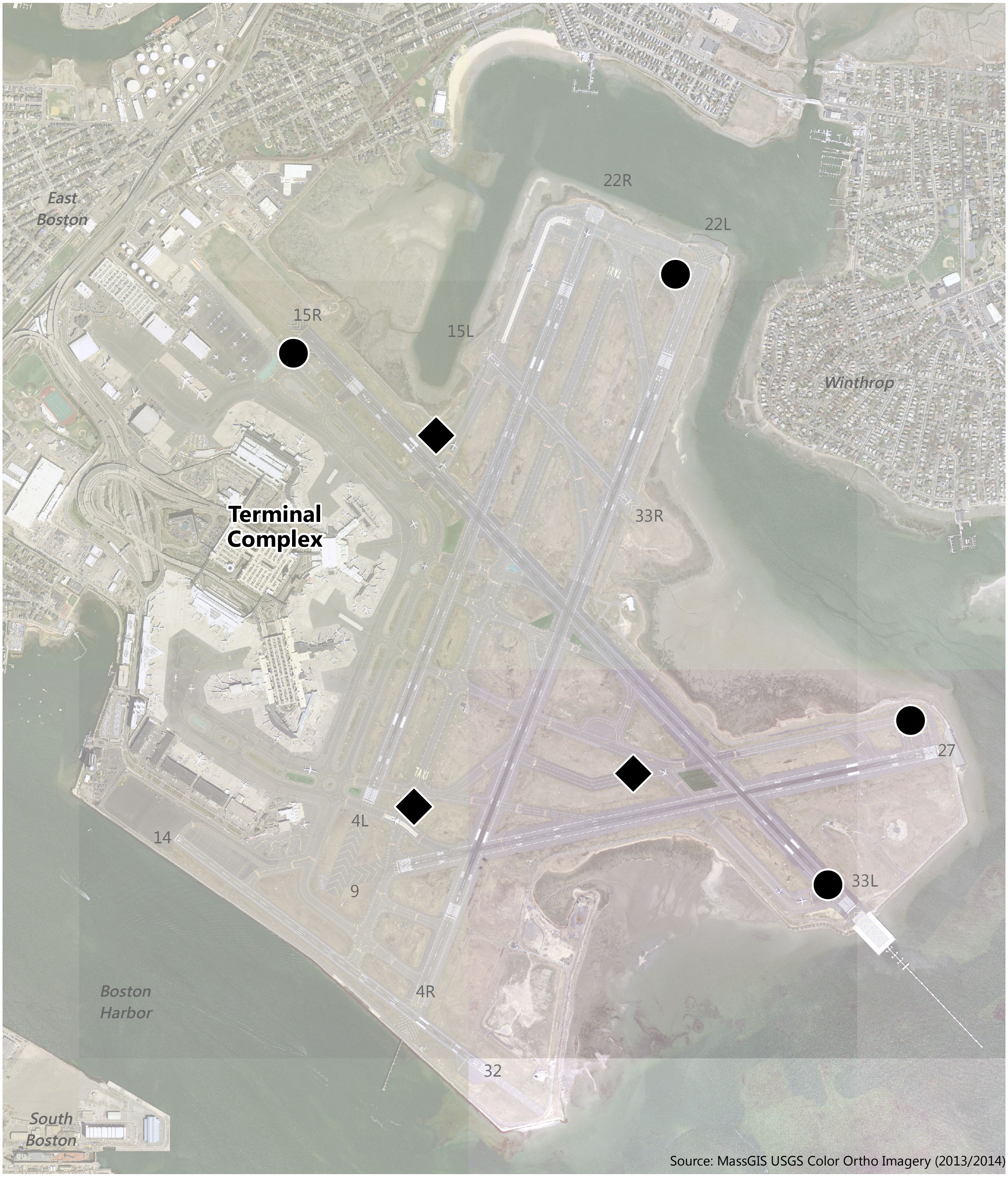

FIGURE 9-4 Logan Airside Improvements | **2015 Environmental Data Report**

Note: Runway 14-32 construction completed in November 2006

◆ Improved Taxiways

● Reductions in Approach Minimums

0 450 900 1800 Feet

Table 9-5 Logan Airside Improvements Planning Project (EOEA #10458)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2015)

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. The 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 the 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 cooperation on regional transportation efforts.
Massport will continue to exercise operational control over Worcester Regional Airport.	**Implemented**. The Authority exercised operational control over Worcester Regional Airport as part of Massport's 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 the 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 (EOEA #10458)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2015) (Continued)

Mitigation Measure	Status
Massport will continue to attract new air service to Worcester Regional Airport	**Implemented.** Following the events of September 11, 2001, the last commercial operator, US Airways Express, ceased operations out of Worcester in early 2003. In 2003 and 2004, Massport continued to work with the City of Worcester to attract passenger service for Worcester Regional Airport. Service by Allegiant Airways commenced in December 2005 but ceased in September 2006. Commercial passenger service was regained when Direct Air began scheduled charter services in November 2008, but commercial passenger services ceased again in 2012. Massport continues to work with carriers and make other facility improvements to develop and sustain commercial service from Worcester. In 2013, JetBlue Airways began commercial service to two Florida locations from Worcester Regional Airport; as of this filing, over 350,000 passengers have been served since JetBlue service began in November 2013.
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.
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 NERASP study was completed in the fall of 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 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 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 Department), and a new high-level platform commuter rail station.

Table 9-5 Logan Airside Improvements Planning Project (EOEA #10458)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2015) (Continued)

Mitigation Measure	Status
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 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 are 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. 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 (EOEA #10458)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2015) (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.** The 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 will seek 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. Phase 3 is expected to be completed by December 2016. FAA has begun implementing new RNAV procedures that were designed in Phase 1. Please refer to website www.bostonoverflight.com for more details.
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 of a proposed rule 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 to receive comments on the proposed regulation. The Massport Board voted to establish the peak period surcharge program on January 16, 2005. The program has been in place since that date. Please refer to Appendix K, *2015 Peak Period Pricing Monitoring Report*.

**Table 9-5 Logan Airside Improvements Planning Project (EOEA #10458)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2015) (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 2015, 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 *2015 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. Since MassRIDES began management of the Logan TMA in January 2006, the joint focus has been on expanding Logan TMA services, broadening HOV options, and supporting all major Logan Airport tenants to become members and actively participate in the Logan TMA. A local "Sunrise Shuttle" has been operating since 2007.

Source: Massport
Note: The mitigation measures in *italics* are those that were referenced in the FAA's ROD and later incorporated into the October 21, 2004 amended Section 61 Findings.

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 is redeveloping the SWSA and has completed the new RCC. In addition to customer service benefits, consolidation of the rental car operations and their shuttle buses into one coordinated operation will result in reduced vehicle miles traveled (VMT) and associated 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 entire 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. Three additional new CNG buses were put into service in the summer of 2015, increasing the total from 18 to 21 buses. Additionally, in keeping with Massport's commitment to sustainability, the Authority is proud that the RCC was awarded Logan Airport's first LEED Gold Certification in 2015.

Table 9-6 outlines the SWSA Redevelopment Program Section 61 commitments which Massport, the construction contractors, and the rental car companies will implement 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, 2015)

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.
Develop a Soil Management Plan and submit to the MassDEP prior to construction for the Activity and Use Limitations (AUL) areas.	**Implemented.** An Excavated Materials Management and Disposal Plan was prepared by a Licensed Site Professional (LSP). Two Release Abatement Measure (RAM) Plans for work within AUL areas were submitted by the Contractor's LSP to the Massachusetts Department of Environmental Protection (MassDEP) in accordance with the Massachusetts Contingency Plan (MCP). Construction occurred within two AUL areas, associated with MCP sites identified by Release Tracking Numbers (RTNs) 3-00956 and 3-2690, and submittal of the RAM Plans were required to detail procedures for managing contaminated soil. RAM Completion Reports were filed in October 2014 for both MCP sites and no ongoing activity is anticipated related to the RAM Plans.

**Table 9-6 Southwest Service Area (SWSA) Redevelopment Program (EEA #14137)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2015) (Continued)**

Mitigation Measure	Status
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. Three additional CNG buses were put into service in September 2015, increasing the total from 18 to 21 buses.
Incorporate noise reduction strategies into site design, such as solid fences/walls, gateway signs/walls, and landscaped berms.	**Implemented.** All noise reduction measure were constructed.
Phase 2 SWSA Airport Edge Buffer and Other Site Landscaping	
Construct other site landscaping that encourages walking/biking by providing safe and welcoming corridors, reduces environmental impact (water efficient; reduce and filter runoff), and screens the SWSA from neighboring properties.	**Implemented.** The Phase 2 SWSA buffer was completed in the fall of 2015.
Building Design	
Energy Efficiency	
Optimize daylight and natural ventilation within the Garage Structure (a Code classification for an "open parking structure") to eliminate the need for substantial mechanical ventilation systems.	**Implemented.** This element is included in the completed project.
Reduce energy consumption by a minimum of 20 percent (as required by MA LEED Plus) by properly sizing building mechanical systems and incorporating high performance/energy efficient mechanical and electrical building systems, such as highly-reflective (high-albedo) roofing materials, reduced lighting intensities, high-efficient heating and cooling systems, and daylighting techniques with window and skylight glazing.	**Implemented.** This element is included in the completed project.
Reduce overall electricity consumption by 2.5 percent through the use of on-site renewable energy (which contributes to the overall 20 percent energy efficiency performance criteria above).	**Implemented.** This element is included in the completed project.
Conduct a third-party commissioning process to ensure the effectiveness of building systems (as required by MA LEED Plus).	**Implemented.** Massport completed the commissioning process and the project met Leadership in Energy and Environmental Design's (LEED's) standard for Enhanced Commissioning.
Water Efficiency and Wastewater Reduction	
Reduce water use demand by a minimum of 20 percent (as required by MA LEED Plus) and to strive for a 30 percent reduction through utilization of high-efficiency/low-flow plumbing fixtures and car wash water reclamation systems.	**Implemented.** This element is included in the completed project.

Table 9-6 Southwest Service Area (SWSA) Redevelopment Program (EEA # 14137)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2015) (Continued)

Mitigation Measure	Status
Reduce water use demand and wastewater generation by reclaiming and reusing car washing water.	**Implemented.** This element is included in the completed project.
Potential collection of and reuse of stormwater runoff for irrigation of landscaped areas.	**Not implemented.** This element was considered as part of the final design, but was not included in the completed project.
Noise Reduction Measures	
Improve the Quick Turnaround Areas (QTAs), including the elimination of outdoor loudspeakers, elimination of car drying blowers through state-of-the-art equipment, enclosed vacuum compressors, and incorporation of six to eight-foot high solid walls/fences designed to further reduce noise from activities at the QTA facilities, including car washing and vehicle movements.	**Implemented.** This element is included in the completed project.
Transportation and Parking	
Roadway Improvements	
Reconstruct Porter Street, including turnaround for exiting taxis.	**Implemented.** This element is included in the completed project.
Reconfigure SR-14 and new alignment of Ramp 1A-S.	**Implemented.** This element is included in the completed project.
Construct new dedicated Unified Bus System access and ramp off of SR-14.	**Implemented.** This element is completed.
Reconstruct traffic signals and pedestrian accommodations at the Harborside Drive/Porter Street intersection.	**Implemented.** This element is included in the completed project.
Reconstruct, widen, and convert Jeffries Street to one-way northbound, between Harborside Drive and Tomahawk Drive.	**Implemented.** This reconfiguration is complete.
Reconstruct traffic signals and pedestrian accommodations at the Harborside Drive/Jeffries Street intersection.	**Implemented.** This element is completed.
Construct the extension of Tomahawk Drive – a one-way westbound roadway connecting Harborside Drive with the Maverick Street Gate and Garage Structure.	**Implemented.** This element is completed.
Reconstruct traffic signals and pedestrian accommodations at the Harborside Drive/Hotel Drive intersection.	**Implemented**. This element is completed.
Reconfigure inbound lane of the Maverick Street Gate to provide additional queue storage.	**Implemented.** This element is completed.

Table 9-6 Southwest Service Area (SWSA) Redevelopment Program (EEA # 14137) Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2015) (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.** This element is completed.
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.** This element is completed.
Provide street and pedestrian-level lighting and advanced warning signals and/or systems at crosswalks.	**Implemented.** This element is completed.
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 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, 2015) (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.** This element is completed.
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.
Construction Management	
Aim to divert/reduce construction waste to landfills.	**Implemented during construction.**
Implement Erosion and Sedimentation Control Program.	**Implemented during construction**.
Retrofit certain diesel construction equipment types with diesel oxidation catalyst and/or particulate filters (in accordance with the DEP Clean Air Construction Initiative).	**Implemented during construction.**
Require the use of ultra-low sulfur diesel fuel for off-road construction vehicles and/or equipment.	**Implemented during construction.**
Construction worker vehicle coordination and trip limitation, including requiring contractors to provide off-airport parking and use of high-occupancy vehicle transportation modes for employees.	**Implemented during construction.**
To ensure no changes in the conditions of abutting homes due to pile driving, Massport will require the Contractor to inspect the conditions of the abutting homes prior to and following pile driving activities.	**Implemented.** Preconstruction residential survey completed.

Source: Massport.

Logan Airport RSA Project – EEA #14442

Permitting History

- Certificate on the Final EA/EIR issued on March 18, 2011.
- The 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, the 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 ended in November 2011. The second construction season started in June 2012 and the project 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** indicates the status 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 the outer 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 facilitated implementation of the reduced aircraft approach minimums previously reviewed and approved by the FAA in a ROD dated August 2, 2002, for the *Logan Airside Improvements Planning Project (Airside Project)*. 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, the 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 commitments for the Logan Airport RSA Project and Massport's progress in achieving these measures.

FIGURE 9-5 Runway End Safety Improvements | **2015 Environmental Data Report**

Table 9-7 Logan Airport Runway Safety Area Improvement Program (EEA # 14442)
Section 61 Mitigation Commitments to be Implemented (as of December 31, 2015)

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 2012, Massport continued to work with the Eelgrass Mitigation Working Group (comprised of federal, state, and local agencies) through 2013 to identify alternative means of eelgrass mitigation. 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 transplantation. 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.
Implement sediment control measures during construction.	**Implemented.** Sedimentation control measures were installed and fully maintained.
Store construction barges outside of any eelgrass beds overnight during construction.	**Implemented.** There was no overnight barge storage in or immediately adjacent to eelgrass beds.
Restrict barge movement to designated construction corridors outside of the eelgrass bed during construction.	**Implemented.** There was limited barge movement in or immediately adjacent to eelgrass beds.
Provide post-construction monitoring and restoration or any additional areas of eelgrass beds that are inadvertently damaged during construction.	**Implemented.** The post-construction monitoring was conducted in November 2012. No remedial measures were required.
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.	**To be implemented** upon completion of Runway 22R habitat mitigation at Rumney Marsh (expected 2017).
Implement erosion and sedimentation control measures according to the Soil Erosion and Sediment Control Plan.	**Implemented** during construction.
Shellfish	
Monitor pilings and substrate at Runway 33L.	**Implemented.** Monitoring conducted summer 2013, 2014, and 2015. Additional monitoring will be conducted in 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.

Table 9-7 Logan Airport Runway Safety Area Improvement Program (EEA # 14442) Section 61 Mitigation Commitments to be Implemented (as of December 31, 2015) (Continued)

Mitigation Measure	Status
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 the 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 the future.
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.
Apply water to dry soil to prevent dust production.	**Implemented.** Completed for Runway 33L and 22R construction.
Stabilize any highly erosive soils with erosion control blankets and other stabilization methods, as necessary.	**Implemented.** Completed for Runway 33L and 22R construction.
Use sediment control methods (such as silt fences and hay bales) during excavation to prevent silt and sediment entering the stormwater system and waterways.	**Implemented.** Completed for Runway 33L and 22R construction.
Maintain equipment to prevent oil and fuel leaks.	**Implemented.** Completed for Runway 33L and 22R construction.
Use silt curtains and semi-permanent (overnight) debris booms and other secondary booms and silt fencing around barges for additional containment.	**Implemented.** Completed for Runway 33L and 22R construction.
Contain and pump slurry and/or silty water to a containment area on a construction barge to contain runoff.	**Implemented.** Completed for Runway 33L and 22R construction.
Noise	
Maintain mufflers on construction equipment.	**Implemented.** Completed for Runway 33L and 22R construction.
Keep truck idling to a minimum in accordance with Massachusetts anti-idling regulations.	**Implemented.** Completed for Runway 33L and 22R construction.
Fit any air-powered equipment with pneumatic exhaust silencers.	**Implemented.** Completed for Runway 33L and 22R construction.

Table 9-7 Logan Airport Runway Safety Area Improvement Program (EEA # 14442) Section 61 Mitigation Commitments to be Implemented (as of December 31, 2015) (Continued)

Mitigation Measure	Status
Do not allow nighttime construction.	**Implemented.** Completed for Runway 33L and 22R construction.
Air Quality	
Keep truck idling to a minimum in accordance with Massachusetts anti-idling regulations.	**Implemented.** Completed for Runway 33L and 22R construction.
Retrofit appropriate diesel construction equipment with diesel oxidation catalyst and/or particulate filters.	**Implemented.** Completed for Runway 33L and 22R construction.
Implement construction worker vehicle trip management, including requiring contractors to provide off-airport parking, use high-occupancy vehicle transportation modes for employees, and join the Logan TMA.	**Implemented.** Completed for Runway 33L and 22R construction.
Traffic	
Limit construction traffic to federal or state highways, restricting the use of East Boston local roadways by construction vehicles.	**Implemented.** Completed for Runway 33L and 22R construction.
Implement construction worker vehicle trip management, including requiring contractors to provide off-airport parking, use high-occupancy vehicle transportation modes for employees, and join the Logan TMA.	**Implemented.** Completed for Runway 33L and 22R construction.

Source: Massport.

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MEPA Appendices

- Appendix A, MEPA Certificates and Responses to Comments
- Appendix B, Comment Letters and Responses
- Appendix C, Proposed Scope for the *2016 ESPR*
- Appendix D, Distribution List

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MEPA Certificates and Responses to Comments

- Secretary of the Executive Office of Energy and Environmental Affairs Certificates on the *Logan Airport 2014 Environmental Data Report (EDR)* and Massport's Responses to Comments raised in the Certificate.
- Copies of the Secretary of the Executive Office of Energy and Environmental Affairs Certificates issued for the reporting years 2011 and 2012/2013.
- Copy of the Secretary of the Executive Office of Energy and Environmental Affairs Certificate issued for the Terminal E Modernization Project Environmental Notification Form and Responses to Comments.
- Copy of the Secretary of the Executive Office of Energy and Environmental Affairs Certificate issued for the Terminal E Modernization Project Draft Environmental Assessment/Environmental Impact Report and Responses to Comments.
- Copy of the Secretary of the Executive Office of Energy and Environmental Affairs Certificate issued for the Terminal E Modernization Project Final Environmental Assessment/Environmental Impact Report.

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November 13, 2015

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
2014 LOGAN AIRPORT ENVIRONMENTAL DATA REPORT

PROJECT NAME	: 2014 Environmental Data Report
PROJECT MUNICIPALITY	: Boston/Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: October 7, 2015

As Secretary of Executive Office of Energy and Environmental Affairs (EEA), I hereby determine that the Environmental Data Report submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (MEPA) (M.G.L. c. 30, ss. 61-62I) and with its implementing regulations (301 CMR 11.00).

Background

The environmental review process for Logan Airport has been structured to occur on two levels: airport-wide and project-specific. The Environmental Status and Planning Report (ESPR) has evolved from a largely retrospective status report on airport operations to a broader analysis that also provides a prospective assessment of long-range plans. It has thus become, consistent with the objectives of the MEPA regulations, part of the Massachusetts Port Authority's (Massport) long-range planning process. The ESPR provides a "big picture" analysis of the environmental impacts of current and anticipated levels of activities, and presents an overall strategy to minimize impacts. The ESPR is supplemented by (and ultimately incorporates) the detailed analyses and mitigation commitments for project-specific Environmental Impact

Reports (EIR). The ESPR is generally updated on a five-year basis; the most recent ESPR for the year 2011 was filed in April of 2013. Environmental Data Reports (EDRs) (formerly referred to as Annual Updates) are filed in the years between ESPRs.

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

The 2014 EDR is the subject of this review. Additionally, this Certificate contains a Scope for the 2015 EDR. This 2014 EDR provides a comprehensive, cumulative analysis of the effects of all Logan Airport activities based on actual passenger activity and aircraft operational levels in 2014 and presents environmental management plans for addressing areas of environmental concern. It also reports on the status of project mitigation. The next anticipated ESPR will report on updated passenger activity levels, aircraft operations forecasts, and environmental conditions forecasts for 2016.

Passenger levels at Logan Airport reached a new peak in 2013, exceeding the 2007 historic peak, while aircraft operations at Logan Airport remained well below the historic peak reached in 1998. The 2014 EDR examines the effects of airlines operating much more efficiently with quieter fleets and flying more passengers per aircraft. As discussed in the 2011 ESPR, the 2014 EDR anticipates further increases in activity levels and some increases in environmental impacts compared to recent years; however, these will remain below levels projected in 2004.

Scope for the 2015 EDR

General

The 2015 EDR should follow the general format of the 2014 EDR. The 2015 EDR should include an Executive Summary and Introduction. To provide context for reviewing agencies and the public, it should provide background information on the environmental policies and planning that shape the environmental reporting, technical studies, and environmental mitigation initiatives at Logan Airport. A-1

The 2015 EDR should provide an update on conditions at Logan Airport for calendar year 2014, including passenger and aircraft operation activity levels. It should continue to serve as a background/context against which projects at Logan Airport can be evaluated. It should also report on the cumulative effects of Logan Airport operations and activities, compared to previous A-2 years, as appropriate. It should provide a status report on Massport's proposed planning initiatives, projects, and mitigation measures. A-2 Cont.

The technical studies in the 2015 EDR should include reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. The 2015 EDR must also respond to those issues explicitly noted in this Certificate and the comments received on the 2014 EDR. A-3

A distribution list for the 2015 EDR (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document. This section must also include copies of all ESPR and EDR Certificates issued since the 2011 Logan ESPR to provide context for reviewers. Supporting technical appendices should be provided as necessary. A-4

Responses to Comments

The 2015 EDR Responses to Comments should address all of the substantive comments from the letters listed at the end of this Certificate. The Responses to Comments included in the 2014 EDR is well-constructed and cross-referenced. I encourage Massport to use the same format in the 2015 EDR. A-5

The majority of comments received on the 2014 EDR focus on noise issues, including measurement of noise, modeling of noise contours, and noise abatement, and emissions reduction issues. In addition to responding to these comments, the 2015 EDR should continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commenters where appropriate. A-6

Activity Levels

The Activity Levels chapter provides a solid analysis of major activity issues and the technical appendix contains useful and detailed information. This chapter presents aviation activity statistics for Logan Airport in 2014. Logan Airport is New England's primary domestic and international airport, operating as an origin-destination airport, rather than a connecting hub for major airlines. The total number of air passengers increased by 4.7 percent to 31.6 million in 2014, compared to 30.2 million in 2013. The 2014 passenger level represents a new record high for Logan Airport.

Passenger-aircraft operations accounted for 91 percent of total aircraft operations. The total number of aircraft operations increased slightly from approximately 361,339 in 2013 to 363,797 in 2014, a 0.7 percent increase. This was preceded by a 2.4 percent increase in 2013. Despite the increase, aircraft operations at Logan Airport remained well below the 487,996 operations in 2000 and the historic peak achieved in 1998. In 1986, Logan Airport served 21.7 million air passengers, as compared to 31.6 million in 2014 with roughly the same number of total operations (363,995).

Aircraft efficiency continued to improve in 2014 as the average number of passengers per aircraft operation grew from 83.6 in 2013 to 87.0 in 2014. This positive trend is indicative of the industry-wide shift toward higher aircraft load factors and an increase in the number of domestic and international destinations. While the number of domestic and international passengers is increasing, international passenger demand is projected to increase at a faster rate than domestic passenger demand. Total international annual passenger numbers increased from 4.4 million in 2013 to 4.9 million in 2014, a 9.8-percent increase. The strong international passenger growth was driven by several new nonstop services introduced by a number of foreign airlines including Emirates, Turkish Airlines, Hainan Airlines, and Cathay Pacific. Recently launched international destinations include Mexico City, Tokyo, Beijing, Dubai, Istanbul, Panama City, Hong Kong, and Shanghai. International air passengers are anticipated to reach 6 million by 2022 and 8 million by 2030.

The 2015 EDR should report on airport activity levels and aircraft operations, including:

- Aircraft operations, including fleet mix and scheduled airline services at Logan Airport;
- Passenger activity levels;
- Cargo and mail activities; A-7
- Compare 2014 aircraft operations, cargo/mail operations, and passenger activity levels to 2013 activity levels; and
- Report on national aviation trends in 2014 and compare to trends at Logan Airport.

It should also report on Massport's activity level forecasts that will become the basis for the planning and impact sections that follow and for Massport's strategic planning initiatives for the future ESPR. Massport should address comments related to activity levels in the 2015 EDR. A-8

Sustainability at Logan Airport

The 2014 EDR describes Massport's airport wide sustainability goals. In October 2000, the Massport Board approved an Environmental Management Policy, which articulates Massport's commitment to protect the environment and to implement sustainable design principles. In 2013, Massport was awarded a grant by the Federal Aviation Administration (FAA) to prepare a Sustainability Management Plan (SMP) for Logan Airport. The purpose of the SMP is to enhance the efficiency and sustainability of Logan Airport's operations and to support the broader sustainability principles of the Commonweath. The Logan Airport SMP planning effort began in May 2013 and was completed in April 2015. The plan is intended to promote and integrate sustainability Airport-wide and to coordinate ongoing sustainability efforts at Massport. A baseline data assessment was completed in winter 2014 to assess current sustainability performance at the Airport. The Logan Airport SMP developed a framework and implementation plan, with metrics and targets, designed to track progress over time.

The 2014 EDR provides an excellent overview of Massport's commitment to incorporate sustainability into all aspects of Massport's activities: Planning and Design; Construction; Operations, Maintenance and Management; and Monitoring of Environmental Performance. It also identifies specific practices to reduce impacts of construction and efforts to address energy intensity, percentage of renewable energy, and GHG reductions. The SMP establishes goals for ten categories: Energy and Greenhouse Gases; Water Conservation; Community, Employee, and Passenger Well-being; Materials, Waste Management, and Recycling; Resiliency; Noise Abatement; Air Quality Improvement; Ground Access and Connectivity; Water Quality/Stormwater; and Natural Resources.

A specific example includes compliance with the Leading by Example Executive Order which requires state agencies to procure 15 percent of their electricity from renewable resources by 2012. The Leading by Example program has influenced Massport's own operations including its offices, heating plants, and garages resulting in Massport receiving the Leading by Example award in 2008. Massport is striving to achieve LEED certification for new and substantial rehabilitation of building projects over 20,000 square feet. Some recent examples of LEED certified buildings at Logan Airport. The new Rental Car Center in the Southwest Service Area (SWSA) began construction in 2010 and was completed in 2013and was awarded Logan Airport's first LEED Gold Certification in 2015.

I commend Massport for its commitment to sustainability and its leadership. Progress on the SMP should be incorporated into subsequent EDRs and ESPRs. The 2015 EDR should report on the progress towards each of the ten goals and sustainability-related performance. A-9

The 2015 EDR should report on the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have undergone MEPA review, including whether they are under construction or completed. The status of mitigation commitments made in the Section 61 Findings for the following projects should be included: A-10

- West Garage/Central Garage (EEA #9790)
- International Gateway (EEA #9791)
- Logan Airside Improvements Planning Project (EEA #10458)
- Terminal A Replacement Project (EEA #12096)
- Southwest Service Area Redevelopment Program/Rental Car Center (EEA #14137)
- Logan Runway Safety Area Improvements Project (EEA #14442)

<u>Planning</u>

The Airport Planning chapter in the 2014 EDR provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2014. It also describes future planning, construction, and permitting activities and initiatives. It includes the following Airport Projects:

- *Parking Consolidation Project*: Massport is consolidating 2,050 temporary parking spaces as an addition to the West Garage and at the existing surface lot between the Logan Office Center and the Harborside Hyatt. These spaces constitute all the remaining spaces permitted under the Logan Airport Parking Freeze. The West Garage addition is atop the existing Hilton Hotel parking lot. The project will incorporate sustainable design and resiliency elements. The consolidation is expected to be completed in 2015.
- *Terminal E Renovation and Enhancements Project*: This project includes interior and exterior improvements at Terminal E to accommodate regular service by wider and

longer Group VI aircraft. The project does not include any new gates, but will reconfigure three existing gates to accommodate Group VI aircraft (including the Airbus A380 and Boeing 747-8 primarily used by international air carriers). An addition to the west side of Terminal E will allow passenger holdrooms to be reconfigured to accommodate the larger passenger loads associated with larger aircraft. The project also includes modifications to the airfield to meet required Federal Aviation Administration (FAA) safety and design standards to accommodate the larger aircraft. An Environmental Assessment (EA) was filed and FAA issued a Finding of No Significant Impact (FONSI) on July 29, 2015. Construction commenced in 2015.

- *Terminal E Modernization Project*: To accommodate existing and long range forecasted demand for international service in an efficient, environmentally-sound manner that also improves customer service, Massport is planning to expand Terminal E. Modernizing Terminal E would add the three contact gates approved in 1996 as part of the International Gateway West Concourse project (EEA #9791), which were never constructed, and an additional two to four additional new gates in an extended concourse. A key feature of this project is the first direct pedestrian connection from the MBTA Blue Line Airport Station to the terminal complex at Logan Airport. This project would also include improvements to Airport roadways to facilitate access. The project is in the conceptual design phase. Massport intends to commence construction prior to 2018. An Environmental Notification Form (ENF) for this project (EEA#15434) was published in the November 9 Environmental Monitor.
- *Logan Airport Greenway Connector Project:* The Logan Airport Greenway Connector ("Greenway Connector") is a pedestrian/bicycle path connecting the Bremen Street Park path to the future City of Boston Narrow Gauge Connector, a pedestrian/bicycle path that begins at the Greenway Overlook and continues to Constitution Beach. Construction of the Greenway Connector began in spring 2013 and was completed in July 2014.
- *The Rental Car Center (RCC)*: Consolidating the rental car shuttle bus fleet and some Massport shuttle buses into a unified shuttle route system resulted in the elimination of eight rental car bus fleets (a net total of 66 buses have been eliminated). It included intersection and roadway infrastructure improvements including signal coordination and dedicated ramp connections. It also created a Ground Transportation Operations Center (GTOC) to support efficient planning and operation of Airport-wide transit activities.

In recognition of the potential and significant effects of climate change on Massport infrastructure and operations, Massport has initiated the Disaster and Infrastructure Resiliency Planning (DIRP) Study. A particular concern for Massport is the effects of sea level rise and projected increases in the severity and frequency of storms. The Study includes Logan Airport, the Port of Boston, and Massport's waterfront assets in South and East Boston. The DIRP Study includes a hazard analysis; modeling of projected sea-level rise and storm surge; and, temperature and precipitation projections and anticipated increases in extreme weather events. The study is nearing completion. The 2015 EDR should provide a summary of the DIRP Study and identify which recommendations Massport will implement in the short term to increase the resiliency of its facilities to the potential effects of climate change. A-11

Massport is developing a long-term parking management plan for Logan Airport. The Long-Term Parking Management Plan will lay out a multi-part strategy for efficiently managing parking supply, pricing, and operations – both at Logan Airport and at off-Airport locations controlled by Massport – to maximize access for transit and shared-ride vehicles while minimizing both drive-and-park and pick-up/drop-off modes. The 2015 EDR should provide updates on this plan. A-12

The 2015 EDR should also report on Massport planning to improve Logan Airport's operations and services in a safe, secure, more efficient, and environmentally sensitive manner. As owner and operator of Logan Airport, Massport also must accommodate and guide tenant development. Specifically, the 2015 EDR should also describe the status of planning initiatives for the following areas: A-13

- Roadway Corridor Project;
- Airport Parking;
- Terminal Area;
- Airside Area;
- Service and Cargo Areas; and
- Airport Buffers and Landscaping.

The 2015 EDR should provide a status report on long-range planning activities. This chapter should include the status and effectiveness of the ground access changes, including roadway and parking projects, that will consolidate and direct airport-related traffic to centralized locations and minimize airport-related traffic on external streets in adjacent neighborhoods. A-14

Regional Transportation

The 2014 EDR describes activity levels at New England's regional airports in 2014 and provides an update on regional planning activities, including long-range transportation efforts. The New England region is anchored by Logan Airport and a system of 10 other commercial service, reliever, and general aviation (GA) airports (regional airports). Overall, passenger traffic at the New England airports in 2014 represented the highest passenger traffic level for the region since the economic downturn in 2008. The increase in the region's passenger traffic was largely driven by continued growth at Logan Airport. In 2014, the total number of air passengers utilizing New England's commercial service airports, including Logan Airport, increased by 3.1 percent from 45.4 million in 2013 to 46.8 million annual air passengers in 2014. Of the 46.8 million passengers using New England's commercial service airports in 2014, 67.6 percent of passengers (31.6 million) used Logan Airport compared to 66.6 percent (30.2 million) in 2013. While passenger activity levels have increased, aircraft operations in the New England region have decreased. In 2014, regional aircraft operations decreased by 4.3 percent, from 1.02 million operations in 2013 to 0.97 million operations in 2014.

The 2015 EDR should describe Logan Airport's role in the region's intermodal transportation system by reporting on the following:

Regional Airports

- 2015 regional airport operations, passenger activity levels, and schedule data within an historical context;
- Status of plans and new improvements as provided by the regional airport authorities;
- Ground access improvements; and
- Role of the Worcester Regional Airport and Hanscom Field in the regional aviation system and Massport's efforts to promote these airports. A-15

Regional Transportation System

- Massport's role in managing the regional transportation facilities within MassDOT;
- Massport's cooperation with other transportation agencies to promote efficient regional highway and transit operations; and
- Report on metropolitan and regional rail initiatives and ridership.

<u>Ground Access to and from Logan Airport</u>

The 2014 EDR reports on transit ridership, roadways, traffic volumes, and parking for both 2012 and 2013. Specifically, the EDR states that Massport has continued to invest in and operate Logan Airport with a goal of increasing the number of passengers arriving by transit or other high occupancy vehicle (HOV) modes. The HOV/transit mode share at Logan Airport continues to rank at the top of U.S. airports. However, private passenger vehicle trips continue to increase with growth in air travel. As Logan Airport air traveler numbers have increased, a constrained parking supply at Logan Airport has resulted in an increase in pick-up and drop-off vehicle trips. These trips generate automobile emissions both locally and regionally. As part of its Long-Term Parking Management Plan, Massport is considering a series of measures to minimize pick-up/drop-off activity.

In 2014, Massport remained in full compliance with the Logan Airport Parking Freeze regulations. Despite an increase in terminal area parking rates on July 1, 2014, daily parking demand more frequently approached the Parking Freeze cap in 2014. Massport is consolidating 2,050 temporary parking spaces in addition to the West Garage and at the existing surface lot between the Logan Office Center and the Harborside Hyatt. These spaces constitute all remaining spaces permitted under the Logan Airport Parking Freeze. Increases in weekday peak commercial parking demand places additional pressure on roadway and parking operations under the Logan Airport Parking Freeze. In 2014, due to high demand on Tuesdays, Wednesdays, and Thursdays, 30,314 cars were diverted to another garage or lot and 56,634 cars were valeted/stacked (when cars are parked in aisles, have their keys taken, and then are re-parked in empty spaces as they become vacant); this represents over a 50 percent increase since 2013. There were about 40 weeks in which one or more of these measures were put into effect in 2014.

The 2015 EDR should report on the following and compare trends to 2014:

- Detailed description of compliance with Logan Airport Parking Freeze;
- High occupancy vehicle (HOV) ridership (including Blue Line, Silver Line, Water Transportation, and Logan Express);
- Massport's cooperation with other transportation agencies to increase transit ridership to and from Logan Airport via the Blue Line and Silver Line;
- Logan Airport Employee Transportation Management Association (Logan TMA) services;
- Logan Airport gateway volumes; A-16
- On-airport traffic volumes;
- On-airport vehicle miles traveled (VMT);
- Parking demand and management (including rates and duration statistics);
- Status of long-range ground access management strategy planning; and
- Results of the 2015 Logan Airport Passenger Survey.
- Massport's target HOV mode share along with incentives; and,
- Non-Airport through-traffic;
- Report on Logan Express usage and efforts to increase capacity and usage;
- Report on water transportation to and from Logan Airport; and
- Report on results of ongoing ground access studies.

Noise Abatement

The 2014 EDR updates the status of the noise environment at Logan Airport in 2012 and 2013, and describes Massport's efforts to reduce noise levels. Many of the issues raised in the noise analysis are ongoing and require continuous monitoring. The 2015 EDR should address the noise issues raised by numerous commenters on the 2014 EDR. A-17

In 2014, an additional 106 residential units received sound insulation bringing the program total to 11,515 residential units treated, amongst the highest in the nation. Since 2000, the number of daily aircraft operations has declined by almost 27 percent (from 1,355 operations per day in 2000 to 997 operations per day in 2014). This trend reflects an increase in the use of larger aircraft, airline consolidation, and increased efficiencies on the part of airlines. As described throughout this EDR, this evolution towards fewer flights with larger, more efficient and quieter aircraft has yielded substantial environmental benefits. Compared to 2000, in 2014:

- Jet operations made up 86 percent of operations compared to 66 percent;
- Overall operations were down by 25 percent while overall passengers were up by 14 percent; and
- The number of people exposed to DNL 65 dB has declined by 50 percent since 2000. Compared to 2013, the 2014 DNL 65 dB noise contours were larger in most areas around the Airport. The DNL contour was larger over East Boston, Winthrop, and Revere.

There were several temporary FAA- mandated airfield/airspace operating factors that influenced the contour changes in 2014. Due to safety concerns at airports across the US in June of 2014, the FAA temporarily halted the use of head-to-head operations or opposite direction operations, in which planes arrive on a runway in one direction and depart in the opposite direction. When in use at Logan Airport, the procedure has aircraft departing from Runway 15R and landing on Runway 33L during the late night (typically midnight to 5:00 AM) when weather conditions are appropriate, including good visibility and little wind. At Logan Airport, head-to-head operations are an important part of the use of the late night noise abatement runway (Runway 15R-33L) since this keeps operations over Boston Harbor. Use of this procedure was restored in early 2015. FAA also restricted the use of converging runways across the United States in January 2014 due to safety concerns. At Logan Airport, Runways 22L and 22R and Runway 27 were affected by this change. While Runway 22R is in use for departing aircraft, arrivals that would typically be directed to Runway 27 were sent by the FAA Air Traffic Control to arrive on Runway 22L. This restriction has since been lifted. Runway 15L-33R was closed for a short period of time (eight weeks) during the summer of 2014 for Runway Safety Area Improvements. This resulted in aircraft using Runway 15R-33L, Runway 4L, and Runway 22L more frequently in 2014 than in 2013. The construction activity also resulted in short closures of the intersecting Runway 4L-22R and Runway 4R-22L, which increased usage of Runway 15R-33L. An additional factor influencing the contour changes was an increase in overall operations and nighttime operations in 2014 compared to 2013. Nighttime operations increased for passenger flights as airlines expanded destinations and the number of flights per day. Several new international airlines began service at Logan Airport in 2014.

The information in the Noise Abatement chapter is very informative. I expect detailed analysis will be provided in the 2015 EDR and that Massport will consider and address the comments on noise and noise related issues. A-18

The 2015 EDR should provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, and the updates in noise modeling. The chapter should report on 2015 conditions and compare those conditions to those of 2014 for the following: A-19

- Fleet Mix, including Stage II, Recertified Stage III, newly manufactured Stage III, and qualifying Stage IV aircraft;
- Nighttime operations;
- Runway utilization (report on aircraft and airline adherence with runway utilization goals);
- Preferential runway advisory system (PRAS) tracking; and
- Flight tracks.

In 2015, the FAA introduced a new combined noise and air quality modeling tool, the Aviation Environmental Design Tool (AEDT), which must be used for all airport projects. The AEDT is a software system that dynamically models aircraft performance in space and time to produce fuel burn, emissions, and noise information. Noise contours for 2015 will be developed using AEDT and compared to the most recent version of the Integrated Noise Model (INM) which has been in place for all previous EDRs and ESPRs. Logan Airport-specific model adjustments made to account for over-water sound propagation and the propagation of sound to areas of higher terrain may be reported as an add-on to AEDT, if accepted by the FAA. This 2015 EDR should report on the following:

- Changes in annual noise contours and noise-impacted population;
- Measured versus modeled noise values, including reasons for differences and any improvements attributable to the models deployed; A-20
- Cumulative Noise Index (CNI);
- Times-Above for 65, 75, and 85 dBA threshold values/Dwell and Persistence of noise levels; and
- Flight track monitoring noise reports.

The 2015 EDR should also report on noise abatement efforts, results from Boston Logan Airport Noise Study (BLANS) study, and provide an update on the noise and operations monitoring system. A-21

Air Quality/Emissions Reduction

The 2014 EDR provides an overview of airport-related air quality issues in 2014 and also efforts to reduce emissions. The air quality modeling reported in 2014 EDR is based on aircraft operations, fleet mix characteristics, and airfield taxiing times combined with ground support equipment (GSE) usage, motor vehicle traffic volumes, and stationary source utilization rates. Total air quality emissions from all sources associated with Logan Airport in 2014 are significantly less than they were a decade ago. The EDR attributes this downward trend to Massport's longstanding objective to accommodate the demands of increasing passenger and cargo activity levels with fewer aircraft operations generating fewer emissions.

In 2014, calculated emissions of volatile organic compounds (VOC), oxides of nitrogen (NOx), and particulate matter (PM) went up slightly. This was primarily attributable to changes in the modeling software, MOVES2014. Overall, modeled air quality emissions were similar in 2014 to 2013 conditions and followed recent trends. The changes in 2014 modeled air quality emissions, as compared to 2013, are primarily due to technical changes in the model itself. Inputs to the model include aircraft operations, fleet mix characteristics, and airfield taxi times combined with ground service equipment (GSE) usage, motor vehicle traffic volumes, and stationary source utilization rates. Model versions used in the 2014 analyses differed in terms of emission factors, most notably otor vehicle emissions. The modeled air quality conditions in 2014 for Logan Airport were for carbon monoxide (CO), NOx, VOCs, and PM.

- Total VOC emissions went up by 3 percent (1,177 kilograms per day [kg/day]) in 2014 compared to 2013. The increase is primarily due to the corresponding increase in aircraft landing and take-offs (LTOs) and an increase in jet fuel and gasoline usage when compared to 2013. For comparison, total VOC emissions were 1,777 kg/day in 2000.
- Total NOx emissions went up by less than 1 percent in 2014 (4,040 kg/day) compared to 2013. This slight increase in 2014 is mostly attributable to the larger number of air carrier operations during this time period. For comparison, total NOX emissions were 5,707 kg/day in 2000.

- Total CO emissions went down by 5 percent in 2014 (6,987 kg/day) compared to 2013. This decrease is mostly attributable to the decrease in GSE factors and motor vehicle emission factors in accordance with MOVES2014. For comparison, total CO emissions were 13,111 kg/day in 2000.
- Total $PM_{10}/PM_{2.5}$ emissions went up by approximately 3 percent in 2014 (95 kg/day) compared to 2013. This small increase is primarily attributable to the higher emission factors of MOVES2014.
- Total greenhouse gas (GHG) emissions went down by approximately 1 percent in 2014 compared to 2013. This decrease was primarily due to a decrease in vehicle miles traveled (VMT).
- Massport's Air Quality Initiative (AQI) has tracked NOx emissions since the benchmark year of 1999. Total NO_x emissions in 2014 were 722 tons per year (tpy) lower than the 1999 benchmark which represents an overall decrease of 31 percent in NOx emissions since 1999 when the program was initiated. For comparison, NO_x emissions in 2013 were 730 tpy lower than the benchmark.

Massport has also committed to include an inventory of GHG emissions from Logan Airport in the 2015 EDR. GHG emissions should be quantified for aircraft, GSE, motor vehicles and stationary sources using appropriate emission factors and methodologies. The 2015 EDR should include an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, and the changes in air quality modeling. The 2015 EDR should provide discussion on progress on the national and international levels to decrease air emissions. It should also include analysis methodologies and assumptions and report on conditions using the FAA's new AEDT model, described above. It will compare results to the most recent version of the Emissions Dispersion Modeling System (EDMS) that has been used in recent EDR/ESPR filings. It should include emissions inventories for CO, NO_x, VOCs, and PM emissions by airline. The 2015 EDR should also report on Massport's and Tenant's Alternative Fuel Vehicle Programs and Logan Airport air quality studies undertaken by Massport or others, as available. A-22

The results of the 2015 GHG emissions inventory should be compared to the 2014 results. This chapter should also include an update on Massport's efforts to encourage the use of single engine taxiing under safe conditions. A-23

Water Quality/Environmental Compliance

The 2014 EDR describes Massport's ongoing environmental management activities including National Pollutant Discharge Elimination System (NPDES) compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan (MCP), and tank management. Massport's primary water quality goal is to prevent or minimize pollutant discharges, thus limiting adverse water quality impacts of airport activities. Massport employs several programs to promote awareness of activities that may impact surface and groundwater quality. Programs include implementing best management practices (BMPs) for pollution prevention by Massport, its tenants, and its construction contractors; training of staff and tenants; and a comprehensive stormwater pollution prevention plan. The EDR reports that Massport continues to comply with water quality and other environmental regulations.

The 2015 EDR should identify any planned stormwater management improvements and report on the status of:

- NPDES Permit and monitoring results for Logan Airport's outfalls and the Fire Training Facility;
- Jet fuel usage and spills;
- MCP activities;
- Tank management;
- Update on the environmental management plan; and
- Fuel spill prevention.

A-24

Conclusion

I have determined that the 2014 EDR for Logan Airport has adequately complied with MEPA. The EDR provides a comprehensive overview of environmental planning, issues and data. Massport may prepare the 2015 EDR for submission in 2016 consistent with the Scope included in this Certificate.

November 13, 2015
Date

Matthew A. Beaton

Comments received:

10/30/2015	Nancy S. Timmerman
11/05/2015	Town of Milton, Office of Selectmen
11/06/2015	Stephen H. Kaiser, PhD
11/06/2015	The Boston Harbor Association
11/06/2015	Cindy L. Christiansen, PhD
11/10/2015	Bill Deignan, Cambridge Community Development Department

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Comment #	Author	Topic	Comment	Response
A-1	Matthew Beaton, Secretary	EDR Content	The 2015 EDR should follow the general format of the 2014 EDR. The 2015 EDR should include an Executive Summary and Introduction. To provide context for reviewing agencies and the public, it should provide background information on the environmental policies and planning that shape the environmental reporting, technical studies, and environmental mitigation initiatives at Logan Airport.	For the first time in the Environmental Data Report (EDR) process, the Executive Summary is presented in English and Spanish. The *2015 EDR* will follow the format specified.
A-2	Matthew Beaton, Secretary	EDR Content	The 2015 EDR should provide an update on conditions at Logan Airport for calendar year 2015, including passenger and aircraft operation activity levels. It should continue to serve as a background/context against which projects at Logan Airport can be evaluated. It should also report on the cumulative effects of Logan Airport operations and activities, compared to previous years, as appropriate. It should provide a status report on Massport's proposed planning initiatives, projects, and mitigation measures.	The *2015 EDR* includes the specified sections as follows: Chapter 2, *Activity Levels*; Chapter 3, *Airport Planning*; Chapter 9, *Project Mitigation Tracking*.
A-3	Matthew Beaton, Secretary	EDR Content	The technical studies in the 2015 EDR should include reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. The 2015 EDR must also respond to those issues explicitly noted in this Certificate and the comments received on the 2014 EDR.	The *2015 EDR* includes the specified sections as follows: Chapter 2, *Activity Levels*; Chapter 4, *Regional Transportation*; Chapter 5, *Ground Access to and from Logan Airport*; Chapter 6, *Noise Abatement*; Chapter 7, *Air Quality/Emissions Reduction*; Chapter 8, *Water Quality/Environmental Compliance;* Chapter 9, *Project Mitigation Tracking;* and a detailed response to comments (Appendix B, *Comment Letters and Responses*).
A-4	Matthew Beaton, Secretary	Distribution/ Responses to Comments	A distribution list for the 2015 EDR (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document. This section must also include copies of all ESPR and EDR Certificates issued since the 2011 Logan ESPR to provide context for reviewers. Supporting technical appendices should be provided as necessary.	The *2015 EDR* includes the specified sections as follows: Appendix D, *Distribution List*, and Appendix A, *MEPA Certificates and Responses to Comments*. In addition, the appendix also includes the Secretary's Certificate on the Terminal E Modernization Project Environmental Notification Form (ENF), issued December 16, 2015, and the Certificate on the Draft Environmental Assessment (EA)/Environmental Impact Report (EIR), issued September 16, 2016, which directs certain items to be addressed in this *2015 EDR* and the following *2016 Environmental Status and Planning Report (ESPR)*. Technical appendices for each chapter are provided where supporting documentation is required.
A-5	Matthew Beaton, Secretary	Responses to Comments	The 2015 EDR Responses to Comments should address all of the substantive comments from the letters listed at the end of this Certificate. The Responses to Comments included in the 2014 EDR is well-constructed and cross-referenced. I encourage Massport to use the same format in the 2015 EDR.	This *2015 EDR* includes the specified sections in Appendix B, *Comment Letters and Responses*, in the suggested format.
A-6	Matthew Beaton, Secretary	Noise/ Responses to Comments	The majority of comments received on the 2014 EDR focus on noise issues, including measurement of noise, modeling of noise contours, and noise abatement, and emissions reduction issues. In addition to responding to these comments, the 2015 EDR should continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commenters where appropriate.	Massport has responded to all comments in Appendix B, *Comment Letters and Responses.* Chapter 6, *Noise Abatement*, includes information on noise tracking and abatement.

Comment #	Author	Topic	Comment	Response
A-7	Matthew Beaton, Secretary	Activity Levels	The 2015 EDR should report on airport activity levels and aircraft operations, including: • Aircraft operations, including fleet mix and scheduled airline services at Logan Airport; • Passenger activity levels; • Cargo and mail activities; • Compare 2014 aircraft operations, cargo/mail operations, and passenger activity levels to 2013 activity levels; and • Report on national aviation trends in 2014 and compare to trends at Logan Airport.	The *2015 EDR* includes the specified sections in Chapter 2, *Activity Levels*.
A-8	Matthew Beaton, Secretary	Activity Levels/ Responses to Comments	It should also report on Massport's activity level forecasts that will become the basis for the planning and impact sections that follow and for Massport's strategic planning initiatives for the future ESPR. Massport should address comments related to activity levels in the 2015 EDR.	The *2015 EDR* includes the specified sections in Chapter 2, *Activity Levels*. Massport has responded to comments related to activity levels in Appendix B, *Comment Letters and Responses.*
A-9	Matthew Beaton, Secretary	Sustainability	I commend Massport for its commitment to sustainability and its leadership. Progress on the SMP [Sustainability Management Plan] should be incorporated into subsequent EDRs and ESPRs. The 2015 EDR should report on the progress towards each of the ten goals and sustainability-related performance.	The *2015 EDR* includes an updated section on sustainability initiatives at Logan Airport in Chapter 1, *Introduction/Executive Summary*. This EDR also references the Logan Airport Sustainability Management Plan, released in April 2015, and Massport's first Annual Sustainability Report, released in April 2016. Both documents are available on Massport's website at: https://www.massport.com/environment/sustainability-management-plan/. Massport plans to continue reporting on its sustainability progress regularly in sustainability reports, which will be referenced in EDRs/ESPRs and available online at https://www.massport.com/environment.
A-10	Matthew Beaton, Secretary	Mitigation	The 2015 EDR should report on the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have undergone MEPA review, including whether they are under construction or completed. The status of mitigation commitments made in the Section 61 Findings for the following projects should be included: • West Garage/Central Garage (EEA #9790); • International Gateway (EEA #9791); • Logan Airside Improvements Planning Project (EEA #10458); • Terminal A Replacement Project (EEA #12096); • Southwest Service Area Redevelopment Program/Rental Car Center (EEA # 14137); and • Logan Runway Safety Area Improvements Project (EEA #14442).	The *2015 EDR* includes the specified sections in Chapter 9, *Project Mitigation Tracking.*
A-11	Matthew Beaton, Secretary	Planning	The 2015 EDR should provide a summary of the DIRP [Disaster and Infrastructure Resiliency Planning] Study and identify which recommendations Massport will implement in the short term to increase the resiliency of its facilities to the potential effects of climate change.	The Disaster and Infrastructure Resiliency Planning Study findings are reported on in Chapter 1, *Introduction/Executive Summary,* and Chapter 3, *Airport Planning.*

Comment #	Author	Topic	Comment	Response
A-12	Matthew Beaton, Secretary	Ground Access/ Planning	Massport is developing a long-term parking management plan for Logan Airport. The Long-Term Parking Management Plan will lay out a multi-part strategy for efficiently managing parking supply, pricing, and operations - both at Logan Airport and at off-Airport locations controlled by Massport - to maximize access for transit and shared-ride vehicles while minimizing both drive-and-park and pick-up/drop-off modes. The 2015 EDR should provide updates on this plan.	The *2015 EDR* includes the specified sections in Chapter 5, *Ground Access to and from Logan Airport*.
A-13	Matthew Beaton, Secretary	Planning	The 2015 EDR should also report on Massport planning to improve Logan Airport's operations and services in a safe, secure, more efficient, and environmentally sensitive manner. As owner and operator of Logan Airport, Massport also must accommodate and guide tenant development. Specifically, the 2015 EDR should also describe the status of planning initiatives for the following areas: • Roadway Corridor Project; • Airport Parking; • Terminal Area; • Airside Area; • Service and Cargo Areas; and • Airport Buffers and Landscaping.	The *2015 EDR* includes the specified sections in Chapter 3, *Airport Planning*.
A-14	Matthew Beaton, Secretary	Planning/ Ground Access	The 2015 EDR should provide a status report on long-range planning activities. This chapter should include the status and effectiveness of the ground access changes, including roadway and parking projects, that will consolidate and direct airport-related traffic to centralized locations and minimize airport-related traffic on external streets in adjacent neighborhoods.	The *2015 EDR* includes the specified sections in Chapter 3, *Airport Planning,* and Chapter 5, *Ground Access to and from Logan Airport*.
A-15	Matthew Beaton, Secretary	Regional Transportation	The 2015 EDR should describe Logan Airport's role in the region's intermodal transportation system by reporting on the following: Regional Airports • 2015 regional airport operations, passenger activity levels, and schedule data within an historical context; • Status of plans and new improvements as provided by the regional airport authorities; • Ground access improvements; and • Role of the Worcester Regional Airport and Hanscom Field in the regional aviation system and Massport' s efforts to promote these airports. Regional Transportation System • Massport's role in managing the regional transportation facilities within MassDOT; • Massport' s cooperation with other transportation agencies to promote efficient regional highway and transit operations; and • Report on metropolitan and regional rail initiatives and ridership.	The *2015 EDR* includes the specified sections in Chapter 4, *Regional Transportation*.

Comment #	Author	Topic	Comment	Response
A-16	Matthew Beaton, Secretary	Ground Access	The 2015 EDR should report on the following and compare trends to 2014: • Detailed description of compliance with Logan Airport Parking Freeze; • High occupancy vehicle (HOV) ridership (including Blue Line, Silver Line, Water Transportation, and Logan Express); • Massport' s cooperation with other transportation agencies to increase transit ridership to and from Logan Airport via the Blue Line and Silver Line; • Logan Airport Employee Transportation Management Association (Logan TMA) services; • Logan Airport gateway volumes; • On-airport traffic volumes; • On-airport vehicle miles traveled (VMT); • Parking· demand and management (including rates and duration statistics); • Status of long-range ground access management strategy planning; • Results of the 2015 Logan Airport Passenger Survey; • Massport's target HOV mode share along with incentives; • Non-Airport through-traffic; • Report on Logan Express usage and efforts to increase capacity and usage; • Report on water transportation to and from Logan Airport; and • Report on results of ongoing ground access studies.	The *2015 EDR* includes the specified sections in Chapter 5, *Ground Access to and from Logan Airport*.
A-17	Matthew Beaton, Secretary	Noise/ Responses to Comments	The 2014 EDR updates the status of the noise environment at Logan Airport in 2012 and 2013, and describes Massport' s efforts to reduce noise levels. Many of the issues raised in the noise analysis are ongoing and require continuous monitoring. The 2015 EDR should address the noise issues raised by numerous commenters on the 2014 EDR.	Chapter 6, *Noise Abatement*, includes information on noise tracking and abatement. Massport has responded to all comments on the *2014 EDR* in Appendix B, *Responses to Comments.*
A-18	Matthew Beaton, Secretary	Noise/ Responses to Comments	The information in the Noise Abatement chapter is very informative. I expect detailed analysis will be provided in the 2015 EDR and that Massport will consider and address the comments on noise and noise related issues.	Chapter 6, *Noise Abatement*, includes information on noise tracking and abatement. Massport has responded to all comments on the *2014 EDR* in Appendix B, *Responses to Comments.*
A-19	Matthew Beaton, Secretary	Noise	The 2015 EDR should provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, and the updates in noise modeling. The chapter should report on 2015 conditions and compare those conditions to those of 2014 for the following: • Fleet Mix, including Stage II, Recertified Stage III, newly manufactured Stage III, and qualifying Stage IV aircraft; • Nighttime operations; • Runway utilization (report on aircraft and airline adherence with runway utilization goals); • Preferential runway advisory system (PRAS) tracking; and • Flight tracks.	The *2015 EDR* includes the specified sections in Chapter 6, *Noise Abatement*.

Comment #	Author	Topic	Comment	Response
A-20	Matthew Beaton, Secretary	Noise	This 2015 EDR should report on the following: • Changes in annual noise contours and noise-impacted population; • Measured versus modeled noise values, including reasons for differences and any improvements attributable to the models deployed; • Cumulative Noise Index (CNI); • Times-Above for 65, 75, and 85 dBA threshold values/Dwell and Persistence of noise levels; and • Flight track monitoring noise reports.	The *2015 EDR* includes the specified sections in Chapter 6, *Noise Abatement*.
A-21	Matthew Beaton, Secretary	Noise	The 2015 EDR should also report on noise abatement efforts, results from Boston Logan Airport Noise Study (BLANS) study, and provide an update on the noise and operations monitoring system.	The *2015 EDR* includes the specified sections in Chapter 6, *Noise Abatement*, and associated Appendix H, *Noise Abatement*
A-22	Matthew Beaton, Secretary	Air Quality/ Emissions Reduction	Massport has also committed to include an inventory of GHG [greenhouse gas] emissions from Logan Airport in the 2015 EDR. GHG emissions should be quantified for aircraft, GSE [ground support equipment], motor vehicles and stationary sources using appropriate emission factors and methodologies. The 2015 EDR should include an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, and the changes in air quality modeling. The 2015 EDR should provide discussion on progress on the national and international levels to decrease air emissions. It should also include analysis methodologies and assumptions and report on conditions using the FAA's [Federal Aviation Administration] new AEDT [Aviation Environmental Design Tool] model, described above. It will compare results to the most recent version of the Emissions Dispersion Modeling System (EDMS) that has been used in recent EDR/ESPR filings. It should include emissions inventories for CO [carbon monoxide], NO_x [oxides of nitrogen], VOCs [volatile organic compounds], and PM [particulate matter] emissions by airline. The 2015 EDR should also report on Massport's and Tenant's Alternative Fuel Vehicle Programs and Logan Airport air quality studies undertaken by Massport or others, as available.	The *2015 EDR* includes the specified sections in Chapter 7, *Air Quality/Emissions Reduction*.
A-23	Matthew Beaton, Secretary	Air Quality/ Emissions Reduction	The results of the 2015 GHG emissions inventory should be compared to the 2014 results. This chapter should also include an update on Massport's efforts to encourage the use of single engine taxiing under safe conditions.	The *2015 EDR* includes the specified sections in Chapter 7, *Air Quality/Emissions Reduction*.
A-24	Matthew Beaton, Secretary	Water Quality	The 2015 EDR should identify any planned stormwater management improvements and report on the status of: • NPDES [National Pollutant Discharge Elimination System] Permit and monitoring results for Logan Airport's outfalls and the Fire Training Facility; • Jet fuel usage and spills; • MCP [Massachusetts Contingency Plan] activities; • Tank management; • Update on the environmental management plan; and • Fuel spill prevention.	The *2015 EDR* includes the specified sections in Chapter 8, *Water Quality/Environmental Compliance and Management*.

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Copies of Secretary of the Executive Office of Energy and Environmental Affairs Certificates issued for the Reporting Years 2011 and 2012/2013

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February 6, 2015

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
2012-2013 LOGAN AIRPORT ENVIRONMENTAL DATA REPORT

PROJECT NAME	: 2012-2013 Environmental Data Report
PROJECT MUNICIPALITY	: Boston / Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: December 10, 2014

As Secretary of Executive Office of Energy and Environmental Affairs (EEA), I hereby determine that the Environmental Data Report submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (MEPA) (M.G.L. c. 30, ss. 61-62I) and with its implementing regulations (301 CMR 11.00).

Background

The environmental review process for Logan Airport has been structured to occur on two levels: airport-wide and project-specific. The Environmental Status and Planning Report (ESPR) has evolved from a largely retrospective status report on airport operations to a broader analysis that also provides a prospective assessment of long-range plans. It has thus become, consistent with the objectives of the MEPA regulations, part of the Massachusetts Port Authority's (Massport) long-range planning process. The ESPR provides a "big picture" analysis of the environmental impacts of current and anticipated levels of activities, and presents an overall strategy to minimize impacts. The ESPR is supplemented by (and ultimately incorporates) the detailed analyses and mitigation commitments associated with project-specific Environmental

Impact Reports (EIR). The ESPR is generally updated on a five-year basis; the most recent ESPR for the year 2011 was filed in April of 2013. Environmental Data Reports (EDRs) (formerly referred to as Annual Updates) are filed in the years between ESPRs. During the review of the 2011 ESPR, Massport requested that the 2012 and 2013 EDRs be combined into one document. The 2012-2013 EDR is the subject of this review. Additionally, this Certificate contains a Scope for the 2014 EDR.

The 2012-2013 EDR provides a comprehensive, cumulative analysis of the effects of all Logan Airport activities based on actual and predicted passenger activity and aircraft operation levels in 2012 and 2013, and presents environmental management plans for addressing areas of concern. The technical studies in the 2012-2013 EDR include reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality and environmental management. The 2012-2013 EDR updates and compares the data presented in the 2011 ESPR, and presents activity levels (including aircraft operations and passenger activity) and environmental conditions at Logan Airport for the calendar years 2012 and 2013. It also reports on the status of project mitigation.

Passenger levels at Logan Airport reached a new peak in 2013, exceeding the 2007 historic peak, while aircraft operations at Logan Airport remained well below the historic peak reached in 1998. The 2012-2013 EDR examines the effects of airlines operating much more efficiently with quieter fleets and flying more passengers per aircraft operation. As discussed in the 2011 ESPR, the 2012-2013 EDR anticipates further increases in activity levels and some increases in environmental impacts compared to recent years.

Scope for the 2014 EDR

General

The 2014 EDR should follow the general format of the 2012-2013 EDR status report. The 2014 EDR should include an Executive Summary and Introduction, similar to previous ESPRs and EDRs. Massport must provide background information on the environmental policies and planning that form the context of the environmental reporting, technical studies, and environmental mitigation initiatives at Logan Airport to provide context for reviewing agencies and the public. A1

The 2014 EDR should provide an update on conditions at Logan Airport for calendar year 2014, including passenger and aircraft operation activity levels. It should continue to serve as a background/context against which projects at Logan Airport can be evaluated. It should also report on the cumulative effects of Logan Airport operations and activities, compared to previous years, as appropriate. It should provide a status report on Massport's proposed planning initiatives, projects, and mitigation measures. A2

The technical studies in the 2014 EDR should include reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. The 2014 EDR must also A3 respond to those issues explicitly noted in this Certificate and the comments received on the 2012-2013 EDR.

A distribution list for the 2014 EDR (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document. This section must also include copies of all ESPR and EDR Certificates issued since the 2004 Logan ESPR (issued on August 16, 2006) to provide context for reviewers. Supporting technical appendices should be provided as necessary. A4

Response to Comments

The 2014 EDR Responses to Comments section should address all of the substantive comments from the letters listed at the end of this Certificate. The Response to Comments chapter included in the 2012-2013 EDR is well-constructed and cross-referenced. I encourage Massport to use the same format in the 2014 EDR. A5

The majority of comments received on the 2012-2013 EDR focus on noise related issues, including measurement of noise, modeling of noise contours, and noise abatement, and emission reduction issues. In addition to responding to these comments, the 2014 EDR should continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commenters where appropriate. A6

Activity Levels

The Activity Levels chapter provides a solid analysis of major activity issues and the technical appendix contains useful and detailed information. This chapter presents aviation activity statistics for Logan Airport in 2012 and 2013. Logan Airport is New England's primary domestic and international airport, operating as an origin-destination airport, rather than a connecting hub for major airlines. In 2012, Logan Airport was the 23rd busiest commercial aviation facility in North America ranked by aircraft operations, and the 20th busiest in North America ranked by number of passengers. In 2013, Logan Airport was the 21st busiest commercial aviation facility in North America ranked by aircraft operations, and remained the 20th busiest in North America ranked by number of passengers.

The total number of air passengers at Logan Airport increased by 1.1 percent to 29.2 million in 2012 and by 3.4 percent to 30.2 million in 2013, compared to 28.9 million in 2011. The 2013 passenger level represents a new record high for Logan Airport. At the same time, the total number of aircraft operations fell from approximately 368,987 in 2011 to 354,869 in 2012, a decrease of 3.8 percent. In 2013, aircraft operations increased by 1.8 percent to 361,339. Despite the increase in airport operations from 2012 to 2013, aircraft operations at Logan Airport remained well below the 487,996 operations accommodated in 2000 and the historic peak of 507,449 operations reached in 1998. Passenger aircraft operations, which accounted for 91 percent of total aircraft operations, increased by 2.4 percent in 2013 after decreasing by 3.9 percent in 2012, compared to 2011 levels.

General aviation (GA) operations which is defined as aviation activity other than commercial airline activity, accounted for seven percent of total operations in 2013. GA decreased by 0.4 percent in 2012 and decreased by 5.1 percent in 2013. The 26,682 GA operations in 2013 remain below the 35,233 GA operations that Logan Airport handled in 2000.

Airline efficiency continued to increase as the average total number of passengers per aircraft operation increased from 78.3 percent in 2011 to 82.4 percent in 2012 and 83.6 percent in 2013. The average number of passengers per aircraft operation in 2012 and 2013 represented approximately 74 percent of average aircraft seat capacity. At Logan Airport, the increasing number of passengers per flight reflects a shift away from smaller aircraft and rising load factors because airlines have reduced or restricted capacity growth after several airline mergers.

Air cargo volumes, including shipments transported in the belly compartments of passenger aircraft, decreased from 562 million pounds in 2011 to 553 million pounds in 2012, a decline of 1.4 percent compared to 2011. Over the same period, all-cargo aircraft operations fell by 16.5 percent to 5,237 million pounds. All-cargo aircraft operations fell at a faster rate than cargo volumes, because all-cargo airlines introduced larger capacity aircraft into service at Logan Airport. In 2013 air cargo volumes increased by 0.8 percent to 558 million pounds and all-cargo operations increased by 3.2 percent to 5,403 million pounds, compared to 2012.

The 2014 EDR should report on airport activity levels and aircraft operations, including:

- Aircraft operations, including fleet mix and scheduled airline services at Logan Airport;
- Passenger activity levels; A7
- Cargo and mail activities;
- Compare 2014 aircraft operations, cargo/mail operations, and passenger activity levels to 2013 activity levels; and
- Report on national aviation trends in 2014 and compare to trends at Logan Airport.

It should also report on Massport's activity level forecasts that will become the basis for the planning and impact sections that follow and for Massport's strategic planning initiatives for the future ESPR. Massport should address comments related to activity levels in the 2014 EDR. A8

Sustainability at Logan Airport

The 2012-2013 EDR describes Massport's airport wide sustainability goals. In October 2000, the Massport Board approved an Authority-wide Environmental Management Policy, which articulates Massport's commitment to protect the environment and to implement sustainable design principles. In October 2004, the Massport Sustainability Team produced the *Massachusetts Port Authority Sustainability Plan* (Sustainability Plan). The Environmental Management Policy is incorporated in the Sustainability Plan as Massport's long-term sustainability goal or vision.

The 2012-2013 EDR describes Massport's continued efforts including Massport-wide sustainability. In 2013, Massport was awarded a grant by the Federal Aviation Administration (FAA) to prepare a Sustainability Management Plan (SMP) for Logan Airport. The Logan

Airport SMP planning effort began in May 2013, and is expected to be completed in 2015. The 2012-2013 EDR indicates that the Logan Airport SMP is intended to promote and integrate sustainability, formulate a list of priority initiatives, and engage employees and tenants in the process. The 2012-2013 EDR provides an excellent overview of Massport's commitment to incorporate sustainability into all aspects of Massport's activities: Planning and Design; Construction; Operations, Maintenance and Management; and Monitoring of Environmental Performance. It also identifies specific practices to reduce impacts associated with construction and efforts to address energy intensity, percentage of renewable energy, and GHG reductions.

A specific example includes compliance with the Leading by Example Executive Order which requires state agencies to procure 15 percent of their electricity from renewable resources by 2012. The Leading by Example program has influenced Massport's own operations including its offices, heating plants, and garages resulting in Massport receiving the Leading by Example award in 2008. As part of the Leading by Example program, all new construction and major renovations over 20,000 square feet constructed by Commonwealth agencies must meet the Massachusetts LEED Plus green building standard established by the Massachusetts Sustainable Design Roundtable.

I commend Massport for its commitment and expect progress on the SMP will be incorporated into subsequent EDRs and ESPRs. The focus in the 2014 EDR should include reporting on data, identifying goals and priorities for specific Massport and tenant projects at Logan Airport that have undergone MEPA review to include energy efficiency/greenhouse gas reduction, water conservation, and waste management and recycling. A9

The 2014 EDR should report on the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have undergone MEPA review, including whether they are under construction or completed. The status of mitigation commitments made in the Section 61 Findings for the following projects should also be reported: A10

- West Garage/Central Garage (EEA #9790)
- International Gateway (EEA #9791)
- Logan Airside Improvements Planning Project (EEA #10458)
- Terminal A Replacement Project (EEA #12096)
- Southwest Service Area Redevelopment Program/Rental Car Center (EEA #14137)
- Logan Runway Safety Area Improvements Project (EEA #14442)

<u>Planning</u>

The Airport Planning chapter in the 2012-2013 EDR provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2012 and 2013. It also describes future planning, construction, and permitting activities and initiatives. It includes the following Airport Projects:

- Southwest Service Area (SWSA) Redevelopment Program (EEA #14137);
- Logan Airport Runway Safety Area (RSA) Improvements Project at Runway Ends 33L and 22R (EEA #14442);

- Logan Airport Runway 33L Light Pier Replacement Project (EEA #14442);
- Green Bus Depot (EEA #14629);
- Martin A. Coughlin (East Boston-Chelsea) Bypass Project (EEA #14661);
- Renovations and Improvements at Terminal B;
- Terminal B Garage Improvement Project;
- North Service Area Roadway Corridor Project;
- Greenway Connector Project a pedestrian/bicycle path connecting the Bremen Street Park path to the future City of Boston pedestrian/bicycle path; and
- Hangar Upgrade Projects.

At the end of 2013, Massport initiated the Disaster and Infrastructure Resiliency Planning (DIRP) Study for Logan Airport, the Port of Boston, and Massport's waterfront assets in South and East Boston according to the 2012-2013 EDR. The DIRP Study includes a hazard analysis, modeling projected sea-level rise and storm surge, and projections of temperature and precipitation and anticipated increases in extreme weather events. The study is nearing completion. The 2014 EDR should address the DIRP Study and identify which recommendations Massport will implement in the short term to increase the resiliency of its facilities to the potential effects of climate change. A11

Massport is in the process of developing a long-term parking management plan for Logan Airport. The Long-Term Parking Management Plan will lay out a multi-part strategy for efficiently managing parking supply, pricing, and operations – both at Logan Airport and at off-Airport locations controlled by Massport – to maximize access for transit and shared-ride vehicles while minimizing both drive-and-park and pick-up/drop-off modes. The 2014 EDR should provide updates on this plan. A12

The 2014 EDR should also continue to assess planning strategies for improving Logan Airport's operations and services in a safe, secure, more efficient, and environmentally sensitive manner. As owner and operator of Logan Airport, Massport also must accommodate and guide tenant development. Therefore, the 2014 EDR should also describe the status of planning initiatives for the following areas: A13

- Roadway Corridor Project;
- Airport Parking;
- Terminal Area;
- Airside Area;
- Service and Cargo Areas; and
- Airport Buffers and Landscaping.

The 2014 EDR should provide a status report on long-range planning activities. This chapter should include the status and effectiveness of the ground access changes, including roadway and parking projects, that will consolidate and direct airport-related traffic to centralized locations and minimize airport-related traffic on external streets in adjacent neighborhoods. A14

Regional Transportation

The 2012-2013 EDR describes activity levels at New England's regional airports in 2012 and 2013 and provides an update on regional planning activities, including long-range transportation efforts.

Overall, aviation activity at New England's regional airports decreased in 2012 and 2013. In 2012, the total number of air passengers utilizing New England's commercial service airports, including Logan Airport, decreased by 1.3 percent from 44.7 million in 2011 to 44.1 million annual air passengers. The decline in the region's passenger traffic largely reflects airline service reductions at many of the regional airports in 2012. Airlines have attempted to maintain tighter capacity control, which has resulted in ongoing service cuts at various secondary and tertiary airports across the nation. While passenger traffic at Logan Airport increased slightly in 2012, reduced passenger levels at regional airports resulted in an overall decline for the region. In 2013, however, overall passenger traffic at New England commercial airports recovered somewhat, increasing 2.8 percent from 44.1 million to 45.4 million passengers. Passenger traffic at New England airports in 2013 was the highest since the economic downturn in 2008. In 2013, total passenger traffic at the regional airports increased 1.6 percent from the previous year, while passenger traffic at Logan Airport increased by 3.4 percent.

The 2014 EDR should describe Logan Airport's role in the region's intermodal transportation system by reporting on the following: A15

Regional Airports

- 2014 regional airport operations, passenger activity levels, and schedule data within an historical context;
- Status of plans and new improvements as provided by the regional airport authorities;
- Ground access improvements; and
- Role of the Worcester Regional Airport and Hanscom Field in the regional aviation system and Massport's efforts to promote these airports.

Regional Transportation System

- Massport's role in managing the regional transportation facilities within the restructured Massachusetts Department of Transportation (MassDOT);
- Massport's cooperation with other transportation agencies to promote efficient regional highway and transit operations; and
- Report on metropolitan and regional rail initiatives and ridership.

Ground Access to and from Logan Airport

The 2012-2013 EDR reports on transit ridership, roadways, traffic volumes, and parking for both 2012 and 2013. Specifically, the average daily vehicular traffic on Airport roadways decreased by 0.2 percent from 99,449 in 2011 to 99,281 in 2012, and then increased by 3.5 percent to 102,771 between 2012 and 2013. The 2012-2013 EDR also updates information on the Logan Parking Freeze limit which is set at 21,088, of which 18,415 are dedicated to commercial

parking spaces and 2,673 are dedicated to employee parking spaces. The EDR indicates that Massport continued to be in full compliance with the Parking Freeze throughout 2012 and 2013.

The 2012-2013 EDR includes key findings for ground access activity to and from the Airport which include:

- Massachusetts Bay Transportation Authority (MBTA) Silver Line bus boardings at the Airport continued to grow, based on ridership estimates.
- In 2012, Blue Line transit boardings at Airport Station increased about seven percent over 2011 levels. In 2013, MBTA Blue Line ridership increased six percent over 2012 levels.
- In 2012, ridership levels on all types of water transportation to the Airport remained flat in comparison to the previous year. Ridership on the MBTA ferry continues to decline, while private water taxi use has grown slightly since 2007. In 2013, ridership on private water taxis increased by three percent.
- In 2012, air passengers using Logan Express bus service increased 10 percent compared to 2011 levels; employee use of Logan Express increased by 16 percent and non-employee passengers increased nearly five percent. In 2013, non-employee passenger ridership increased nearly eight percent over 2012 levels, and employee passenger activity increased almost two percent.
- In September 2013, Massport solicited an operator for a Back Bay express shuttle bus service, which commenced in April 2014. The Back Bay Logan Express, provides improved service to those transit riders who are affected by the two-year Government Center MBTA Station closure and increases high occupancy vehicle (HOV) use from the inner Boston area.

The 2014 EDR should report on the following conditions and provide a discussion of analysis in 2014 and compare them to 2013:

- Detailed description of compliance with Logan Airport Parking Freeze;
- High occupancy vehicle (HOV) ridership (including Blue Line, Silver Line, Water Transportation, and Logan Express);
- Massport's cooperation with other transportation agencies to increase transit ridership to and from Logan Airport via the Blue Line and Silver Line;
- Logan Airport Employee Transportation Management Association (Logan TMA) services; A16
- Logan Airport gateway volumes;
- On-airport traffic volumes;
- On-airport vehicle miles traveled (VMT);
- Parking demand and management (including rates and duration statistics);
- Status of long-range ground access management strategy planning; and
- Results of the 2013 Logan Airport Passenger Survey.
- Massport's target HOV mode share along with incentives; and,
- Non-Airport through-traffic;

Noise Abatement

The 2012-2013 EDR updates the status of the noise environment at Logan Airport in 2012 and 2013, and describes Massport's efforts to reduce noise levels. Many of the issues raised in the noise analysis are ongoing and require continuous monitoring. The 2014 EDR should address the noise issues raised by numerous commenters on the 2012-2013 EDR

Compared to 2011, the 2012 Day-Night Average Sound Level (DNL) 65-decibel (dB) contours were slightly larger in East Boston, Revere, South Boston, and Winthrop and smaller over Boston Harbor towards Long Island and south towards Columbia Point. The 2012 contours remained substantially smaller than the 2000 contours. There are several factors that influenced the contour changes, including: Runway 15R-33L, the nighttime noise abatement runway, was temporarily closed from June 16, 2012 through October 2, 2012 to allow for the second and final period of construction of the enhanced Runway 33L RSA. There were also partial construction closures of the runway before and after this period. Typically, this runway is used during these periods for head-to-head operations (arrivals to Runway 33L and departures from Runway 15R) at night, which keeps air traffic over Boston Harbor, and away from the community. The 2012 RSA construction closure was extended for longer period than in 2011, which also extended the use of other runways for nighttime operations during 2012. During this period, night operations primarily used Runway 22R and Runway 9 for departures and Runway 4R, 27, and 22L for arrivals.

Compared to 2012, the 2013 DNL 65 dB contours were slightly larger in East Boston and slightly smaller in Revere, South Boston, and Winthrop. The 2013 contours remained substantially smaller than the 2000 contours. There are several factors that influenced the contour changes, including:

- Runway use in 2013 was reflective of a typical year (return to pre-construction conditions), with an increased use (compared to 2012) of Runway 15R-33L and Runway 27;
- The availability of all runway configurations in 2013, resulted in lower levels of arrivals to Runways 22L, 27, and 4R;
- Due to the runway closure, the overall number of people exposed to DNL values greater than 65 dB increased to 4,736 people in 2012 from 3,947 people in 2011 (an increase of 789 people); and
- In 2013 with runway use back to pre-construction patterns, the overall number of people exposed to DNL values greater than 65 dB decreased to 4,307 people in 2013 from 4,736 people in 2012 (a decrease of 429 people).

The number of people residing within the DNL 70 dB contour increased from 130 people in 2011 to 200 people in 2012 and returned to 130 people in 2013. These levels are still well below the number of people exposed in the year 2000 when 17,745 people were exposed to DNL noise levels greater than 65 dB and 1,551 people were exposed to DNL levels greater than 70 dB. All of the residences exposed to levels greater than DNL 65 dB in 2012 and 2013 have been eligible to participate in Massport's residential sound insulation program (RSIP). Participation in the program is voluntary and Massport has provided sound insulation to all of homeowners who

have chosen to participate. An additional 76 residential units received sound insulation treatment in 2013 bringing the program total to 11,409 residential units. Massport will continue to seek funding for this program.

Massport is participating in a FAA aircraft noise study as part of the Airside Improvement Project mitigation. The primary focus of the Boston Logan Airport Noise Study (BLANS) is to determine viable ways to reduce noise from aircraft operations to and from Logan Airport without diminishing airport safety and efficiency. The Runway Navigation (RNAV) departure portions of Phase 1 of the project, first implemented in 2010, continued to be utilized in 2012 and 2013. The 2012-2013 EDR detailed the Flight Track Monitoring reports in Appendix of Noise Abatement.

The information in the Noise Abatement chapter is very informative and I encourage Massport to continue with detailed analysis in the 2014 EDR. I strongly advise Massport to consider and address the comments on noise and noise related issues.

The 2014 EDR should provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, and the updates in noise modeling. The chapter should report on 2014 conditions and compare those conditions to those of 2013 for the following: A17

- Fleet Mix, including Stage II, Recertified (Hushkitted) Stage III, newly manufactured Stage III, and qualifying Stage IV aircraft;
- Nighttime operations;
- Runway utilization (report on aircraft and airline adherence with runway utilization goals);
- Preferential runway advisory system (PRAS) tracking; and
- Flight tracks.

The 2014 EDR should also report on 2014 conditions and compare those to 2013 conditions for the following noise indicators: A18

- Using the FAA's most current version of the Integrated Noise Model (INM), and RealContoursTM and RealProfilesTM, produce an accurate set of Day-Night Sound Level (DNL) noise contours.
- Update on FAA's combined air quality and noise modeling tool (Aviation Environmental Design Tool - AEDT)
- Noise-impacted population;
- Measured versus modeled noise values, including reasons for differences and any improvements attributable to the use of RealContoursTM and RealProfilesTM;
- Cumulative Noise Index (CNI);
- Times-Above for 65, 75, and 85 dBA threshold values/Dwell and Persistence of noise levels;
- Installation and benefits of the new noise monitoring system; and
- Flight track monitoring noise quarterly reports.

The 2014 EDR should also report on noise abatement efforts, results from Boston Logan Airport Noise Study (BLANS) study, and provide a status update on the new noise and operations monitoring system. A19

Air Quality/Emissions Reduction

The 2012-2013 EDR provides an overview of airport-related air quality issues in 2012 and 2013 and also efforts to reduce emissions. The air quality modeling reported in 2012-2013 EDR is based on aircraft operations, fleet mix characteristics, and airfield taxiing times combined with ground support equipment (GSE) usage, motor vehicle traffic volumes, and stationary source utilization rates. Motor vehicle emissions for the 2012 analysis were obtained from the United States Environmental Protection Agency's (EPA's) MOBILE model (MOBILE6.2.03) combined with MassDEP-recommended motor vehicle fleet mix data, operating conditions, and other Massachusetts-specific input parameters. The most up-to-date EPA mobile model, Motor Vehicle Emission Simulator (MOVES), was used to develop 2013 motor vehicle emission factors. For comparative purposes, both MOBILE and MOVES were used to generate the 2013 motor vehicle emission factors.

The following is a summary of modeled air quality conditions for Logan Airport in the 2012 to 2013 time-period:

- Total volatile organic compound (VOC) emissions in 2012 were 1,080 kilograms per day (kg/day), or approximately three percent lower than 2011 levels. By comparison, total VOC emissions in 2013 were 1,138 kg/day, or 5 percent higher than 2012 levels. For comparison, total VOC emissions were 1,777 kg/day in 2000.
- Total emissions of oxides of nitrogen (NO_x) in 2012 were 4,099 kg/day, or less than one percent higher than 2011 levels. However, total emissions of NO_x in 2013 were 4,020 kg/day, or two percent lower than 2012 levels. For comparison, total NO_x emissions were 5,707 kg/day in 2000.
- Total emissions of carbon monoxide (CO) in 2012 were 6,739 kg/day, or three percent lower than 2011 levels. However, total emissions of CO in 2013 were 7,340 kg/day, or nine percent higher than 2012 levels. For comparison, total CO emissions were 13,111 kg/day in 2000.
- Total emissions of particulate matter $(PM)_{10}/PM_{2.5}$ increased in 2012 by approximately seven percent to 72 kg/day compared to 2011 levels. This particular increase is unique and is mostly attributable to a change the MOBILE6.2.03 model. Total modeled emissions of $PM_{10}/PM_{2.5}$ again increased in 2013 by approximately 28 percent to 92 kg/day compared to 2012 levels. This increase is primarily attributable to the updated computer modeling (i.e., Emissions and Dispersion Modeling System [EDMS] and MassDEP-preferred model –MOVES) used to calculate aircraft and motor vehicle emissions.
- With respect to Massport's Air Quality Initiative (AQI) 1999 benchmark, total NO_x emissions in 2012 were 698 tons per year (tpy) lower than the benchmark and in 2013 emissions were 730 tpy lower than the benchmark. This represents an overall decrease of 31 percent in NO_x emissions since 1999. For comparison, total NO_x emissions in 2000 were 51 tpy lower than the benchmark or a decrease of 2 percent since 1999.

The year 2013 marks the seventh consecutive year in which Massport has voluntarily prepared a greenhouse gas (GHG) emissions inventory for the EDR/ESPR. The 2012 and 2013 GHG emission inventory was again prepared following methodological guidance by the Transportation Research Board's (TRB) Airport Cooperative Research Program (ACRP). Total Logan Airport GHG emissions in 2012 were approximately three percent lower than 2011 levels primarily due to lower fuel consumption by stationary sources. Total Logan Airport GHG emissions in 2013 were approximately six percent higher than 2012 levels primarily due to the increase in usage of passenger ground access vehicles on off-airport roadways. In 2012, Massport-related emissions represented 10 percent of total GHG emissions at the Airport; tenant-based emissions represented approximately 69 percent; electrical consumption represented 14 percent; and passenger vehicle emissions represented six percent. Similarly, in 2013, Massport-related emissions represented 13 percent of total GHG emissions at the Airport, tenant-based emissions represented approximately 66 percent, electrical consumption represented 10 percent, and passenger vehicle emissions represented 10 percent.

The 2014 EDR should include an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, and the changes in air quality modeling. The 2014 EDR should provide discussion on progress on the national and international levels to decrease air emissions. It should also include analysis methodologies and assumptions and report on 2014 conditions using the most recent versions of the EDMS and MOVES models. The 2014 EDR should include an emissions inventory for CO, NO_x, VOCs, and PM. It should include NO_2 monitoring and identify NO_x emissions by airline. A20

The 2014 EDR should also report on the following AQI for 2014: A21

- AQI Emissions Monitoring and Tracking;
- Massport's and Tenant's Alternative Fuel Vehicle Programs; and
- The status of Logan Airport air quality studies undertaken by Massport or others, as available.

Massport has also committed to include an inventory of GHG emissions from Logan Airport in 2014. GHG emissions should be quantified for aircraft, GSE, motor vehicles and stationary sources using emission factors and methodologies outlined in the MEPA Greenhouse Gas Emissions Policy and Protocol. The results of the 2014 GHG emissions inventory should be compared to the 2013 results. This chapter should also include an update on Massport's efforts to encourage the use of single engine taxiing under safe conditions. A22

Water Quality/Environmental Compliance

The 2012-2013 EDR describes Massport's ongoing environmental management activities including National Pollutant Discharge Elimination System (NPDES) compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan (MCP), and tank management.

The 2014 EDR should report on the 2014 status of:

- NPDES Permit and monitoring results for Logan Airport's outfalls and the Fire Training Facility;
- Jet fuel usage and spills;
- MCP activities;
- Tank management;
- Update on the environmental management plan; and
- Fuel spill prevention.

It should also identify any planned stormwater management improvements.

A23

Conclusion

I have determined that the 2012-2013 EDR for Logan Airport has adequately compiled with MEPA. Massport may prepare a 2014 EDR for submission in 2015 consistent with the scope included in this Certificate.

February 6, 2015
Date

Matthew A. Beaton

Comments received:

01/14/2015	Frank J. Ciano
01/26/2015	Cindy L. Christiansen
01/26/2015	City of Somerville, Mayor Joseph Curtatone
01/27/2015	The Boston Harbor Association
01/27/2015	Nancy S. Timmerman
02/02/2015	Massachusetts Department of Public Health

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The Commonwealth of Massachusetts

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June 14, 2013

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
2011 LOGAN AIRPORT ENVIRONMENTAL STATUS AND PLANNING REPORT

PROJECT NAME	: 2011 Environmental Status and Planning Report
PROJECT MUNICIPALITY	: Boston and Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority (Massport)
DATE NOTICED IN MONITOR	: April 24, 2013

As Secretary of Environmental Affairs, I hereby determine that the Environmental Status and Planning Report submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (G. L. c. 30, ss. 61-62H) and with its implementing regulations (301 CMR 11.00).

The environmental review process for Logan Airport has been structured to occur on two levels: airport-wide and project-specific. The Environmental Status and Planning Report (ESPR) has evolved from a largely retrospective status report on airport operations to a broader analysis that also provides a prospective assessment of long-range plans. It has thus become, consistent with the objectives of the MEPA regulations, part of Massport's long range planning. The ESPR provides a "big picture" analysis of environmental impacts associated with current and anticipated levels of activities, and presents an overall mitigation strategy aimed at avoiding increases in such impacts. The ESPR analysis is supplemented by (and ultimately incorporates) the detailed analyses and mitigation commitments of project-specific Environmental Impact Reports (EIR). The ESPR is generally updated on a five year basis, with much less detailed Environmental Data Reports (EDR) (formerly Annual Updates) filed in the years between ESPRs. The 2011 ESPR is the subject of this review. In addition, Massport has requested to combine the 2012-2013 EDRs into one document. I have considered and granted this request. This Certificate also contains a Scope for the 2012-2013 EDR.

In general, the ESPR has responded to the scope. In particular, the 2011 ESPR contains a wealth of useful data on activity levels and impacts, and lays out a forecast for trends in the future years. The technical studies in the 2011 ESPR include reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. The 2011 ESPR updates and compares the data presented in the 2010 EDR, and presents activity levels (including aircraft operations and passenger activity) and environmental conditions at Logan Airport for calendar year 2011. In addition to the annual report on 2011 conditions, two other primary functions of this 2011 ESPR are to provide a discussion of future activity levels at Logan Airport through the year 2030 based on an updated forecast, and to predict the associated potential environmental conditions at the Airport in 2030. The 2011 ESPR also presents historical data on the environmental conditions at Logan Airport dating back to 1990 in instances where historical information is available. Historical data are included in the technical appendices. Overall the 2011 ESPR provides a comprehensive, cumulative analysis of the effects of all Logan Airport activities based on actual and predicted passenger activity and aircraft operation levels in 2011 and 2030 and presents environmental management plans for addressing areas of environmental concern.

The majority of comments received on the 2011 ESPR focused on noise issues, including measurement of noise, modeling of noise contours, and noise abatement. In addition to responding to these comments, the 2012-2013 EDR should also report on the progress and other refinements for tracking noise and abatement efforts, as further described in the Scope below.

Background

In 1979, the Secretary of the Executive Office of Environmental Affairs issued a Certificate requiring Massport to define, evaluate, and disclose, every three years, the impact of long-term growth at the airport through a Generic Environmental Impact Report (GEIR). The Certificate also required the submission of interim Annual Updates to provide data on conditions for the years between the GEIRs. The GEIR provided projections of environmental conditions where the cumulative effects of individual projects could be understood. The Secretary's Certificate on the *1997 Annual Update* proposed a revised environmental review process for Logan Airport. As a result, Massport evaluates the cumulative impacts associated with airport activities through preparation of an ESPR every five years and provides data updates annually through the EDRs.

Review of the 2011 ESPR and Scope for the 2012-2013 EDR

Framework for the 2011 ESPR

Massport has adopted a new, long-term forecast for the long-range planning horizon,

2030. Previous forecasts for the 1999 ESPR and the 2004 ESPR forecasts anticipated that Logan Airport would be handling 37.5 million annual passengers in 2015 and 42.8 million passengers in 2020, respectively. The 2011 ESPR revisits previous forecasts and revises them based on current and predicted conditions, and to consider a more distant time horizon.

For this 2011 ESPR, Massport updated the Logan Airport long-range forecast with 2015, 2020, and 2030 as the forecast years. Three scenarios were also developed (Low, Moderate, and High). Massport views the Moderate forecast scenario as the most likely forecast of future activity levels at Logan Airport. Massport's forecast under the Moderate scenario predicts that there will be 39.8 million passengers using Logan Airport in 2030. The updated forecast takes into account slower-than-anticipated passenger growth (compared to previous forecasts), the increasing efficiency of aircraft (higher passenger load factors), and fleet mix trends, including a growing prevalence of larger capacity jet aircraft. This 2011 ESPR examines both airside and landside activities, including planned Massport projects, and projects being carried out by others that affect the Airport, such as the FAA's Boston Logan Airport Noise Study (BLANS). Future year projections incorporate available information about projects that have undergone or are currently under MEPA review.

Cumulative analysis of airport activities are based on actual and projected passenger activity levels, aircraft operations, and the facilities and services needed to serve them. Analysis conditions for current and future years are used to assess environmental conditions and to develop, evaluate, and adjust environmental management actions.

General

The 2012-2013 EDR should follow the general format of the 2010 EDR status report on Massport's planning initiatives, projects, and mitigation measures. The 2012-2013 EDR should include an Executive Summary and Introduction, similar to previous ESPRs and EDRs. Massport must provide necessary background information to allow reviewing agencies and the public to understand the environmental policies and planning which form the context of the environmental reporting, technical studies, and environmental mitigation initiatives at Logan Airport.

Specifically, the 2012-2013 EDR should provide an update on conditions at Logan Airport for calendar year 2012 and 2013. The EDR should continue to serve as a background/context against which projects at Logan Airport can be evaluated. It should also report on the cumulative effects of Logan Airport operations and activities, compared to previous years, as appropriate.

The 2012-2013 EDR should report on 2012 and 2013 passenger and aircraft operation activity levels. This will be followed by a status report on Massport's proposed planning initiatives and projects and mitigation. In this way, Massport should provide the necessary background information to allow the reviewer to understand the environmental policies and

planning which form the context of the environmental reporting, technical studies, and environmental mitigation initiatives at Logan Airport.

The technical studies in the 2012-2013 EDR should include reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. The 2012-2013 EDR must also respond to those issues explicitly noted in this Certificate and the comments received on the 2011 ESPR.

A distribution list for the 2012-2013 EDR (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document. This section must also include copies of all ESPR and EDR Certificates issued since the 2004 Logan Environmental Status and Planning Report (issued on August 16, 2006) to provide context for reviewers. Supporting technical appendices should be provided as necessary.

Responses to Comments

The 2012-2013 EDR must include responses to comments that address all of the substantive comments from the letters listed at the end of this Certificate. The responses to comments included in the 2011 ESPR is well-constructed and cross-referenced. Massport may follow the same format in addressing comments in the 2012-2013 EDR.

The majority of comments received on the 2011 ESPR focus on noise related issues, including measurement of noise, modeling of noise contours, and noise abatement, and emission reduction issues. In addition to responding to these comments, the 2012-2013 EDR should continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commenters where appropriate.

Activity Levels

The Activity Levels chapter provides a solid analysis of major activity issues and the technical appendix contains useful and detailed information. This section in the 2011 ESPR specifically presents aviation activity statistics for Logan Airport in 2011 and compares activity levels to the prior year. The specific activity measures discussed include air passengers, aircraft operations, fleet mix, and cargo/mail volumes. This chapters also provides Massport's long-range 2030 aviation forecast for Logan Airport.

The 2012-2013 EDR must report on airport activity levels, including information on aircraft operations, including fleet mix, passenger activity levels, and cargo and mail operations. A primary purpose of this section of the 2012-2013 EDR will be to report on airport activity levels for 2012 and 2013, including:

- Aircraft operations, including fleet mix and scheduled airline services at Logan Airport;

- Passenger activity levels;
- Cargo and mail activities;
- Compare 2012 and 2013 aircraft operations, cargo/mail operations, and passenger activity levels to 2011 activity levels; and
- Report on national aviation trends in 2012/2013 and compare to trends at Logan Airport.

It should also report on Massport's activity level forecasts that will become the basis for the planning and impact sections that follow and for Massport's strategic planning initiatives over the next few years. In addition to reporting the analysis of major activity issues, I advise Massport to consider and attempt to address all comments related to activity levels in the 2010 EDR.

Planning

The Airport Planning chapter in the 2011 ESPR provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2011. It also describes known future planning, construction, and permitting activities and initiatives.

The 2012-2013 EDR should continue to assess planning strategies for improving Logan Airport's operations and services in a safe, secure, more efficient, and environmentally sensitive manner. As owner and operator of Logan Airport, Massport also must accommodate and guide tenant development. Therefore, the 2012-2013 EDR should describe the status of planning initiatives for the following areas:

- Roadway Corridor Project;
- Airport Parking;
- Terminal Area;
- Airside Area;
- Service and Cargo Areas; and
- Airport Buffers and Landscaping.

The 2012-2013 EDR should continue to assess the status of long-range planning activities. The chapter should report on the status of public works projects implemented by other agencies within the boundaries of Logan Airport. The chapter will also report on the status and effectiveness of the ground access related changes including roadway and parking projects, which consolidate and direct airport-related traffic to centralized locations and minimize airport-related traffic on external streets in adjacent neighborhoods.

Regional Transportation

In general, the 2011 ESPR has met the requirements with respect to regional transportation issues. It describes activity levels at New England's regional airports in 2011 and updates recent regional planning activities.

Overall, aviation activity at New England's regional airports increased in 2011, because the regional airports experienced a modest recovery after the 2008/2009 Economic Recession. Highlights for the regional airports and the status of long-range regional transportation planning efforts in the region which are relevant to Massport's three airports as well as the regional transportation network are provided in the 2011 ESPR.

The 2012-2013 EDR should describe Logan Airport's role in the region's intermodal transportation system by reporting on the following:

Regional Airports

- 2012 and 2013 regional airport operations, passenger activity levels, and schedule data within an historical context;
- Status of plans and new improvements as provided by the regional airport authorities;
- Ground access improvements to the regional airports; and
- The role that Worcester Regional Airport and Hanscom Field play in the regional aviation system and Massport's efforts to promote these airports.

Regional Transportation System

- Massport's role in managing the regional transportation facilities within the restructured Massachusetts Department of Transportation (MassDOT);
- Massport's cooperation with other transportation agencies to promote efficient regional highway and transit operations; and
- Report on metropolitan and regional rail initiatives and ridership.

Ground Transportation

The 2011 ESPR reported on transit ridership, roadways, traffic volumes and parking for 2011. It also provides forecasts for traffic volumes, parking, and VMT for the year 2030.

The 2012-2013 EDR should report on 2012 and 2013 conditions and provide a comparison of 2012 and 2013 findings to those of 2011 for the following:

- Detailed description of compliance with Logan Airport Parking Freeze;
- High occupancy vehicle (HOV) ridership (including Blue Line, Silver Line, Scheduled, Unscheduled, Water Transportation, and Logan Express);
- Logan Airport Employee Transportation Management Association (Logan TMA) services;
- Logan Airport gateway volumes;
- On-airport traffic volumes;
- On-airport vehicle miles traveled (VMT);
- Parking demand and management (including rates and duration statistics);
- Status of long-range ground access management strategy planning; and

- Results of the 2013 Logan Airport Passenger Survey.

The 2012-2013 EDR should also present a discussion of the following topics:

- Definition of HOV;
- Massport's target HOV mode share along with incentives;
- Non-Airport through-traffic;
- Massport's cooperation with other transportation agencies to increase transit ridership to and from Logan Airport via the Blue Line and Silver Line;
- Report on Logan Express usage and efforts to increase capacity and usage;
- Progress on enhancing water transportation to and from Logan Airport;
- Progress on rental car consolidation;
- Report on results of ground access study; and
- Strategies for enhancing services and increasing employee membership in the Logan Airport TMA.

Noise

The 2011 ESPR updates the status of the noise environment at Logan Airport in 2011, and describes Massport's efforts to reduce noise levels. It also provides noise contour population counts for 2030. The technical appendix contains useful and detailed information, while the main document provides a solid analysis of major noise issues. Many of the issues raised in the noise analysis are ongoing and require continuous monitoring. The future 2012-2013 EDR represents an appropriate forum to serve this updating function and to address the noise issues raised by numerous commenters on the 2011 ESPR.

In 2011 the following changes occurred in the Airport noise environment:

- Compared to 2010, the 2011 DNL decibel (dB) contours were smaller in East Boston and over Boston Harbor toward Hull. The DNL 65 dB contour was slightly larger in Revere, South Boston, and in most of Winthrop for 2011.
- The overall number of people exposed to DNL values greater than 65 dB increased to 3,947 people in 2011 from 3,830 people in 2010 (an increase of 117 people). The number of people residing within the DNL 70 dB contour remained at 130 people. These levels are well below the numbers of people exposed in the year 2000 when 17,745 people were exposed to DNL noise levels greater than 65 dB and 1,551 people were exposed to DNL levels greater than 70 dB.
- In 2011, Massport provided sound insulation to 114 homes, 84 percent of which were in Chelsea. The focus of the program in Chelsea was to fulfill federal and state mitigation commitments related to the opening of Runway 14-32. Since the inception of Massport's residential sound insulation program (RSIP), 11,333 homes have received sound insulation treatment in East Boston, South Boston, Winthrop, Revere, and Chelsea.

Based on the 2030 forecast of aircraft operations and expected aircraft fleet mix, the following conditions are expected in 2030:

- There is forecast to be a larger number of operations and a higher percent of jet fleet activity than in 2011. The higher level of operations is not a capacity challenge as the Airport has operated in the past with over 1,300 operations per day.
- The 2030 fleet mix consists of 81 percent commercial jets whereas the 2011 fleet mix consists of 78 percent commercial jets. The 2000 fleet mix had a lower proportion of commercial jets at 62 percent of the fleet.
- Total operations are expected to increase by 29 percent or 290 operations per day from 2011 to 2030, from 1,011 operations per day in 2011 to 1,301 operations per day in 2030. Compared to 2000, which is the last year that Logan Airport had over 1,300 daily operations, 2030 is forecasted to have 54 fewer daily operations (1,355 in 2000 and 1,301 in 2030). Daytime commercial operations are projected to increase by 254 operations per day from 819 in 2011 to 1,073 in 2030, however this is still fewer than the 1,142 daytime operations in 2000. Nighttime commercial operations are projected to increase from 114 in 2011 to 154 in 2030. This is an increase compared to 2000 when 126 daily operations occurred at night.
- The 2030 operations forecast produced a larger set of DNL noise contours with the number of people exposed to noise levels greater than DNL 65 dB increasing from 3,947 in 2011 to 12,211 people in 2030. This is still significantly fewer than the number of people exposed in 2000 (17,745 people). The number of people within the DNL 70 dB is also projected to increase from 130 in 2011 to 352 people in 2030 but still remaining well below the 1,551 people within the DNL 70 dB in 2000. All of the residences within the forecasted 2030 DNL 65 dB contour are in areas where Massport has implemented its sound insulation program.

The information in this chapter is very informative and I encourage Massport to continue with detailed analysis in the 2012-2013 EDR. I strongly advise Massport to consider and address the comments on noise and noise related issues.

The 2012-2013 EDR should provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, and the updates in noise modeling. The chapter should report on 2012 and 2013 conditions and compare those conditions to those of 2011 for the following:

- Fleet Mix, including Stage II, Recertified (Hushkitted) Stage III, newly manufactured Stage III, and qualifying Stage IV aircraft;
- Nighttime operations;
- Runway utilization (report on aircraft and airline adherence with runway utilization goals);
- Preferential runway advisory system (PRAS) tracking; and
- Flight tracks.

The 2012-2013 EDR should also report on 2012 and 2013 conditions and compare those to 2011 conditions for the following noise indicators:

- Using the Federal Aviation Administration's (FAA) most current version of the Integrated Noise Model (INM), and RealContoursTM and RealProfilesTM, produce an accurate set of Day-Night Sound Level (DNL) noise contours. Adjustments made to account for over-water sound propagation and the propagation of sound to areas of higher terrain will be reported;
- Noise-impacted population;
- Measured versus modeled noise values, including reasons for differences and any improvements attributable to the use of RealContoursTM and RealProfilesTM;
- Cumulative Noise Index (CNI);
- Times-Above for 65, 75, and 85 dBA threshold values/Dwell and Persistence of noise levels;
- Installation and benefits of the new noise monitoring system; and
- Flight track monitoring noise quarterly reports.

The 2012-2013 EDR should also report on noise abatement efforts, results from Boston Logan Airport Noise Study (BLANS) study, and provide a status update on the new noise and operations monitoring system.

Air Quality

The 2011 ESPR provides an overview of airport-related air quality issues in 2011 and efforts to reduce emissions. It also predicts emission levels for 2030. Overall total volatile organic compounds (VOC) emissions were 1,109 kilograms per day (kg/day), or 9 percent higher than 2010 levels, but still follow a long-range (i.e., a period of over 20 years) downward trend decreasing by almost 76 percent since 1990. This one-year increase is primarily due to the increase in landing and takeoff operations (LTOs) when compared to 2010 (176,322 LTOs in 2010 and 184,494 LTOs in 2011). Total emissions of oxides of nitrogen (NOX) were 4,077 kg/day, or 2 percent higher than 2010 levels. In 2011, total NOx emissions at Logan Airport were approximately 29 percent lower than 2000 levels. Also, total NOx emissions in 2011 were 707 tons per year (tpy) lower than Massport's 1999 Air Quality Initiative (AQI) benchmark. This represents an overall decrease of 30 percent in NOx emissions since 1999. Total emissions of carbon monoxide (CO) were 6,919 kg/day, or 3 percent lower than 2010 levels and 53 percent lower than 2000 levels; following the same long-range downward trend as VOCs and NOx. Total emissions of particulate matter (PM10/PM2.5) associated with Logan Airport increased in 2011 by approximately 5 percent to 67 kg/day compared to 2010 levels, but still following a long-range downward trend decreasing by 19 percent since 2005 (2005 is the first year that PM10/PM2.5 emissions were reported). This one-year increase is mostly attributable to the corresponding increase in stationary source use, particularly snow melters in conjunction with the unusually heavy snowfall in early 2011.

Since 1999, there has been a continuing trend of decreasing nitrogen dioxide (NO2) concentrations at both the Massport and Massachusetts Department of Environmental Protection (MassDEP) monitoring sites located in the vicinity of Logan Airport. In addition, the annual NO2 concentrations at all monitoring locations in 2011 continued to be well within the National Ambient Air Quality Standards (NAAQS) for NO2. The NO2 monitoring program was discontinued in 2012. Massport's Air Quality Monitoring Study is now complete, having collected data on a variety of ambient air pollutants over a two-year period as a means of assessing any air quality changes attributable to the operation of the Centerfield Taxiway which was completed in 2009. The findings from this Study will be submitted to MassDEP in 2013, and reported in the next Logan Airport EDR.

2011 marks the fifth consecutive year in which Massport has voluntarily prepared a greenhouse gas (GHG) emissions inventory for the EDR/ESPR. The 2011 GHG emission inventory was prepared following methodological guidance by the Transportation Research Board's (TRB) Airport Cooperative Research Program (ACRP). The 2011 inventory assigns GHG emissions based on ownership or control (whether it is controlled by Massport, the airlines or other airport tenants, or the general public). Total Logan Airport GHG emissions in 2011 were 5 percent higher than 2010 levels primarily due to the increase in aircraft operations and passenger vehicles accessing the Airport. Massport-related emissions represent only 12 percent of total GHG emissions at the Airport, tenant-based emissions represent approximately 68 percent, electrical consumption represents 14 percent; and passenger vehicle emissions represent 6 percent. This inventory is one of the three GHG emissions inventories Massport prepares annually; however, the other two only comprise stationary sources of GHGs and are filed with MassDEP and the U.S. Environmental Protection Agency (EPA) respectively.

The 2012-2013 EDR should include an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, and the changes in air quality modeling. The chapter should provide discussion on progress on the national and international levels to decrease air emissions to provide context for this chapter. The chapter will also discuss analysis methodologies and assumptions and report on 2012 and 2013 conditions using the most recent versions of the Emissions Dispersion Modeling System (EDMS) and MOBILE motor vehicle emissions. The 2012-2013 EDR should include:

- Emissions inventory for carbon monoxide (CO)
- Emissions inventory for oxides of nitrogen (NOx)
- Emissions inventory for volatile organic compounds (VOCs)
- Emissions inventory for particulate matter (PM)
- Nitrogen dioxide (NO2) monitoring
- NOx emissions by airline

The 2012-2013 EDR should also report on the following air quality initiatives (AQI) for 2012 and 2013:

- Air Quality Initiative Tracking;

- Massport's and Tenant's Alternative Fuel Vehicle Programs; and
- The status of Logan Airport air quality studies undertaken by Massport or others, as available.

Massport has also committed to include an inventory of greenhouse gas (GHG) emissions from Logan Airport in 2012 and 2013. GHG emissions should be quantified for aircraft, ground service equipment (GSE), motor vehicles and stationary sources using emission factors and methodologies outlined in the MEPA Greenhouse Gas Emissions Policy and Protocol. The results of the 2012 and 2013 GHG emissions inventory should be compared to the 2011 results. This chapter should also include an update on Massport's efforts to encourage the use of single engine taxiing under safe conditions.

Water Quality/Environmental Compliance

The 2011 ESPR describes Massport's ongoing environmental management activities including National Pollutant Discharge Elimination System (NPDES) compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan (MCP), and tank management.

The 2012-2013 EDR should report on the 2012/2013 status of:

- National Pollutant Discharge Elimination System (NPDES) Permit and monitoring results for Logan Airport's outfalls and the Fire Training Facility;
- Jet fuel usage and spills;
- Massachusetts Contingency Plan (MCP) Activities;
- Tank management;
- Update on the environmental management plan; and
- Fuel spill prevention.

The chapter should also present a discussion of the following topics:

- Future stormwater management improvements (if any); and
- Future MCP and tank management activities.

Sustainability at Logan Airport

This chapter describes Massport's airport-wide sustainability goals. In October 2000, the Massport Board approved an Authority-wide Environmental Management Policy that articulates Massport's commitment to protect the environment and to implement sustainable design principles. In October 2004, the Massport Sustainability Team produced the *Massachusetts Port Authority Sustainability Plan* (Sustainability Plan). The Environmental Management Policy is incorporated in the Sustainability Plan as Massport's long-term sustainability goal or vision. It also identifies the actions necessary to achieve the goals, the staff members responsible for each sustainability goal, and the timeline for achieving the goals.

The 2012-2013 EDR should report on the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have undergone MEPA review and other commitments and have commenced construction. The status of mitigation commitments made in the Section 61 Findings for the following projects should also be reported:

- West Garage/Central Garage
- International Gateway
- Runway Ends 22R and 33L Runway Safety Area Improvements
- Replacement Terminal A
- Logan Airside Improvements Planning
- Southwest Service Area Redevelopment Program

This chapter should also update the status of Massport's mitigation commitments and also will identify projects for which mitigation is complete.

Distribution of the 2012-2013 EDR

Massport should explore opportunities to advance the reporting of information through Massport's website. Massport should strive to collect and analyze the information required for the 2012-2013 EDR and report this information in a timely manner. For several recent projects, including the 2011 ESPR, Massport has published bi-lingual meeting and project notices and made the services of an interpreter available upon request. Massport should consider continuing these services for the 2012-2013 EDR submittal.

Conclusion

I have determined that the 2011 ESPR for Logan Airport has adequately complied with MEPA and that Massport must submit a 2012-2013 EDR that responds to the issues raised in comments received. The 2012-2013 EDR must include a copy of this Certificate and a copy of each comment letter received on the 2011 ESPR. In particular, Massport should provide a thorough examination of issues raised regarding individual noise monitoring locations, noise measurement and modeling, noise abatement, and air quality issues.

June 14, 2013
Date

Richard K. Sullivan Jr.

Comments Received:

06/06/2013	Philip Johenning
06/07/2013	Nancy Timmerman
06/07/2013	Stephen Kaiser, PhD
06/07/2013	Darryl Pomicter
06/07/2013	Town of Milton
06/14/2013	The Boston Harbor Association

RKS/ACC/acc

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Copy of the Secretary of the Executive Office of Energy and Environmental Affairs Certificate issued for the Terminal E Modernization Project Environmental Notification Form and Responses to Comments

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The Commonwealth of Massachusetts

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December 16, 2015

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
ENVIRONMENTAL NOTIFICATION FORM

PROJECT NAME	: Terminal E Modernization
PROJECT MUNICIPALITY	: East Boston
PROJECT WATERSHED	: Boston Harbor
EEA NUMBER	: 15434
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: November 9, 2015

Pursuant to the Massachusetts Environmental Policy Act (M.G. L. c. 30, ss. 61-62I) and Section 11.06 of the MEPA regulations (301 CMR 11.00), I have carefully reviewed the Environmental Notification Form (ENF), comments submitted on it, and have carefully considered whether an EIR is warranted. The project is undergoing MEPA review and requires an ENF pursuant to 301 CMR 11.03(6)(b)(6) because it will be undertaken by a State Agency and consists of the expansion of an existing terminal at Logan Airport by greater than 100,000 sf. The project does not exceed a Mandatory EIR threshold. Mandatory EIR thresholds are established to identify a category of projects, or aspects thereof, for which it is presumed that the environmental impacts warrant additional analysis in an EIR.

Comments identify concerns with the project and its impacts and identify broader concerns associated with airport operations and growth. These include comments from Senator Petruccelli, Representative Madaro, and Councilor LaMattina; Representative Garett J. Bradley; the City of Boston Environment Department; the Town of Hull; the Milton Board of Selectmen; representatives of the Massport Citizens Advisory Committee (CAC); and many residents. I have weighed these concerns against the presumption that the project is not subject to a Mandatory EIR and that Massport will prepare an Environmental Assessment (EA) for review pursuant to the National Environmental Policy Act (NEPA), which will include additional opportunities for public comment.

I have determined that additional information regarding the necessary details of design and development of the Terminal E expansion is warranted to properly assess potential impacts. The Scope for the EIR is narrowly tailored to the project and its specific impacts. It is intended to

augment the federal review process, not duplicate it. The EIR is not intended to address broad concerns associated with airport operations and growth. The venue for addressing cumulative environmental impacts is through the Environmental Status and Planning Reports (ESPR) and Environmental Data Reports (EDR).

Through these reports, Logan Airport is subject to comprehensive and regular MEPA review, including opportunities for public comment. This regular updating and reporting on planning and cumulative impacts is unique among State Agencies. It reflects the challenge and complexity of managing and modernizing Logan Airport within a dense, urban area. It recognizes that the proximity of communities to the Airport warrants an enhanced level of public engagement and a concerted, long-term effort to minimize and mitigate impacts.

I expect that Massport can prepare a Draft EIR that will adequately address the Scope such that I may determine, pursuant to 301 CMR 11.08, that no substantive issues remain to be addressed and allow the DEIR to be reviewed as a Final EIR (FEIR) or as a Response to Comments on the DEIR.

Project Description

The project proposes modernizing Boston-Logan International Airport's John A. Volpe International Terminal (Terminal E) with a 500,000 to 700,000-square foot (sf) addition that corrects facility deficiencies and accommodates current and anticipated passenger volumes. The project includes three gates which previously underwent MEPA review (International Gateway Project, EEA #9791) but were not constructed, and two to four additional aircraft gates, passenger holdrooms, concourse, concessions, and passenger processing areas. The project includes Customs and Border Patrol (CBP) and Federal Inspection Services (FIS) facilities to replace and expand FIS facilities that were originally reviewed under MEPA (Terminal B, Pier A Improvements/Satellite FIS Facility, EEA #12235) but also not constructed. The project also includes a direct pedestrian connection between Terminal E and the Massachusetts Bay Transportation Authority's (MBTA) Blue Line Airport Station.

Terminal E was constructed in 1974 with 12 gates and served 1.4 million annual passengers. In 2014, it served approximately five million passengers. The ENF indicates that the current level of passenger activity routinely causes severe congestion in the terminal and negatively impacts customer service and operations. During peak late afternoon and early evening periods, passengers experience severe congestion and delays at the ticket counters and security screening areas, and there is insufficient seating, concessions, and other support services. The ENF indicates that aircraft must use remote parking facilities at hardstands in the North Cargo Area and passengers are bused to the terminal during peak periods when there are insufficient gates. Massport has clearly demonstrated the need for the project and made a compelling case for the expansion.

The project is proposed in two phases. The first phase could include up to five new gates; part of the concourse extension, including the majority of the additional terminal processing area; roadway and curb improvements; and direct pedestrian connections to the MBTA Blue Line Airport Station. The second phase would primarily consist of the remainder of the concourse area, additional gates, holdrooms, boarding bridges; support spaces such as concessions, mechanical spaces, airline and airport operations spaces; and passenger processing areas. Both phases include airside modifications to accommodate aircraft maneuvering, taxiing, parking, and docking operational requirements.

The project will displace ground service equipment (GSE), other airside activities, existing surface parking, the cell phone lot, and the gas station which will be relocated within existing airport boundaries.

Environmental Status and Planning Report (ESPR)

The MEPA environmental review process for Logan Airport occurs on two levels: airport-wide and project-specific. The ESPR and EDR provide a "big picture" analysis of the environmental impacts of current and anticipated levels of airport-wide activities (including aircraft operations and passenger activity), and presents comprehensive strategies to avoid, minimize and mitigate impacts. The ESPR is generally updated on a five-year basis; the most recent ESPR for the year 2011 was filed in April 2013. Environmental Data Reports (EDRs) evaluate environmental conditions for the reporting year as compared to the previous year and are filed in the years between ESPRs. The most recent EDR for the year 2014 was filed in October 2015. The ESPR is supplemented by (and ultimately incorporates) the EDRs and the detailed analyses and mitigation commitments that emerge from project-specific reviews. This process provides a comprehensive and continuous review of airport programs, projects, environmental impacts and associated data.

The MEPA regulations (Section 11.06(2)) indicate that during the course of an ENF review I may review any relevant information from any other source to determine whether to require an EIR, and, if so, what to require in the Scope. To provide context for this project-specific review and because many issues raised by commenters relate to airport-wide operations and impacts, this Certificate refers to documents from the Environmental Status and Planning Report (ESPR) process (EEA#3247/5146). Massport indicates that the Terminal E project is consistent with the analysis presented in the Environmental Status and Planning Report (ESPR) and has incorporated that document by reference into the ENF as the framework for analyzing cumulative impacts of, and mitigation for, Logan Airport projects, and considers the regional transportation context.

The 2011 ESPR reported on key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. In addition to the annual report on 2011 conditions, the ESPR evaluated the cumulative impacts of passenger growth and associated ground and aircraft operations looking forward to 2030. The ESPR also presented environmental management plans for addressing areas of environmental concern.

The 2011 ESPR identifies a future phase of the International Gateway Project – Terminal E, which includes three new gates, and assumes it is constructed by 2030. The 2012/2013 EDR also identifies this project and indicates it will be constructed beyond 2022. The 2014 EDR identifies the Terminal E Modernization Project as a stand-alone project. It indicates that it would include an additional two to four gates for a total of five to seven gates and construction could begin in 2018.

Logan Airport and Project Site

The Airport boundary encompasses approximately 2,400 acres in East Boston and Winthrop, including approximately 700 acres underwater in Boston Harbor. The Airport is surrounded on three sides by Boston Harbor and is accessible by two public transit lines and the roadway system. The airfield is comprised of six runways and approximately 15 miles of taxiway. Logan Airport has four passenger terminals, A, B, C, and E, each with its own ticketing, baggage claim, and ground transportation facilities.

Terminal E is located adjacent to the North Cargo Area, closest to the MBTA Blue Line Airport Station. Land uses in the area of the proposed project include UPS aircraft parking and loading area, the airport's Remain Over Night aircraft parking area, the North Cargo Area equipment storage area, a building occupied by United Parcel Service (UPS), the MBTA Blue Line Airport Station, airport roadways, various short-term and cell phone parking lots, and a gas station.

The project site is located within the coastal zone of Massachusetts. The entirety of the project site is comprised of previously disturbed impervious area. It is not located in Priority or Estimated Habitat as mapped by the Division of Fisheries and Wildlife's (DFW) Natural Heritage and Endangered Species Program (NHESP). The project site does not contain wetland resource areas regulated pursuant to the Wetland Protect Act and its implementing regulations (310 CMR 10.00).

The ENF identified the following projects within the vicinity of Terminal E that have been reviewed under MEPA: Terminal A Replacement (EEA#9329), Terminal E Modifications (EEA#9324), Federal Inspection Services (FIS) Facility and West Concourse Project / International Gateway (EEA#9791), and Terminal B, Pier A Improvements/Satellite FIS Facility (EEA#12235).

Permitting and Jurisdiction

The project is undergoing MEPA review and requires an ENF pursuant to 301 CMR 11.03(6)(b)(6) because it will be undertaken by a State Agency and results in the expansion of an existing terminal at Logan Airport by greater than 100,000 sf.

The project requires a Sewer Permit Modification from the Boston Water and Sewer Commission (BWSC) and may require an Industrial User Permit from the Massachusetts Water Resource Authority (MWRA). The project may be subject to Massachusetts Office of Coastal Zone Management (CZM) federal consistency review.

The project requires approval by the Federal Aviation Administration (FAA) for changes to the Airport Layout Plan and, therefore, requires an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA). The project also requires a National Pollutant Discharge Elimination System (NPDES) General Permit for Construction from the U.S. Environmental Protection Agency.

Because the project will be undertaken by a State Agency, MEPA jurisdiction is broad in scope and extends to all aspects of the project that may cause Damage to the Environment, as defined in the MEPA regulations.

Environmental Impacts and Mitigation

The project includes construction of approximately 500,000 to 700,000 sf of new floor area (for a maximum 1,500,000 sf total), and will increase both water consumption and wastewater generation by approximately 25,600 gallons per day (76,800 gpd total). The project will not create new impervious area and will eliminate approximately 60 parking spaces. The ENF indicates that the project will accommodate existing and forecasted passenger levels and operations and, therefore, will not increase passenger enplanements or vehicle trips.

Measures to avoid, minimize and mitigate project impacts include improving high-occupancy vehicle (HOV) access to the airport via a direct pedestrian connection to the MBTA Blue Line Airport Station and reducing air emissions, greenhouse gas (GHG) emissions, and energy consumption by providing better access to gate plug-ins and pre-conditioned air. The ENF also indicates that the building will act as a noise barrier to the adjacent neighborhood and Memorial Stadium Park.

Review of the ENF

The ENF includes a general description of proposed activities, a conceptual plan, and a limited analysis of alternatives. It does not provide a typical level of information necessary to evaluate the potential environmental impacts of the project for the purpose of MEPA review. The ENF does not address why construction projections have changed compared to the ESPR and EDR or how the increase in gates may affect the impact analysis which is based on the 2011 ESPR forecasts. The ENF provides a scope for the NEPA EA that identifies further analysis and data that will be provided to assess potential impacts and measures to avoid, minimize, and mitigate these impacts. As requested by Massport, the ENF was subject to an extended 30-day comment period to provide additional time for public review and comment. C.1

Environmental Justice

Massport provided outreach consistent with the spirit and intent of the enhanced public participation provisions of the EJ Policy. Massport requested and was granted an extension of the comment period to provide additional time to review and comment on the ENF. The meeting notice was published in The Boston Herald, The East Boston Times, and the Winthrop Transcript. It was translated into Spanish and also published in El Mundo. Spanish language translation was provided at the joint MEPA/NEPA meeting held on November 19, 2015. In addition, Massport held additional meetings and presented information regarding the Terminal E Expansion at a number of meetings from September through December. I expect that Massport will employ similar approaches to ensure public review and comment of the EIR. C.2

Massport has also provided enhanced air quality analysis and assessment of cumulative impacts in the ESPR and EDRs that address the spirit and intent of the EJ Policy. The Scope for the EA indicates that it will evaluate potential disproportionate noise and air quality impacts for existing and future build years 2022 and 2030; demonstrate how it will avoid, minimize, and/or mitigate these impacts to the greatest feasible extent; and, ensure that its proposed actions will not unduly burden low income or minority areas. C.3

I have received numerous comment letters regarding environmental justice and concerns that the burden of cumulative noise, air pollution, and traffic impacts associated with growth and increased operations will be borne by neighboring communities, independent of this specific project. The Executive Office of Energy and Environmental Affairs (EEA) Environmental Justice Policy (EJ Policy) was designed to improve protection of low income and communities of color from environmental pollution as well as promote community involvement in planning and environmental decision-making to maintain and/or enhance the environmental quality of their neighborhoods.

Alternatives Analysis

The ENF identified a maximum developable footprint and indicated that all Build Alternatives will be located within previously developed land within the Airport Boundary. It did not identify a Preferred Alternative or compare relative impacts/benefits of alternatives. The ENF indicated that conceptual Build Alternatives will be developed during the NEPA permitting process based on airport industry planning standards, FAA, Customs and Border Patrol, and Transportation Security Administration (TSA) requirements that define various terminal, airside, and landside functions. The key differences among potential alternatives will relate to the internal and external layout of the building, the ability to efficiently accommodate passengers, and constructability. According to the ENF, all Build Alternatives will include phased development of three gates followed by the development of between two and four additional new gates, additional concourse with supporting facilities, a new direct pedestrian connection to the MBTA's Blue Line Airport Station, reconfiguration of adjacent roadways and short-term parking areas, and reconfiguration of some airside operations. All Build Alternatives will be located within existing paved and developed areas of the airport that are currently used for aviation or aviation-related activities. C.4

The ENF indicates that under the No-Build alternative, passenger and aircraft operations would continue to increase as projected in the 2011 ESPR, but there would be no significant changes to Terminal E interior or exterior facilities. Gate service facilities would be inadequate to efficiently handle the increase in scheduled operations and passengers and arriving aircraft would wait on the apron with engines idling until an aircraft clears a gate or park at a "hardstand" away from the Terminal at a North Cargo Area aircraft parking area and passengers will deplane using mobile stairs and be bused to the terminal. Hardstand operations, aircraft idling, and the use of on-board diesel auxiliary power units (APU) require greater use of energy, including bussing passengers to and from the terminal, and use of the aircraft engines to provide electricity to the cabin during these ground operations. The ENF indicates that the No-Build alternative would result in insufficient passenger processing capacity, long wait times at ticketing and security, and additional congestion at the curb and roadway. Based on these considerations, the No-Build alternative was eliminated.

Comments on the ENF request Massport accommodate more demand at regional airports and evaluate regional project alternatives to the proposed project. I acknowledge that long-term strategies to mitigate Logan's impacts will continue to include an emphasis on diverting travel to regional airports and to rail. Regional transportation will continue to be addressed through the ESPR and EDR, not through this project-specific review. C.5

The 2011 ESPR and 2014 EDR provide a thorough analysis of trends in regional airport activity and identify initiatives and joint efforts to improve the efficiency of the regional transportation system (including regional rail transportation initiatives). The reports identify Massport investments in Hanscom Field and Worcester Regional Airports, consistent with the findings of the 2006 New England Regional Airport System Plan (NERASP) Study. Future ESPRs and EDRs will require Massport to report on Logan's role in the regional transportation system; Massport's efforts to promote the Worcester Regional Airport and Hanscom Field; the status of plans and improvements provided by the regional airport authorities; cooperation with other transportation agencies to promote efficient regional highway and transit operations; and, report on metropolitan and regional rail initiatives and ridership. The reports demonstrate that Massport has continued to emphasize and build on opportunities to strengthen regional transportation.

Climate Change Adaptation and Resiliency Measures

Massport recently completed a Disaster and Infrastructure Resiliency Planning (DIRP) Study and generated a Floodproofing Design Guide which are intended to improve their ability to restore operational capabilities during and after major disruptions, and to adapt and enhance facilities to be more resilient to the effects of extreme weather events. The DIRP Study identified increased storm and sea-level rise as the threats with the highest probability of occurring and impacting Massport operations. The Floodproofing Design Guide also notes that Logan Airport is increasingly susceptible to flooding hazards caused by extreme storms and rising sea levels as a result of climate change.

The ENF does not include information regarding current Federal Emergency Management Agency (FEMA) floodplain mapping. MassDEP comments note that preliminary flood mapping[1] depicts the 100-year flood zone to the west of the project site, near the Airport MBTA Station. Comments from MassDEP and CZM indicate the proximity of the project to the coastal environment may make it susceptible to sea level rise and increased storm intensity and frequency-related impacts. Massport should draw on the DIRP Study and Floodproofing Design Guide to develop mitigation strategies to support the functionality and resiliency of Terminal E in the near and distant future. I encourage Massport to consult with CZM as the project design process progresses. C.6

Greenhouse Gas Emissions

Because I am requiring an EIR, the project is subject to review under the May 2010 MEPA Greenhouse Gas (GHG) Emissions Policy and Protocol ("the Policy"). The ENF indicates that Massport will quantify stationary and mobile source GHG emissions generated by the project and will identify measures to avoid, minimize, or mitigate GHG emissions to determine the applicability of state and federal requirements. I note that mobile sources will only include passenger vehicles and GSE. The ENF indicates that the energy demand of the project may require a new substation and that energy modeling will be used to quantify the GHG emissions for the terminal building. C.7 C.8 C.9

[1] Preliminary Flood Insurance Rate Map, Map Number 25025C0082J, March 16, 2016

Massport has incorporated sustainability into all aspects of its activities through a Sustainability Management Plan as described in the 2014 EDR. Recent Massport accomplishments include compliance with the Leading by Example Executive Order which requires state agencies to procure 15 percent of their electricity from renewable resources; the new Rental Car Center in the Southwest Service Area receiving Logan's first LEED Gold Certification in 2015; and expansion of the Logan Express Bus Service and ongoing support of HOV measures.

Noise

The ENF asserts that the project will not increase the number of aircraft operations when compared to the Future No-Build Alternative. The ENF also indicates that the proposed terminal building will act as a sound barrier to dampen or reflect noise because it will be positioned between the airfield and roadway. These benefits were not analyzed in the ENF. The ENF indicates that the EA will assess the potential for anticipated ground noise impacts resulting from proposed changes to the functioning of the North Cargo Area. The EA will also contain an analysis of the specific sound barrier benefits of the proposed terminal.

Impacts associated with existing operations and noise levels, and potential increases in impacts associated with this project and long-term growth, are a major concern identified in most comment letters. Letters identify a particular concern with nighttime noise and concentrations of flight tracks and increased flight frequency due to the FAA's area navigation (RNAV) procedures. As documented in the ESPR and annual EDR submittals, implementation of several of the RNAV procedures have generated increased noise complaints in some towns surrounding Logan Airport. The procedures themselves have resulted in aircraft at higher altitudes, though in patterns that are concentrated over certain communities. Since 2000, the number of daily aircraft operations and the number of people exposed to the 65 decibel (dB) Day-Night Average Sound Level (DNL) has declined by approximately 27 percent and fifty percent (respectively); reflecting a trend towards fewer overall flights with larger, more efficient, and quieter aircraft. I acknowledge that projected increases in flight operations will increase cumulative noise impacts compared to existing conditions, although they will remain below historic levels. Cumulative impacts will continue to be addressed through the ESPR and EDR, not through project specific review of the Terminal E project. C.10

Air Quality

The ENF indicates that the project will not alter runway use and will not affect the number of anticipated aircraft operations or generate any new vehicle trips. The project may alter airside ground operations in the North Cargo Area, including aircraft taxiing and parking, use of hardstands and busing, and use of supporting ground service equipment (GSE). The ENF indicates that an emissions inventory for the EPA criteria pollutants for airside ground operations (not flight operations) will be conducted for existing and future-year conditions using the recently released FAA Aviation Environmental Design Tool (AEDT). The AEDT will evaluate changes in aircraft ground operations and associated GSE and airside motor vehicle emissions will be assessed using the EPA MOVES model.

Total air quality emissions from all sources at Logan Airport in recent years are significantly less than they were a decade ago. The ENF attributes this downward trend to

Massport's longstanding objective to accommodate the demands of increasing passenger and cargo activity levels with fewer aircraft operations generating fewer emissions. The 2014 EDR demonstrated that total emissions are incrementally increasing. Massport will continue to assess the applicability of emissions reduction measures to the extent practicable and report on air quality in the ESPR and the EDR. C.11

Many comments cite the findings or request additional information on the 2004 Logan Airport Health Study performed by the Massachusetts Department of Public Health (DPH)[2]. The study was published in May 2014 and identified two respiratory outcomes for adults and children living in the high exposure area. In addition to contributions from Logan Airport, the study identified high background levels of air pollutants. The results of this study and have been reported in the annual EDR filings and include actions Massport is taking based on recommendations of the study. Cumulative air quality impacts will continue to be addressed through the ESPR and EDR, not through project specific review of the Terminal E project. C.12

The 2014 EDR indicates that Massport is working with DPH and the East Boston Health Center on implementing the DPH recommendations, including:

- Massport is providing funding to the East Boston Neighborhood Health Center to help expand the efforts of its asthma and chronic obstructive pulmonary disease (COPD) prevention and treatment program in East Boston and launch a program in Winthrop for screening children, providing asthma kits, and home visits;
- Massport entered into an agreement with the Massachusetts League of Community Health Centers for the evaluation and assessment of the Asthma and COPD Prevention and Treatment Program, and engagement of community health centers in the North End, Charlestown, Chelsea, and South Boston. The East Boston Neighborhood Health Center will conduct the same evaluations for the East Boston and Winthrop Community Program.
- Massport entered into an agreement with DPH to expand or establish the Asthma and COPD Prevention and Treatment Program in South Boston, the North End, Chelsea, and Charlestown in collaboration with the Massachusetts General Hospital and the South Boston Neighborhood Health Center, and to conduct training on the Community Health Worker assessments.

Transportation

The ENF asserts that the project will not increase passenger enplanements or vehicle trips to the airport, and therefore, the transportation analysis will be limited to the airport transportation network. The project will require relocation of existing uses in the project area to other airport locations. The ENF indicates that the EA will describe the existing transportation network at the airport, anticipated modifications to the transportation network, and anticipated transportation impacts of the project. According to the ENF, the EA will evaluate potential transportation impacts that may result from the relocated uses. The analysis will evaluate traffic impacts of the preferred alternative and a No-Build Alternative. The analysis will be conducted

[2] The study is available for download at http://www.mass.gov/eohhs/gov/departments/dph/programs/environmental-health/investigations/logan-airport-health-study.html

using the Logan Airport VISSIM model for existing and proposed conditions, with supporting traffic analyses performed using other software (Synchro and QATAR). The analysis will use the VISSIM model results from 2014 (as reported in the 2014 EDR) as the baseline year and the build conditions will be evaluated for 2022 and 2030.

The project includes construction of a direct pedestrian connection between Terminal E and the MBTA Blue Line Airport Station. The EA will include an analysis of the existing public transportation options serving the airport and evaluate the potential impacts the direct connection may have on ridership and operations. C.13

Many comments urge that I require a detailed analysis of ground transportation issues due to the cumulative impacts of landside and air operations at Logan and the identified issues with limited parking capacity. The issues of ground transportation and parking are clearly relevant to any discussion of cumulative impacts, and are an important component of any cumulative air quality analysis, which will continue to be addressed through the ESPR and EDR, not through this project specific review of the Terminal E Expansion. C.14

The ESPR and annual EDR updates include a substantial body of analysis on ground transportation issues. The 2014 EDR indicates that Massport is developing a Long-Term Parking Management Plan intended to address the parking supply, pricing and operations associated with Logan's constrained parking. Strategies to address the parking issue may have implications for design of the Terminal E Modernization project, including curbside access and/or short-term parking areas. C.15

Wastewater & Water Supply

According to the ENF, the project will generate an additional 25,600 gallons per day (gpd) of wastewater flow, for a total of 76,900 gpd. Similarly, the project will consume an additional 25,600 gpd of potable water, for a total of 76,800 gpd. MassDEP has indicated that the project will not require a Sewer Connection Permit from MassDEP. However, under the terms of the new Sewer System Extension and Connection Regulations (314 CMR 12.00), MassDEP requires that sewer authorities with permitted combined sewer overflows (CSOs), including the Boston Water and Sewer Commission (BWSC), require the removal of four gallons of infiltration and inflow (I/I) for each gallon of new wastewater flows generated by any new connection that would generate greater than 15,000 gpd. I refer Massport to comments from BWSC that provide additional guidance on this issue and identify applicable design standards for all new or relocated water mains and sewers. C.16

Comments from MWRA indicate that the project site is served by BWSC combined sewers that discharge to the MWRA's East Boston Branch Sewer. The ENF indicates that there is sufficient capacity in the existing collection system to accommodate the additional flow. I refer Massport to comments from MWRA which request the analysis also consider wet weather flow conditions. C.17

Stormwater

The ENF indicates that the project will not create new impervious area as development of the terminal will occur in an area that is already paved. The Terminal E complex will continue to drain to the North Outfall, which is equipped with end-of-pipe treatment to remove debris and floating oils and grease from stormwater prior to discharge. Comments from CZM indicate that samples from the North Outfall recently exceeded water quality standards for bacteria and recommend that Massport develop a strategy to identify and eliminate illicit sewer connections to address this issue. C.18

According to the ENF, the EA will include a drainage analysis and description of the proposed stormwater management measures and identify the size and location of stormwater management features. The EA will also demonstrate how the project will meet MassDEP Stormwater Management Standards, Logan Airport's stormwater management practices, and the requirements of the NPDES Multi-Sector General Permit under which the airport operates. I refer Massport to comments from BWSC that identify applicable design standards and plan requirements, and provide guidance on discharge of dewatering drainage. C.19

Historic and Archaeological Resources

According to the ENF, the project site does not contain any properties listed in the State or National Registers of Historic Places. The project site contains both an area and a structure that are included in the Massachusetts Historical Commission's (MHC) Inventory of Historic and Archaeological Assets of the Commonwealth (the Inventory). Specifically, the entirety of Logan Airport is identified as an Inventoried Area (MHC ID#BOS.K) and Terminal E is identified as an Inventoried Structure (MHC ID#BOS.63). The ENF contains a commitment to coordinate with MHC to identify potential impacts and avoidance, minimization, and mitigation measures.

Construction Period

The ENF does not identify specific construction period impacts or associated mitigation measures. It indicates that construction period impacts, including noise, air quality, traffic, solid and hazardous waste, and water quality will be evaluated in the EA. It will also describe project phasing and sequencing. Massport participates in MassDEP's Clean Construction Equipment Initiative and requires engine retrofits to reduce exposure to diesel exhaust fumes and particulate emissions. The ENF indicates that demolition activities will comply with MassDEP's Solid Waste and Air Quality control regulations. I refer Massport to comments from MassDEP that provide guidance on asbestos removal and the handling of asphalt, brick, and concrete. The ENF indicates Massport will recycle construction & demolition (C&D) waste. C.20

The ENF indicates that contaminated material will be managed in compliance with the Massachusetts Contingency Plan (MCP) and that a Soil Management Plan may be required to determine whether excavated soils generated through foundation construction can be used onsite or hauled off-site for reuse and/or disposal. The ENF indicates that areas near the site have been regulated under c.21E Release Tracking Number (RTN) 3-10027 (Phase V) and RTN 3-324. MassDEP comments note RTN 3-324 appears to be linked to a site in a different city. Massport should review and confirm the RTN or provide the correct RTN for the site. C.21 I refer Massport to MassDEP comments, which provide additional guidance on the excavation, removal and/or C.22

disposal of contaminated soil, pumping of contaminated groundwater, and/or working on contaminated media. C.22 Cont.

Conclusion

The ENF has provided an overview of the Terminal E Expansion, identified potential environmental impacts, and identified opportunities to avoid, minimize and mitigate impacts; however, the ENF did not provide sufficient information to demonstrate that Massport has sufficiently analyzed alternatives and measures to avoid, minimize and mitigate potential impacts of this specific proposal to the maximum extent practicable.

As noted previously, numerous comments raise concerns about the project, the management of growth at Logan Airport, the environmental and community impacts of this growth, and the mitigation of impacts. I have also received comments that suggest review of the Terminal E Modernization project has been improperly segmented under MEPA from the review of airport operations as a whole.

Massport asserts that international passenger activity is forecast to increase independent of any additional facilities. The 2011 ESPR provides accurate forecasts of passenger demand and aviation activity in 2030 and documents that demand for passenger service is primarily determined by external factors, including economic growth, cost of travel, and demographic shifts. In addition, I note that Massport has been engaged in planning to accommodate growth in international passengers and operations since the 1990's.

The issue of cumulative airport-wide impacts and segmentation is not new to the review of projects at Logan Airport. The ESPR and EDR provide a cumulative analysis of Logan Airport operations, environmental impacts, and mitigation measures. Review of individual projects proceeds within the context of this long-term planning and analysis of cumulative impacts. The record of MEPA review clearly demonstrates that Massport has and continues to identify impacts associated with individual projects within the context of long-term plans and cumulative impacts of Logan Airport. Cumulative impacts and project specific impacts will continue to be assessed on separate tracks; they will complement each other and ensure that projects are not viewed in isolation. C.23

Based on a review of the ENF, consultation with State Agencies and review of comment letters, I am requiring that Massport submit an EIR consisting of the EA and limited additional information identified in the Scope. The DEIR will consist of a project specific review of the Terminal E Modernization project within the context of airport-wide operations and impacts as a whole. The purpose of the DEIR is to:

1. Provide a detailed and comprehensive project description including conceptual design; C.24
2. Identify protect-specific impacts and the project's consistency with Logan planning and annual reporting; C.25
3. Consider how alternative building design and location, within the project site, can minimize impacts and maximize benefits; and, C.26
4. Provide draft Section 61 Findings that identify project-specific mitigation measures. C.27

Through this review, Massport will demonstrate that it has met its obligations under MEPA to avoid, minimize and mitigate impacts of the Terminal E Modernization to the maximum extent feasible.

In recognition of the comment letters that raise concerns with cumulative airport-wide impacts pertaining to traffic and parking, air quality, and noise and, consistent with the MEPA review structure for Logan Airport, I am requiring Massport to respond to comments regarding airport operations and cumulative impacts in subsequent ESPR and/or EDR documents. The next ESPR will analyze calendar year 2016 and will likely be filed in late 2017 or 2018 and the next EDR will analyze calendar year 2015 and will likely be filed in the fall of 2016. C.28

The 2015 EDR Scope includes reporting on noise, air quality, and long-term parking management. C.29 The 2016 ESPR should revise growth projections based on the changes in the Terminal E Modernization Project that occurred subsequent to the 2011 ESPR (if necessary). C.30 It should also should reflect the proposed connection to the Airport Station and identify the anticipated ridership, changes in the HOV mode share, and ground access planning considerations. C.31

SCOPE

General

The ENF included a proposed scope for the Environmental Assessment that will undergo review pursuant to the National Environmental Policy Act (NEPA). It includes a project description and permitting, alternatives, air quality, climate, coastal resources, hazardous materials, solid waste, pollution prevention, historical, architectural, archaeological and cultural resources, land use, natural resources and energy supply, noise and compatible land use, transportation, water resources, and construction impacts. In the interest of harmonizing State and federal review and in recognition of the significant and on-going planning and analysis represented by the ESPR and the EDRs, Massport may submit the EA as the Draft EIR. The EA should be supplemented by addressing the additions and modifications identified in this Scope. If Massport would prefer to tailor the EIR rather than submit the EA, the EIR should consist of the standard MEPA requirements for an EIR (Section 11.07(6)) and address the requirements of the MEPA GHG Emissions Policy and Protocol. C.32

Massport may also choose to coordinate the State and federal review. MEPA comment and review periods may be adjusted to align with NEPA deadlines. Lastly, I note that this certificate applies to the review of the project under MEPA only, and does not restrict the ability of the federal government to act on those aspects of the project subject to NEPA.

Project Description and Permitting

The EIR should identify and describe any changes to the project since the filing of the ENF and provide an update on State, local, and federal permitting. It should include a discussion of permitting requirements and document the project's consistency with regulatory standards. C.33

The EIR should include updated site plans for existing and post-development conditions at a legible scale including curbside improvements and changes to the on-airport roadways. C.34

The EIR should provide an update on consultations with the MBTA regarding the proposed connection to the MBTA Airport Station. The EIR should identify whether a Land Transfer (including easement) from MBTA will be required to construct the pedestrian connection to the MBTA Airport Station. The EIR should include a conceptual design for the proposed connection to the Airport Station and identify anticipated ridership, potential changes in the HOV mode share, and associated ground access planning considerations. C.35

Alternatives Analysis

The EIR should identify the planning metrics, facility requirements, and assumptions used to design the project and to determine the final number and location of gates. It should compare and contrast benefits and potential impacts of alternatives in narrative form and it a tabular format. C.36 The EIR should identify the peak hour used to determine gate locations and design passenger hold rooms. The EIR should identify the number of planes that are currently forced to "hard stand" during peak hours due to lack of available gates to the number of planes. It should identify the number forced to "hard stand" during peak hours under proposed alternatives. C.37 The EIR should include a discussion of the proposed project and alternatives consistency with the long-term growth forecasts contained in the ESPR and EDR. C.38

GHG Emissions and Climate Change Adaptation and Resiliency

The project is in the conceptual design state and, as such, provides meaningful opportunities for reduction GHG emissions associated with the building location, orientation and design as well as incorporation of resiliency and adaptation considerations. The EIR should describe the project's consistency with the DIRP Study and Massport's Floodproofing Design Guide to demonstrate that the project will incorporate proactive site design measures to address potential impacts related to predicted sea level rise. C.39 In addition to Massport assets, I encourage Massport to consult with the MBTA to review existing station vulnerabilities, as operations of the Blue Line and this station are important to support Massport HOV goals. C.40

The EIR should include an analysis of GHG emissions and mitigation measures in accordance with the standard requirements of the MEPA GHG Policy and Protocol. The analysis should include project-related stationary source emissions and mobile source emissions (passenger vehicles and GSE). I refer Massport to comments from DOER and MassDEP which provide additional guidance regarding mitigation measures that should be explored as part of the GHG analysis. C.41 DOER identifies combined heat and power (CHP) as a particularly promising and effective energy efficiency measure that could also support resiliency of the facility. The EIR should include a feasibility analysis of CHP and a roof-mounted solar photovoltaic (PV) system. I encourage Massport to meet with representatives from MEPA and DOER prior to preparation of the GHG analysis. C.42

Noise

The EA will include a noise analysis. The EIR should identify how the sound barrier benefits of the terminal have been maximized through its location and design. The EIR should C.43

identify whether the addition of new gates constructed to current industry standards would affect the fleet mix and, potentially, alter/increase noise and vibration on Logan Airport and within the surrounding community compared to the 2030 forecasts. C.43 Cont.

Air Quality

The EA will include an emissions inventory for the EPA criteria pollutants for airside ground operations for existing and future-year conditions to evaluate changes in aircraft ground operations and associated GSE and airside motor vehicle emissions. C.44 The EIR should quantify the impacts or benefits of providing direct access to plug-in gate operations and decreasing reliance on auxiliary power units, ground support equipment, and busing passengers around the airport. C.45 Massport should consider the potential and relative benefits of alternative building locations on the site and design between the airfield and neighborhoods as it relates to creating a potential barrier to particulate matter and other hazardous air pollutants. C.46

Construction Period

The EA IR should identify construction period impacts, including noise, air quality, traffic, solid and hazardous waste, and water quality and identify avoidance, minimization, and mitigation measures. C.47 It should also describe project phasing and sequencing. C.48

Mitigation/Draft Section 61 Findings

The EIR should include a separate chapter summarizing proposed mitigation measures. This chapter should also include draft Section 61 Findings for each area of impact associated with Massport's Preferred Alternative. The EIR should contain clear commitments to implement these mitigation measures, estimate the individual costs of each proposed measure, identify the parties responsible for implementation (either funding design and construction or performing actual construction), and a schedule for implementation. C.49 To ensure that all GHG emissions reduction measures adopted by the Proponent in the Preferred Alternative are actually constructed or performed by the Proponent, I require Proponents to provide a self-certification to the MEPA Office indicating that all of the required mitigation measures, or their equivalent, have been completed. The commitment to provide this self-certification in the manner outlined above should be incorporated into the draft Section 61 Findings included in the EIR. C.50

Responses to Comments

The EIR should contain a copy of this Certificate and a copy of each comment letter received on the ENF. Based on the large volume of comment letters received, the comment letters may be provided electronically on a CD. In order to ensure that the issues raised by commenters are addressed, the EIR should include direct responses to these comments to the extent that they are within MEPA jurisdiction. This directive is not intended, and shall not be construed, to enlarge the scope of the EIR beyond what has been expressly identified in this Certificate. The response can refer to future EDRs and/or ESPRs to address issues that are not within the DEIR Scope. C.51 In addition to items noted in the Scope, the response to comments section should address comments from MassDEP pertaining to wastewater, recycling, source reduction and water conservation efforts. C.52 The EIR should also address wet weather capacity, C.53

wastewater flows, and I/I removal requirements as outlined in MWRA and BWSC's comments. C.53 Cont. I recommend that Massport employ an indexed response to comments format, supplemented as appropriate with direct narrative response. C.54

Circulation

In accordance with Section 11.16 of the MEPA Regulations and as modified by this Certificate, Massport should circulate a hard copy of the EIR to each State and City Agency from which the Proponent will seek permits. Massport must circulate a copy of the EIR to all other parties that submitted individual written comments. Per 301 CMR 11.16(5), the Proponent may circulate copies of the EIR to these other parties in CD-ROM format or by directing commenters to a project website address. However, Massport should make available a reasonable number of hard copies to accommodate those without convenient access to a computer and distribute these upon request on a first-come, first-served basis. Massport should send correspondence accompanying the CD-ROM or website address indicating that hard copies are available upon request, noting relevant comment deadlines, and appropriate addresses for submission of comments. A CD-ROM copy of the filing should also be provided to the MEPA Office. A copy of the EIR should be made available for review at the following Libraries: Boston Public Library – Main, Connolly, Orient Heights, Charlestown, and East Boson Branches, Chelsea Public Library, Winthrop Public Library, Revere Public Library, Everett Public Library, Milton Public Library, and Hull Public Library. C.55

December 16, 2015
Date

Matthew A. Beaton

Comments received:

12/07/2015	Massachusetts Department of Environmental Protection – Northeast Regional Office (MassDEP)
12/07/2015	Massachusetts Water Resources Authority (MWRA)
12/07/2015	Madeleine Steczynski
12/07/2015	Jane O'Reilly
12/07/2015	Alexis Daniels
12/07/2015	Chris Marchi (1st letter)
12/07/2015	Jason Burrell
12/07/2015	John Casamassima
12/07/2015	Kannan Thiruvengadam
12/07/2015	Robin Maguire
12/07/2015	Susanna Starrett
12/07/2015	Theresa Turino
12/08/2015	Alfred Pucillo
12/08/2015	Duane Eric Lock
12/08/2015	Jeannie Grieci
12/08/2015	Joanne Donatelli
12/08/2015	Joanne T. Pomodoro

12/08/2015	John Antonellis
12/08/2015	Lisa Rusch
12/08/2015	Lorraine Curry
12/08/2015	Magdalena Ayed
12/08/2015	Mary Elizabeth Nofziger
12/08/2015	Nancy Lagro
12/08/2015	Normairiis Casiano
12/08/2015	Rebecca Lock
12/08/2015	Sandra Downey
12/08/2015	Danielle Dell'Olio
12/08/2015	Allyson and Michael Simons
12/08/2015	Patricia J D'Amore
12/08/2015	Jessica L. Curtis
12/08/2015	Daniel Cano on behalf of the Eagle Hill Civic Association and Jeffries Point Neighborhood Association (dated 12/02/15)
12/08/2015	Dan Bailey
12/08/2015	Matthew Neave
12/08/2015	Salvador Cartagena
12/08/2015	Alexis Pumphrey
12/08/2015	Jeff Lee
12/08/2015	Kelly Rusch
12/08/2015	Christine Passarriello
12/08/2015	Rick Lockney (with attached data)
12/08/2015	Camille MacLean
12/09/2015	Angela Mroz
12/09/2015	Pamela Loring
12/09/2015	Brian Gannon
12/09/2015	Jay Benson
12/09/2015	Peter Chipman
12/09/2015	Kathyrn Leeber
12/09/2015	Carol Taylor
12/09/2015	Rebecca Lynds
12/09/2015	Georges Arnaout
12/09/2015	Lisa Locke
12/09/2015	James Linthwaite
12/09/2015	Mary J. Ryan
12/09/2015	Steve and Chrissy Holt
12/09/2015	Paul Paquin
12/09/2015	Karis L. North
12/09/2015	David and Carissa Juengst
12/09/2015	Caroline Sulick
12/09/2015	Maria Graceffa
12/09/2015	Robyn Riddle
12/09/2015	Elda and Mark Prudden
12/09/2015	Christine Thompson
12/09/2015	Frank J. Ciano, Arlington Logan CAC and Massport CAC Representative
12/09/2015	Senator Petruccelli, Representative Madaro, Councilor LaMattina
12/09/2015	Elke O'Brien

12/09/2015	Jeff Kerr (1st letter)
12/09/2015	Christina Leshock
12/09/2015	Collin Cameron
12/09/2015	Aaron M. Toffler, on behalf of Airport Impact Relief, Incorporated (AIR, Inc.)
12/09/2015	Jason Hibbard
12/09/2015	Gisela Voss and Dan Kernan
12/09/2015	Elizabeth Kay
12/09/2015	Harvey Rowe
12/09/2015	Jill Romano, Wenham Logan CAC Representative
12/09/2015	Leanne Tirabassi
12/09/2015	Myron Kassaraba, Belmont Logan CAC and Massport CAC Representative
12/09/2015	Nancy Plotkin
12/09/2015	Larry A. Butler
12/09/2015	Rowan Curran
12/09/2015	Lois Freedman
12/09/2015	Kathleen Conlon, Milton Board of Selectmen
12/09/2015	Frank Kerr, Hull Neighbors for Quiet Skies
12/09/2015	Jim Roberts
12/09/2015	Tom Hardey
12/09/2015	Donna Goes
12/09/2015	Colleen MacDonald
12/09/2015	Brian Carney
12/09/2015	Billy Avalos
12/09/2015	John Walkey
12/09/2015	Stephan Marin
12/09/2015	Amelia Cardona
12/09/2015	Jeff Karr (2nd Letter)
12/09/2015	Priscilla Beadle
12/09/2015	H. Gerald Zeller
12/09/2015	Arnie Freedman
12/09/2015	Bonita K Koelker
12/09/2015	Mary Ellen Welch
12/09/2015	Marie & James Fraher
12/09/2015	Erica Mattison, Environmental League of MA, Massport CAC Representative
12/09/2015	Lynn Marie Ray
12/09/2015	Dennis Saide
12/09/2015	Vera Schneider
12/09/2015	Neill K. Ray
12/09/2015	Boston Harbor Association
12/09/2015	Nicole Al Rashid
12/09/2015	Ellen M. Tan, Commonwealth Land Trust
12/09/2015	Cindy L. Christiansen, Milton Logan CAC Representative
12/09/2015	Patricia Waddleton
12/09/2015	Evie Rose
12/09/2015	Carey Lam
12/09/2015	Kathy Beitler
12/09/2015	Joe Berkeley
12/09/2015	Eileen M. Boylen

12/09/2015	David Flynn
12/09/2015	Michael Passariello
12/09/2015	Richard Armenia
12/09/2015	James B. Lampke, Town of Hull, Acting Town Manager
12/09/2015	Cindy Borges-Peralta
12/09/2015	Stephen Cooper
12/09/2015	Tina St. Gelais Kelly
12/09/2015	Tara Ten Eyck
12/09/2015	Maria Ticona
12/09/2015	Ira Fleishman
12/09/2015	Andrew Schmidt
12/09/2015	Debbie Ellerin
12/10/2015	Jeeyoon Kim
12/10/2015	Boston Water and Sewer Commission (BWSC)
12/10/2015	George and Diane Nassopoulos
12/10/2015	Betsy Lewenberg
12/10/2015	Representative Garett J. Bradley
12/11/2015	Massachusetts Office of Coastal Zone Management (CZM)
12/11/2015	Chris Marchi, (2nd letter)
12/11/2015	City of Boston – Environmental Department
12/11/2015	Mary Beth Hamwey
12/11/2015	Maureen White
12/11/2015	Jesse Purvis
12/11/2015	John Tyler
12/11/2015	Renee MacLean
12/11/2015	Edward MacLean
12/11/2015	E.F. (45 Grovers Ave.)
12/11/2015	D.P. (402 Meridian St.)
12/11/2015	Daniel Cordon
12/11/2015	Tanya Hahnel
12/11/2015	B.R. (412 Summer St.)
12/11/2015	A.V. (198 Everett St.)
12/11/2015	Gillian B. Anderson
12/12/2015	Elizabeth Stoy
12/15/2015	Department of Energy Resources (DOER)

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Comment #	Author	Topic	Comment	Response
C.5	Matthew Beaton, Secretary	Regional Transportation	I acknowledge that long-term strategies to mitigate Logan's impacts will continue to include an emphasis on diverting travel to regional airports and to rail. Regional transportation will continue to be addressed through the ESPR and EDR, not through this project-specific review.	Regional transportation is addressed in Chapter 4, *Regional Transportation,* of this *2015 Environmental Data Report (EDR).* It will continue to be addressed through the ongoing Environmental Status and Planning Report (ESPR) and EDR process.
C.10	Matthew Beaton, Secretary	General	Cumulative impacts will continue to be addressed through the ESPR and EDR, not through project specific review of the Terminal E project.	This *2015 EDR* reports on cumulative, Airport-wide impacts for 2015. The forthcoming *2016 ESPR* will assess cumulative impacts of overall airport operations through 2035. Massport is unique among state agencies and airports in the U.S. for publishing annual environmental reports specifically designed to describe, analyze, and project the cumulative effects of Logan Airport operations based on current and anticipated future operating conditions. This process was developed with the Executive Office of Energy and Environmental Affairs (EEA) to allow individual projects at Logan Airport to be considered and analyzed in the broader, airport-wide context. Additional information specific to the Terminal E Modernization Project will be reported on in future EDR/ESPR filings, as appropriate.
C.11	Matthew Beaton, Secretary	Air Quality/ Emissions Reduction	The 2014 EDR demonstrated that total emissions are incrementally increasing. Massport will continue to assess the applicability of emissions reduction measures to the extent practicable and report on air quality in the ESPR and the EDR.	Massport will continue to assess the applicability of emissions reduction measures and report on air quality in the ESPR and the EDR. Chapter 7, *Air Quality/Emissions Reduction* reports on Airport emissions in 2015. the *2016 ESPR* will report on conditions in 2016 and will assess impacts through 2035. As stated in the Introduction to the *1999 ESPR*, "While the Logan ESPR and EDRs provide the broad planning context for projects proposed for Logan Airport and future planning concepts under consideration by Massport, no specific projects can be built solely on the basis of inclusion and discussion in the 1999 ESPR." Projects that require state (Massachusetts Environmental Policy Act [MEPA]) or federal (National Environmental Policy Act [NEPA]) review undergo a separate review processes. In short, Massport's annual reports provide the planning context which complements the individual project-specific filings. The *2015 EDR* and *2016 ESPR* will continue to report on baseline and cumulative impacts of overall Airport operations.
C.12	Matthew Beaton, Secretary	Air Quality/ Emissions Reduction	Cumulative air quality impacts will continue to be addressed through the ESPR and EDR, not through project specific review of the Terminal E project.	As directed by the Secretary, this *2015 EDR* reports on cumulative, Airport-wide air quality impacts in Chapter 7, *Air Quality/Emissions Reduction.* Cumulative impacts will continue to be addressed through the ESPR and EDR.

Comment #	Author	Topic	Comment	Response
C.14	Matthew Beaton, Secretary	Ground Access/ Air Quality	The issues of ground transportation and parking are clearly relevant to any discussion of cumulative impacts, and are an important component of any cumulative air quality analysis, which will continue to be addressed through the ESPR and EDR, not through this project specific review of the Terminal E Expansion.	As directed by the Secretary, this *2015 EDR* reports on ground transportation and parking in Chapter 5, *Ground Access to and from Logan Airport*. The air quality analysis is reported in Chapter 7, *Air Quality/Emissions Reduction*. These issues will continue to be addressed through the ESPR and EDR.
C.15	Matthew Beaton, Secretary	Ground Access	The ESPR and annual EDR updates include a substantial body of analysis on ground transportation issues. The 2014 EDR indicates that Massport is developing a Long-Term Parking Management Plan intended to address the parking supply, pricing and operations associated with Logan's constrained parking. Strategies to address the parking issue may have implications for design of the Terminal E Modernization project, including curbside access and/or short-term parking areas.	This *2015 EDR* documents updates to Massport's Long-Term Parking Management Plan, which is intended to address the parking supply, pricing, and operations associated with Logan Airport's constrained parking. The Long-Term Parking Management Plan was originally published in the *2012/2013 EDR*. The *2014 EDR* and this *2015 EDR* report on this plan in Chapter 5, *Ground Access to and from Logan Airport.* Massport is in conceptual planning and design phase of the Logan Airport Parking Project which is predicated on the approval of a draft regulatory change, issued by the Massachusetts Department of Environmental Protection (MassDEP) to amend the Logan Airport Parking Freeze Regulation, 310 CMR 7.30, to allow for some additional commercially parked vehicles at Logan Airport. Consistent with its Long-term Parking Management Plan, Massport proposes to build up to 5,000 new on-Airport commercial parking spaces at Logan Airport, subject to an amendment to the Parking Freeze. This project is part of Massport's comprehensive strategy to address environmentally undesirable drop-off/pick-up trips. The new spaces are intended to accommodate existing and anticipated air passenger demand for parking at the Airport and would be planned and constructed in an environmentally sensitive manner. The new parking spaces would reduce regional air passenger-related vehicle miles traveled and associated vehicle air emissions. Massport has proposed two on-Airport siting locations for the garage(s). Each of these sites currently includes parking as an existing use. The proposed additional parking garage(s) at Logan Airport are subject to MEPA review under 301 CMR 11.03 (6)(a), through preparation of a mandatory Environmental Impact Report for "Construction of 1,000 or more new parking spaces at a single location." While the current Parking Freeze cap is in place, no additional parking spaces may be constructed within the Airport footprint.

Comment #	Author	Topic	Comment	Response
C.23	Matthew Beaton, Secretary	General	The ESPR and EDR provide a cumulative analysis of Logan Airport operations, environmental impacts, and mitigation measures. Review of individual projects proceeds within the context of this long-term planning and analysis of cumulative impacts. The record of MEPA review clearly demonstrates that Massport has and continues to identify impacts associated with individual projects within the context of long-term plans and cumulative impacts of Logan Airport. Cumulative impacts and project specific impacts will continue to be assessed on separate tracks; they will complement each other and ensure that projects are not viewed in isolation.	Massport is unique among state agencies and airports in the U.S. for publishing annual environmental reports specifically designed to describe, analyze, and project the cumulative effects of Logan Airport operations based on current and anticipated future operating conditions. This process was developed to allow individual projects at Logan Airport to be considered and analyzed in the broader, airport-wide context. A brief overview of that long-standing process follows. Massport has been producing annual reports for MEPA and for public review since 1979. Initially, these annual reports were called the Generic Environmental Impact Report (GEIR) and are now called Environmental Status and Planning Reports (ESPR) with interim Environmental Data Reports (EDR). These reports assess the environmental effect of overall changes in operations at Logan Airport. The reports provide an overall context, within which changes in the total environmental impacts at Logan Airport can be assessed. As stated in the Introduction to the 1999 ESPR, "While the Logan ESPR and EDRs provide the broad planning context for projects proposed for Logan Airport and future planning concepts under consideration by Massport, no specific projects can be built solely on the basis of inclusion and discussion in the 1999 ESPR." Projects that require state (MEPA) or federal (NEPA) review undergo a separate review process. In short, Massport's annual reports provide the planning context which complements the individual, project-specific filings. This *2015 EDR* and the following *2016 ESPR* will continue report on baseline and cumulative impacts of overall airport operations.
C.28	Matthew Beaton, Secretary	General	In recognition of the comment letters that raise concerns with cumulative airport-wide impacts pertaining to traffic and parking, air quality, and noise and, consistent with the MEPA review structure for Logan Airport, I am requiring Massport to respond to comments regarding airport operations and cumulative impacts in subsequent ESPR and/or EDR documents.	This *2015 EDR* and the *2016 ESPR* will address comments regarding airport operations and cumulative impacts through 2035.
C.29	Matthew Beaton, Secretary	General	The 2015 EDR Scope includes reporting on noise, air quality, and long-term parking management.	The *2015 EDR* includes an assessment of Airport-wide noise (Chapter 6, *Noise Abatement*), air quality conditions (Chapter 7, *Air Quality/Emissions Reduction*), and the status of Massport's Long-Term Parking Management Plan (Chapter 5, *Ground Access to and from Logan Airport*).
C.30	Matthew Beaton, Secretary	Activity Levels	The 2016 ESPR should revise growth projections based on the changes in the Terminal E Modernization Project that occurred subsequent to the 2011 ESPR (if necessary).	The *2016 ESPR* will update aircraft operations and passenger activity levels through 2035 based on aviation industry trends, economic, and demographic factors. Consideration will also be given to the Federal Aviation Administration's (FAA's) terminal area forecasts.

Comment #	Author	Topic	Comment	Response
C.31	Matthew Beaton, Secretary	Ground Access	It should also should reflect the proposed connection to the Airport Station and identify the anticipated ridership, changes in the HOV mode share, and ground access planning considerations.	A review of ridership and trainset capacity on the Massachusetts Bay Transportation Authority (MBTA) Blue Line indicates that there is significant reserve capacity (passenger space available within the trainset) on the Blue Line during the peak hour in the peak direction. Even with a doubling of Blue Line use by air passengers, there is still significant Blue Line capacity available. This *2015 EDR* reports on HOV mode share, ridership, and ground access planning in Chapter 5, *Ground Access to and from Logan Airport*.

Copy of the Secretary of the Executive Office of Energy and Environmental Affairs Certificate issued for the Terminal E Modernization Project Draft Environmental Assessment/Environmental Impact Report and Responses to Comments

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SECRETARY

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September 16, 2016

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS ON THE DRAFT ENVIRONMENTAL IMPACT REPORT

PROJECT NAME	: Terminal E Modernization
PROJECT MUNICIPALITY	: East Boston
PROJECT WATERSHED	: Boston Harbor
EEA NUMBER	: 15434
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: July 20, 2016

As Secretary of Energy and Environmental Affairs, I hereby determine that the Draft Environmental Impact Report (DEIR) submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (MEPA; M.G.L. c.30, ss.61-621) and with its implementing regulations (301 CMR 11.00). Consistent with Section 11.08 (8)(b)(2)(b) of the MEPA regulations, I am requiring the Proponent to file responses to comments on the DEIR and draft Section 61 Findings. The responses to comments and draft Section 61 Findings shall be filed, circulated, and reviewed as a Final Environmental Impact Report (FEIR). C.1

Comments on the DEIR reflect myriad concerns regarding existing airport operations and noise levels and potential increases in impacts associated with long-term growth. I have received comment letters from elected officials, including U.S. Congressman Michael E. Capuano, State Senator Joseph Boncore, State Representative Adrian Madaro, Boston City Councilor Salvatore LaMattina, and Chelsea City Councilor Roy Avellaneda. Comments were also submitted by municipalities, State and regional agencies, environmental advocacy groups, businesses and residents. The issue of cumulative airport-wide impacts, particularly noise and air quality, is not new to the review of projects at Logan Airport. As noted in past Certificates, the EIR is not intended to address broad concerns associated with airport operations and growth. The venue for addressing cumulative environmental impacts is through the Environmental Status and Planning Reports (ESPR) and Environmental Data Reports (EDR). Through these reports, Logan Airport is subject to comprehensive and regular MEPA review, including opportunities for public comment on the cumulative impacts. This regular updating and reporting on planning and cumulative impacts is unique among State Agencies. It reflects the challenge and complexity of

managing and modernizing Logan Airport within a dense, urban area. It recognizes that the proximity of communities to the Airport warrants an enhanced level of public engagement and a concerted, long-term effort to minimize and mitigate impacts.

Subsequent ESPRs and EDRs will update the cumulative impacts of passenger growth and associated ground and aircraft operations based on revised forecasts and update and revise environmental management plans to address impacts. Future submittals will continue to document potential impacts and trends and propose measures to implement the broad goal of maintaining or reducing Logan's overall environmental impacts, even as annual passenger volumes rise in the future. The next ESPR will analyze calendar year 2016 and will likely be filed in 2017 or 2018 and the next EDR will analyze calendar year 2015 and will likely be filed in the fall of 2016. C.2 C.3

Over the past year, Massport has engaged in a concerted outreach effort with elected officials, municipalities and community groups to identify and discuss potential Massport projects, including but not limited to, Terminal E. Massport created the Logan Airport Impact Advisory Group (IAG) to solicit comment and to identify and prioritize projects and programs of significance to the IAG. One project prioritized through this process is the construction of a pedestrian connection between the Massachusetts Bay Transportation Authority (MBTA) Blue Line Airport Station to Terminal E. Massport has incorporated this connection into the Terminal E project. I commend Massport for its outreach efforts which have been beneficial to informing the MEPA process. I encourage Massport to continue a productive dialogue with interested stakeholders, including through the IAG. C.4

Project Description

The project proposes modernizing Boston-Logan International Airport's John A. Volpe International Terminal (Terminal E) with a 560,000-square foot (sf) addition that corrects facility deficiencies and accommodates current and anticipated passenger volumes. The project includes three gates which previously underwent MEPA review (International Gateway Project, EEA #9791) but were not constructed, and four additional aircraft gates, passenger holdrooms, concourse, concessions, and passenger processing areas. The project includes Customs and Border Patrol (CBP) and Federal Inspection Services (FIS) facilities to replace and expand FIS facilities that were originally reviewed under MEPA (Terminal B, Pier A Improvements/Satellite FIS Facility, EEA #12235) but also not constructed. The project includes a direct pedestrian connection between Terminal E and the MBTA Blue Line Airport Station.

Terminal E was constructed in 1974 with 12 gates and served 1.4 million annual passengers. In 2014, it served approximately five million passengers. The DEIR indicates that the current level of passenger activity routinely causes severe congestion in the terminal at peak times, leading to greatly reduced customer service, and inefficient operations in the terminal and gates. According to the DEIR, gate congestion leads to airside delays and inefficiencies on the North Apron. When no gates are available, arriving aircraft and passengers are held on the apron. The DEIR indicates that aircraft must use remote parking facilities at hardstands in the North Cargo Area and passengers are bused to the terminal during peak periods when there are insufficient gates. The DEIR builds upon the information presented in the ENF regarding challenges associated with current operations at Terminal E. Massport has clearly demonstrated the need for the project and made a compelling case for the expansion.

The DEIR provided additional information to clarify and revise project phasing. The project is proposed in two phases. Phase 1 will be constructed from 2018 – 2022 and will include construction of four new gates with associated passenger holdrooms and elevators/escalators to relieve existing deficiencies and accommodate interim growth. A partial new concourse will be constructed to allow for future expansion to a seven-gate facility at full build-out. Phase 1 will not require modifications to roadway realignment. Phase 2 will be built by 2028 and will provide three additional gates and the MBTA connection. The DEIR indicates the project will be fully constructed and operational by 2030. Due to planning and budget constraints, the MBTA pedestrian connection has been shifted from Phase 1 as proposed in the ENF to Phase 2. The DEIR indicates that no other significant changes have occurred since the ENF was filed.

The project will displace ground service equipment (GSE), other airside activities, existing surface parking, the cell phone lot, and the gas station which will be relocated within existing airport boundaries. Relocation of ground facilities that conflict with the new concourse location, including the gas station, will occur in Phase 1.

Environmental Status and Planning Report (ESPR) and Environmental Data Reports (EDRs)

The MEPA environmental review process for Logan Airport occurs on two levels: airport-wide and project-specific. The ESPR and EDR provide a "big picture" analysis of the environmental impacts of current and anticipated levels of airport-wide activities (including aircraft operations and passenger activity), and presents comprehensive strategies to avoid, minimize and mitigate impacts. The ESPR is generally updated on a five-year basis; the most recent ESPR for the year 2011 was filed in April 2013 and it contained updated passenger activity levels and aircraft operations forecasts through 2030. EDRs evaluate environmental conditions for the reporting year as compared to the previous year and are filed in the years between ESPRs. The most recent EDR for the year 2014 was filed in October 2015. The EDR provided a comprehensive cumulative analysis of the effects of all Logan Airport activities based on actual passenger activity and aircraft operation levels in 2014 and presents environmental management plans for addressing environmental impacts. The ESPR is supplemented by (and ultimately incorporates) the EDRs and the detailed analyses and mitigation commitments that emerge from project-specific reviews. This process provides a comprehensive and continuous review of airport programs, projects, environmental impacts and associated data.

The 2015 EDR Scope includes, but is not limited to, reporting on noise, air quality, and long-term parking management. The 2015 EDR and 2016 ESPR should reflect the proposed connection to the Airport Station, provide updates on the planning and design of the connection, and identify the anticipated ridership, changes in the HOV mode share, and ground access planning considerations. C.5

The MEPA regulations (Section 11.06(2)) indicate that during the course of an ENF review I may review any relevant information from any other source to determine whether to require an EIR, and, if so, what to require in the Scope. To provide context for this project-specific review and because many issues raised by commenters relate to airport-wide operations and impacts, this Certificate refers to documents from the ESPR process (EEA#3247/5146).

Logan Airport and Project Site

The Airport boundary encompasses approximately 2,400 acres in East Boston and Winthrop, including approximately 700 acres underwater in Boston Harbor. The Airport is surrounded on three sides by Boston Harbor and is accessible by two public transit lines and the roadway system. The airfield is comprised of six runways and approximately 15 miles of taxiway. Logan Airport has four passenger terminals, A, B, C, and E, each with its own ticketing, baggage claim, and ground transportation facilities.

Terminal E is located adjacent to the North Cargo Area, closest to the MBTA Blue Line Airport Station. Land uses in the area of the proposed project include UPS aircraft parking and loading area, the airport's Remain Over Night aircraft parking area, the North Cargo Area equipment storage area, a building occupied by United Parcel Service (UPS), the MBTA Blue Line Airport Station, airport roadways, various short-term and cell phone parking lots, and a gas station.

The project site is located within the coastal zone of Massachusetts. The entirety of the project site is comprised of previously disturbed impervious area. It is not located in Priority or Estimated Habitat as mapped by the Division of Fisheries and Wildlife's (DFW) Natural Heritage and Endangered Species Program (NHESP). The project site does not contain wetland resource areas regulated pursuant to the Wetland Protect Act and its implementing regulations (310 CMR 10.00).

The ENF identified the following projects within the vicinity of Terminal E that have been reviewed under MEPA: Terminal A Replacement (EEA#9329), Terminal E Modifications (EEA#9324), Federal Inspection Services (FIS) Facility and West Concourse Project / International Gateway (EEA#9791), and Terminal B, Pier A Improvements/Satellite FIS Facility (EEA#12235).

Permitting and Jurisdiction

The project is undergoing MEPA review and required an ENF pursuant to 301 CMR 11.03(6)(b)(6) because it will be undertaken by a State Agency and results in the expansion of an existing terminal at Logan Airport by greater than 100,000 sf.

The project requires a Sewer Permit Modification from the Boston Water and Sewer Commission (BWSC) and may require an Industrial User Permit from the Massachusetts Water Resource Authority (MWRA). The project may be subject to Massachusetts Office of Coastal Zone Management (CZM) federal consistency review.

The project requires approval by the Federal Aviation Administration (FAA) for changes to the Airport Layout Plan and, therefore, requires an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA). The project also requires a National Pollutant Discharge Elimination System (NPDES) General Permit for Construction from the U.S. Environmental Protection Agency.

Because the project will be undertaken by a State Agency, MEPA jurisdiction is broad in scope and extends to all aspects of the project that may cause Damage to the Environment, as defined in the MEPA regulations.

Environmental Impacts and Mitigation

As described in the ENF, the project includes construction of approximately 500,000 to 700,000 sf of new floor area (for a maximum 1,500,000 sf total), and will increase both water consumption and wastewater generation by approximately 25,600 gallons per day (76,800 gpd total). The project will not create new impervious area and will eliminate approximately 60 parking spaces. The DEIR indicates that the project will accommodate existing and forecasted passenger levels and operations and, therefore, will not increase passenger enplanements or vehicle trips.

Measures to avoid, minimize and mitigate project impacts include reducing air emissions, greenhouse gas (GHG) emissions, and energy consumption compared to existing conditions by improving access to gate plug-ins, pre-conditioned air, and reducing busing operations. In addition, the building is designed to act as a noise barrier to the adjacent residential areas and Memorial Stadium Park.

Review of the DEIR

The DEIR has been filed to provide additional information regarding the necessary details of design and development of the Terminal E expansion to support assessment of potential impacts and has been coordinated with the federal NEPA process. In accordance with my Certificate on the ENF, the Environmental Assessment (EA) as required under NEPA formed the basis of the DEIR.[1] This Certificate applies to the review of the project under MEPA only, and does not restrict the ability of the federal government to act on those aspects of the project subject to NEPA. The DEIR included FAA's draft Finding of No Significant Impact (FONSI). The DEIR described the proposed project, identified existing conditions, described potential environmental impacts and mitigation measures, and provided an expanded discussion of alternatives. It included an update on state, local, and federal permitting and provided a discussion of permitting requirements and the project's consistency with regulatory standards. At Massport's request, the comment period was extended by three weeks to September 9, 2016. C.6

The DEIR identified ongoing projects that are currently under construction and are assumed to be completed prior to commencement of construction for the Terminal E Project. It also identified a potential parking garage, which is predicated on the approval of a draft regulatory change by MassDEP to amend the Logan Airport Parking Freeze Regulation (310 CMR 7.30). The DEIR indicates that the potential parking garage will be subject to MEPA review pursuant to 301 CMR (6)(a)(7) because it will be constructed by a State Agency and will include construction of 1,000 or more new parking spaces. This project is conceptual in nature and the DEIR did not provide a schedule or timeline for its design or construction or for initiating MEPA review. I encourage Massport to consult with the MEPA Office prior to preparing an ENF for this project. C.7

[1] The Federal Aviation Administration (FAA) is reviewing the project as an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA).

Environmental Justice Policy

I have received numerous comment letters regarding environmental justice and concerns that the burden of cumulative noise, air pollution, and traffic impacts associated with growth and increased operations will be borne by neighboring communities, independent of this specific project. The Executive Office of Energy and Environmental Affairs (EEA) Environmental Justice Policy (EJ Policy) was designed to improve protection of low income and communities of color from environmental pollution as well as promote community involvement in planning and environmental decision-making to maintain and/or enhance the environmental quality of their neighborhoods. Massport provided outreach consistent with the spirit and intent of the enhanced public participation provisions of the EJ Policy. Massport requested and was granted an extension of the comment period to provide additional time to review and comment on the DEIR. The meeting notice was published in English and Spanish in the Boston Herald and the East Boston Times. Spanish language translation was also provided at a Public Information Meeting held the evening of August 10, 2016 at the Mario Umana Middle School Academy Auditorium in East Boston. I received many comment letters requesting Massport provide a Spanish language version of the Executive Summary provided with the DEIR filing. Massport has indicated it will provide a Spanish translation of the DEIR Executive Summary. I encourage Massport to continue providing translated Executive Summaries with all future MEPA filings. C.8

Alternatives Analysis

The DEIR included an expanded alternatives analysis that identified the planning metrics, facility requirements, and assumptions used to design the project and to determine the final number of gates based on the passenger projections for year 2030. The DEIR provided a gating analysis for forecast passenger activity and aircraft operations levels to determine the number of gates required to accommodate the volumes of passengers and aircraft that will be arriving and departing at Terminal E during the average weekday peak-hours. As described in the DEIR, Massport has limited control over the scheduling of transatlantic flights, which are subject to lengthy flight times and time zone changes that cause arrival and departure peaks to occur within a relatively short time period. The DEIR indicates that peak hour for international departures will be between 9:00 pm to 10:00 pm and the peak hour for international arrivals will be between 6:00 pm and 7:00 pm. According to the DEIR, approximately 1,954 passengers are projected to depart in 2030 during the peak hour (9:00 pm to 10:00 pm) and 1,885 passengers are projected to arrive during the peak hour (6:00 pm to 7:00 pm). Based on this, the gating analysis indicates that Logan Airport will require an additional seven gates for a total of 19 gates to efficiently support international operations.

The DEIR identified the number of planes that are forced to "hard stand" during peak hours due to lack of available gates under existing, future No-Build, and future Build-Conditions. As described in the DEIR, in the summer of 2015, aircraft scheduling demanded 13 gates, one more than the existing twelve gates. Throughout 2015, only 10 of the existing 12 Terminal E gates were available for use as two were decommissioned to allow for construction of the Terminal E Renovation and Enhancements Project. From April to September 2015, facility constraints at Terminal E resulted in 293 gate-delays, which affected approximately 44,000 passengers and 49 ramp busing operations to remote hardstands which affected over 8,200 passengers. As described in the DEIR, aircraft waiting for gates account for 55-percent of total delays at Terminal E, while busing operations to remote hardstands account for 11-percent of total delays. According to the DEIR, in the proposed (2030) Build-Condition, only two operations will require use of a "hard stand" and busing, whereas under the No-Build, 17 flights (arrival and departure) per day will require busing operations. The DEIR also included a summary of key aircraft gate and passenger terminal area facility program requirements for the proposed project to address current deficiencies and meet the needs for future anticipated aircraft and passenger handling.

The DEIR evaluated the following alternate configurations of the new terminal area and the North Apron:

- Alternative A: Separate Core Terminal – New linear concourse and terminal core, with new separate curb frontage.
- Alternative B: Concourse Extension – Extension from existing concourse extending westward from the Gate 12 area at the west end of Terminal E.
- Alternative C: Satellite Concourse – New portion of the terminal positioned as a separate two-sided concourse structure with underground passageway connecting the new gates to the existing terminal space.
- Alternative D: Extended Core Terminal *(Preferred Alternative)* – New extension of the existing concourse, terminal core, and terminal frontages.

Each alternative included seven new gates consistent with the need identified in the gating analysis. The key differences among the terminal configuration alternatives relate to efficiency of interior operations, frontage on the adjacent roadway, disruption to the existing operations during construction, and cost. With the exception of the ability to buffer ground noise from ground operations, there is little difference in environmental impacts among the alternatives. Alternative D was selected as it provides the greatest passenger processing efficiency, interior space, and noise buffering benefits compared to the other alternatives. Massport also evaluated three alternative roadway configurations based on the preferred terminal configuration. The three roadway alternatives (Bi-Level S-Curves, Single S-Curve, and Northern Loop Ramps) all extend the roadway frontage to facilitate drop-off and pick-up along the new building area, and realign the roadway ramps servicing Terminal E. The DEIR indicates that the roadway configurations have similar environmental impacts since the limit of work is currently fully developed and that all build options will replicate the existing traffic flow patterns. The Preferred Alternative (Single S-Curve) was selected as it provides the best alignment for traffic operations while minimizing the overall footprint.

Comments on the DEIR continue to request that Massport accommodate more demand at regional airports in lieu of or in conjunction with the proposed project. I acknowledge that long-term strategies to mitigate Logan's impacts will continue to include an emphasis on diverting travel to regional airports and to rail. As indicated in the Certificate on the ENF, regional transportation will continue to be addressed through the ESPR and EDR, not through this project specific review. C.9

GHG Emissions

Because I required an EIR, the project is subject to review under the May 2010 MEPA Greenhouse Gas (GHG) Emissions Policy and Protocol ("the Policy"). The DEIR included an analysis of GHG emissions and mitigation measures that is generally in accordance with the standard requirements of the MEPA GHG Policy and Protocol; however, the FEIR must address C.10

several issues. The DEIR did not address many of the comments and recommendations provided in the DOER ENF comment letter. I refer Massport to DOER's comment letter. In addition, discrepancies exist between the mitigation measures presented in Table 6-1 (Summary of Terminal E Modernization Beneficial Measures), the "Sustainability Features" narrative (Section 6.2.2), the Draft Section 61 Findings (Appendix B), and the information provided in the MEPA Greenhouse Gas Analysis Technical Report (Appendix G). It is unclear which GHG reduction measures have been committed to by the Proponent and which will continue to be evaluated. For example, many measures included in Table 6-1 which summarizes Massport's commitments to beneficial measures are subsequently referred to (in Section 6.2.2 of the narrative) as measures "to-be considered for their feasibility and applicability" during the preliminary design phase and later design phases. As indicated below, the Response to Comments must provide a detailed response to address each of the issues identified in DOER's comment letter and draft Section 61 Findings should be revised accordingly. C.11 C.12 C.13

The Base Case scenario is based on the 8th Edition of the Massachusetts Building Code that includes the International Energy Conservation Code 2012. The eQUEST v.3.64 modeling software was used to perform the GHG analysis. The DEIR indicates that Massport will build the Terminal E project to achieve LEED Silver or higher certification. The DEIR summarized the following design mitigation measures that were modeled in the GHG analysis and proposed for adoption by the Proponent: C.14

- Improved building envelope (wall insulation of U-0.05, roof insulation of U-0.037, improved glazing of U-0.34, and reduced window to wall ration of 25%)
- Improved Air Handling Units (Variable Air Volume with reduced fan power per cfm; dual enthalpy air economizer to maximize benefit of using outdoor air to condition the building; automatic rest of fan static pressure and supply air temperature based on space loading to reduce fan power, cooling energy, and heating energy);
- Efficient water loops with reduced water supply temperature and wider return temperatures to reduce demand on the pumping and fan systems; and
- Reduced interior lighting power density (LPD) of 0.62 W/SF and reduced exterior lighting power of 9.3 kW.

These design measures were not identified in Table 6-1 or specifically identified in the draft Section 61 Findings. They should be incorporated into revised draft Section 61 Findings. The DEIR identifies the several energy conservation measures that were considered and eliminated primarily for concerns regarding constructability, ease of operations and maintenance and cost. Measures that were eliminated include automated reflective interior blinds to reduce solar heat gain, geothermal heat pumps, fan cycling based on occupancy load, and combined heat and power (CHP). I refer the Proponent to DOER' s comment letter which recommends further evaluation of CHP to address Terminal E's service water loads. Massport has indicated that conversion of the equipment at Logan's Central Heating and Cooling Plant will be evaluated as the equipment reaches the end of its useful life. I expect that further evaluation of CHP will be evaluated as part of that process and reported in future EDRs and ESPRS. C.15 C.16 C.17

Massport has committed to evaluate the following energy efficiency measures as project design progresses: dual box minimum, fin tube radiation, energy recovery wheel, dynamic V8 filtration, and implementation of a solar photovoltaic (pv) array. According to the DEIR, these C.18

measures could increase energy savings by 70% compared to the currently proposed project. C.18
However, the DEIR does not indicate why these mitigation measures cannot be incorporated into the project design at this time nor does it identify the additional analysis that would be required to inform a determination during subsequent design. C.19
In addition, Section 6.2.2 of the DEIR notes that Massport will investigate the feasibility of providing 2.5% of the project's power with on-site renewable energy through the use of Solar PV; and the Greenhouse Gas Analysis Technical Report (Appendix G) indicates that a 300 kW solar PV array may continue to be evaluated for inclusion in the project. As part of this evaluation, Massport should identify the total rooftop area available for a potential solar PV array and perform a financial feasibility analysis. To date Massport has installed a total of approximately 916 kW of solar PV at Logan and Hanscom airports. The FEIR should identify the basis for delaying a decision regarding installation of a C.20
solar PV project on the rooftop of Terminal E or, at a minimum, re-affirm the commitment to build it as "solar ready" until subsequent design phases. C.21

Stationary source GHG emissions associated with the energy use of the proposed Terminal E expansion are estimated to generate 5,850 tpy of CO_2 in the Base Case Scenario. Through the adoption of energy efficiency measures, the Preferred Alternative will reduce CO_2 emissions associated with the terminal expansion by 685 tpy, for a total of 5,165 tpy, or a 11.7 percent decrease. The GHG analysis also evaluated total net new GHG emissions from aircraft, GSE, airside ground access vehicles, and additional energy demand associated with the Terminal E expansion. The FAA's Aviation Environmental Design Tool (AEDT) and EPA's MOVES and NONROAD models were used to calculate the GHG emissions associated with the operations, including aircraft engines, GSE/auxiliary power units (APUs), and ground access vehicles. Changes to operations are estimated to reduce GHG emissions by an additional 5,371 tpy.

Climate Change Adaptation and Resiliency

The DEIR described the project's consistency with Massport's Disaster and Infrastructure Resiliency Planning (DIRP) Study and Floodproofing Design Guide. Terminal E will be above the projected 2070 coastal flood elevation. The Design Guide establishes Design Flood Elevations (DFEs) that are more conservative than existing building code requirements. The DEIR indicates that the first level of the project and associated utilities and critical equipment is generally located above the DFE. In areas where spaces must be located below the DFE, critical areas will be flood proofed or protected through use of the following measures: watertight shields on doors, windows, and louvers; exterior and interior membranes and sealants; drainage collection systems and sump pumps; early warning devices to monitor water levels; sealing electrical conduits and other utilities; back-flow preventer valves on drainage and sanitary sewer piping; and use of flood openings to equalize hydrostatic pressure. The DEIR notes that Massport has consulted with CZM regarding development of coastal resiliency design measures. Massport will continue consultations with CZM and MBTA and to review existing station vulnerabilities, as operations of the Blue Line and this station are important to support Massport HOV goals. Updates on this consultation and the design measures that are considered and/or incorporated into the design to improve the MBTA station's coastal resiliency should be provided in the EDR and ESPR documents. C.22

Air Quality

The DEIR included an analysis to determine whether and to what extent the proposed project will increase criteria pollutants. The analysis evaluated changes in emissions from aircraft engines, APUs and GSE, airside vehicles, and airport passenger and employee motor vehicles under the 2030 No-Build and 2030 Build scenarios. The FAA's AEDT was used to evaluate changes in emissions from aircraft ground operations. EPA's MOVES and NONROAD models were used to evaluate changes in emissions from ground support equipment and motor vehicle emissions. Results of the analysis indicate that total emissions of all pollutants will decrease within the project area under future conditions with the proposed project compared to future conditions without the project.

	Carbon Monoxide	Volatile Organic Compounds	Nitrogen Oxides	Sulfur Oxides	Particulate $Matter_{10}$	Particulate $Matter_{2.5}$
2030 No-Build	294 tpy	35 tpy	59 tpy	9 tpy	11 tpy	4 tpy
2030 Build Condition	268 tpy	33 tpy	33 tpy	6 tpy	10 tpy	3 tpy
Percent Change	-9%	-6%	-44%	-33%	-9%	-25%

The DEIR indicates that the reductions are largely due to the availability and use of gate-furnished electricity and air conditioning rather than APUs while parked at hardstands; reduced reliance on GSE to transport passengers, baggage, and cargo; and improved aircraft operational conditions (e.g., less congestion and delay) on the taxiways and aprons. The DEIR indicates that project complies with the applicable emission thresholds contained in the State Implementation Plan (SIP) and will not cause or contribute to a violation of the National Ambient Air Quality Standards (NAAQS). The DEIR quantified temporary construction-related impacts and confirmed that construction-related emissions will not exceed applicable emission thresholds.

Total air quality emissions from all sources at Logan Airport in recent years are significantly less than they were a decade ago; however, the 2014 EDR demonstrated that total emissions are increasing incrementally. The overall reduction is associated with industry trends of accommodating the demands of increasing passenger and cargo activity levels with fewer aircraft operations generating fewer emissions. Massport will continue to assess the applicability of emissions reduction measures to the extent practicable and report on air quality in the ESPR and the EDR. C.23

Noise

The DEIR asserts that the project will not result in any changes to the number and type of aircraft operations when compared to the Future No-Build Alternative. It indicates that demand is driven by economic and market factors; and, therefore, growth at Logan Airport will continue to occur regardless of the Terminal E project. Cumulative impacts will continue to be addressed through the ESPR and EDR. C.24

The DEIR included a noise evaluation which evaluated project-related ground noise conditions and the ability of the terminal extension to mitigate noise. The noise model also identified how changes in the use of Terminal E gates and the North Cargo Area will affect ground noise levels. The extension of Terminal E has been designed to provide a noise barrier between the airport and the community. It will result in reduced noise levels at Jeffries Point, East Boston Memorial Park, and most residential areas in East Boston west of the ramp areas between Route 1A and Putnam Street. Specifically, the project will reduce noise from aircraft ground operations near Terminal E by five to 18 dB and from single event maximum noise levels by two to 15 dB in the Jefferies Point neighborhood. It will reduce noise from aircraft ground operations near Terminal E by three to 15 dB and from single event maximum noise levels by 1 to eleven dB in the Bremen Street area south of Putnam Street to Route 1A. The DEIR indicates that the project will not result in a significant noise increase within the Day-Night Average Sound Level (DNL) 65 dB contour.

I received many letters which identify a particular concern with concentrations of flight tracks and increased flight frequency due to the FAA's area navigation (RNAV) procedures. The primary purpose of the RNAV procedures is to increase safety and operational efficiency. As documented in the ESPR and annual EDR submittals, implementation of several of the RNAV procedures have generated increased noise complaints in some towns surrounding Logan Airport and I have received many comment letters from residents of the Town of Hull on this issue. The procedures themselves have resulted in aircraft at higher altitudes although patterns are concentrated over certain communities. I note that the FAA is implementing the RNAV program nation-wide. This program is separate from and unrelated to the Terminal E Modernization project. Through my review of the ESPR and EDRs, I am aware of The Boston Logan Airport Noise Study (BLANS)[2]; an ongoing and joint effort between the FAA, Massport, and the Logan Airport Citizen Advisory Committee (CAC). The RNAV procedures to Runways 27, 4L, and 33L were subject to review during Phase 3 of the BLANS[3]. The purpose of Phase 3, currently underway, is to identify opportunities to balance the use of Logan's runways and reduce persistent noise over communities. Flight operations are significantly lower than historic levels; however, I acknowledge that projected increases in flight operations will increase cumulative noise impacts compared to existing conditions. As noted previously, the ESPR and EDRs provide a forum and meaningful opportunities for public review of information and analysis related to these issues. I also encourage residents to contact their CAC representatives to identify additional methods to participate in improving the noise environment around Boston-Logan Airport.

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Construction Period

The DEIR provided additional construction phase information (presented below in the Mitigation Measures section) to identify construction period impacts and measures to control construction traffic, air quality, noise, and water quality impacts.

Mitigation/Draft Section 61 Findings

The DEIR contained a separate chapter on mitigation measures and provided draft Section 61 Findings in an Appendix. It generally describes mitigation measures and contains commitments to mitigation. As noted earlier, additional clarity is necessary regarding those C.27

[2]Information on the Boston Logan Airport Noise Study can be found at http://www.bostonoverflight.com/index.aspx
[3] These environmental documents can be found at http://www.bostonoverflight.com/phase3_documents.aspx

measures that are commitments and those that will be evaluated as project design progresses. This is particularly relevant to the GHG mitigation measures. The Proponent has committed to implement the following measures to avoid, minimize, and mitigate environmental impacts: C.27 Cont.

Operational Impacts

- The Terminal E expansion has been sited and will be designed to act as a noise barrier to the adjacent East Boston neighborhoods and Memorial Stadium park to the southwest of the North Apron. The new structures will have a minimum height of 45-ft above ground level.
- New gates will have electric power and pre-conditioned air to allow aircraft to plug in at gate rather than be serviced remotely to reduce need for on-board engine/auxiliary power unit operation, thereby reducing aircraft air emissions and GHG emissions.
- New gates will increase ramp efficiency and reduce movements on North Apron and the need to bus passengers between terminal and remote aircraft parking locations, thereby reducing ground transportation related air emissions and mobile source GHG emissions.
- Roadway and curb improvements which will improve vehicle flow and high-occupancy vehicle access.

Sustainable Design Features/Greenhouse Gas Emissions

- Improved building envelope (wall insulation of U-0.05, roof insulation of U-0.037, improved glazing of U-0.34, and reduced window to wall ratio of 25%).
- Improved Air Handling Units.
- Efficient water loops with reduced water supply temperature and wider return temperatures to reduce demand on the pumping and fan systems.
- Reduced interior lighting power density of 0.62 W/SF and reduced exterior lighting power of 9.3 kW.
- The roof design will incorporate materials with a minimum reflectance rating of 0.70 and emittance value of at least 0.75 for a minimum of 75% of the available roof area. Roofing materials will be non-glare to reduce heat island effect.
- Final design will incorporate infrastructure for collection, storage, and handling of recyclable materials.
- The contractor will be required to develop a construction waste management plan that requires diversion or reduction of construction waste by at least 75%.
- Massport will establish a project-specific goal for sourcing materials extracted, harvested, recovered, and or manufactured within New England.
- The project will be designed to achieve energy efficiencies of a minimum of 20% below the MA Energy Code.
- Continued investigation into the feasibility of supplying 2.5% of the project's power with on-site renewable energy systems.
- The project will be developed to accommodate rooftop solar.
- Project will include water conservation devices that reduce water use by 20% below the MA Plumbing Code.
- Project will incorporate occupancy sensors in all indoor areas to reduce electrical demand.

Construction Period

- Work hours will be limited to 7:00 AM to 5:00 PM unless constrained by operational conditions at the Airport.

- Adequate storage areas for construction supplies will be maintained on airport property.
- Soil Management Plan will be developed based on sub-surface investigations to address identification and disposal of contaminated materials.
- Stormwater Pollution Prevention Plan will be developed to keep sediment and contaminants out of the stormwater management system during construction.
- Management Plan for Dewatering will be developed (if required) to address requirements for testing, handling, and treatment prior to discharge of contaminated groundwater.
- Rodent control, inspection, monitoring, and treatment will be carried out before, during, and after completion of all foundation and utilities demolition and construction work. Rodent extermination prior to work will consist of treatment throughout the project area, including building exteriors and interiors and will continue throughout construction.
- Noise control techniques will be used to reduce noise from pile driving by at least 5 A-weighted decibels (dBA) below unmitigated levels through enclosing the point of impact for the pile drive; installation of an impact cushion between the pile drive and the pile; or requiring the application of energy-absorbing material to steel piles.
- Measures to reduce ground transportation impacts from project construction include:
  - Designated truck routes designed to keep construction-related traffic off of residential streets unless they are seeking construction-related access to or from local businesses.
  - Concrete production/batching will occur in existing plants with access to Route 1A or I-90 to reduce on-airport activities and to consolidate truck trips.
  - Construction companies will be encouraged to provide off-Airport parking for their employees and to provide shuttle services from these locations.
- The following measures will address construction phase air quality impacts:
  - Enforcement of construction vehicle anti-idling provisions;
  - Retrofitting diesel construction equipment with diesel oxidation catalysts and/or particulate filters;
  - Fugitive dust will be controlled via wetting or sweeping and all trucks hauling materials from the construction site will be covered.

Responses to Comments

The Response to Comments should contain a copy of this Certificate and a copy of each comment letter received on the DEIR. Comment letters may be provided electronically on a CD. As many of the comment letters identify similar concerns, the FEIR may contain a thematic response to comments to the extent that they are within MEPA jurisdiction. The response can also refer to future EDRs and/or ESPRs to address issues that are not within the Scope of this review. This directive is not intended, and shall not be construed, to enlarge the scope beyond what has been expressly identified in this Certificate. I recommend that Massport employ an indexed response to comments format, supplemented as appropriate with direct narrative response.

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The response to comments section should address specific comments from DOER and a revised GHG analysis should be provided, if necessary to provide a meaningful response. The Response to Comments should clarify GHG reduction measures and to demonstrate that GHG emissions will be minimized, avoided, and mitigated to the maximum extent practicable. I expect that the FEIR will provide a comprehensive and thoughtful response to the DOER comment letter and that Massport will consult with DOER prior to filing the Response to Comments.

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Mitigation/Draft Section 61 Findings

The Response to Comments should include revised draft Section 61 Findings which should include a complete list of all mitigation measures developed through MEPA review of the project, including but not limited to, measures specifically incorporated into the terminal design or operational measures to minimize GHG emissions. The Section 61 findings should clarify which GHG mitigation measures are proposed as mitigation and which will continue to be evaluated. It should reconcile the data contained in Table 6-1, Sustainability Features narrative in Section 6.2.2, and the information provided in the GHG Analysis Technical Report (Appendix G). The revised draft Section 61 Findings should clarify the reduction in GHG emissions (compared to the base case) that is being committed to as mitigation. The draft Section 61 Findings should also identify whether each mitigation commitment will be incorporated or provided as part of Phase 1, Phase 2, or both phases of the project.

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To ensure that all GHG emissions reduction measures adopted by the Proponent in the Preferred Alternative are actually constructed or performed, I require proponents to provide a self-certification to the MEPA Office. Specifically, Massport must provide a certification to the MEPA Office signed by an appropriate professional (e.g., engineer, architect, transportation planner, general contractor) indicating that the all of the mitigation measures proposed in the EIR have been incorporated into the project. Alternatively, Massport may certify that equivalent emissions reduction measures that collectively are designed to reduce GHG emissions by the same percentage as the measures outlined in the EIR, based on the same modeling assumptions, have been adopted. The certification should be supported by plans that clearly illustrate where GHG mitigation measures have been incorporated. For those measures that are operational in nature (i.e. TDM) the Proponent should provide an updated plan identifying the measures, the schedule for implementation and how progress towards achieving the measures will be obtained. The commitment to provide this self-certification in the manner outlined above should be incorporated into the draft Section 61 Findings included in the EIR.

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Circulation

In accordance with Section 11.16 of the MEPA Regulations and as modified by this Certificate, Massport should circulate a hard copy of the FEIR to each State and City Agency from which the Proponent will seek permits. Massport must circulate a copy of the FEIR to all other parties that submitted individual written comments. Per 301 CMR 11.16(5), the Proponent may circulate copies of the FEIR to these other parties in CD-ROM format or by directing commenters to a project website address. However, Massport should make available a reasonable number of hard copies to accommodate those without convenient access to a computer and distribute these upon request on a first-come, first-served basis. Massport should send correspondence accompanying the CD-ROM or website address indicating that hard copies are available upon request, noting relevant comment deadlines, and appropriate addresses for submission of comments. A CD-ROM copy of the filing should also be provided to the MEPA Office. A copy of the EIR should be made available for review at the following Libraries: Boston Public Library – Main, Connolly, Orient Heights, Charlestown, and East Boston Branches, Chelsea Public Library, Winthrop Public Library, Revere Public Library, Everett Public Library, Milton Public Library, and Hull Public Library.

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Conclusion

Based on a review of the DEIR, consultation with State Agencies, and a review of comment letters, I have determined that the DEIR adequately and properly complies with MEPA and its implementing regulations. The Proponent may submit the Response to Comments and draft Section 61 Findings as the FEIR. C.48

September 16, 2016
Date

Matthew A. Beaton

Comments received:

7/28/2016	Greater Boston Convention & Visitors Bureau
8/1/2016	MassEcon
8/1/2016	Murphy, Hesse, Toomey & Lehane, LLP on behalf of the Town of Milton
8/3/2016	Local 22, Construction & General Laborers' Union
8/3/2016	Mary J. Ryan
8/3/2016	Air Impact Relief (AIR) via Aaron Toffler
8/5/2016	American Council of Engineering Compananies of Massachusetts (ACEC/MA)
8/5/2016	Associated Industries of Massachusetts (AIM)
8/10/2016	Conference of Boston Teaching Hospitals
8/11/2016	Boston Financial Services Leadership Council (BFSLC)
8/11/2016	Susanna Starrett
8/12/2016	Massachusetts Business Roundtable
8/14/2016	Magdalena Ayed
8/15/2016	Juan Ramos
8/15/2016	Linda Barber
8/15/2016	Sema Bekiroglu
8/16/2016	Town of Hull, Philip Lemnios, Town Manager
8/16/2016	Edward J. MacLean
8/16/2016	Renee MacLean
8/17/2016	Andrea White
8/17/2016	David Gardner
8/17/2016	Eugene Courier
8/17/2016	Evie Rose
8/17/2016	Herb Zeller
8/17/2016	Hull Neighbors for Quiet Skies
8/17/2016	Ira Fleishman
8/17/2016	Jen Hartnett-Bullen

8/17/2016	Joe Berkeley
8/17/2016	Juliet Floyd
8/17/2016	Karen Delano
8/17/2016	Kathy A. Beitler
8/17/2016	Linda Karoff
8/17/2016	Lisa Borden
8/17/2016	Maria Graceffa
8/17/2016	Mary Schultz
8/17/2016	Michael Doiron
8/17/2016	Michael Parks
8/17/2016	Philip R. Delano
8/17/2016	Richard Monarch
8/17/2016	Robert Stenberg
8/17/2016	Rosanne Bush
8/17/2016	Sallyann Kakas
8/17/2016	Sarah & Harold Chisholm
8/17/2016	Susan Ovans
8/17/2016	Thomas Hardey
8/17/2016	Tim Fox
8/17/2016	Val Woolley
8/18/2016	Betsy Lewenberg
8/18/2016	Jeff Kerr
8/18/2016	Karen Walsh
8/18/2016	Lloyd Emery
8/18/2016	Nancy Curtis
8/18/2016	Robyn Riddle
8/18/2016	Sheila Connor
8/18/2016	Stephen Etkind
8/18/2016	Nicole Dunn
8/18/2016	Patricia Hynes
8/18/2016	Mr. and Mrs. Tomassini
8/18/2016	Pamela Loring
8/18/2016	Canice Thynne
8/18/2016	John Brennan
8/18/2016	James & Barbara Barrow
8/18/2016	Rebecca and Tillmann Hein
8/18/2016	Stephanie B. Shafran
8/18/2016	Diane & George Nassopoulos
8/18/2016	Chris Maher
8/18/2016	Donna Goes
8/18/2016	Liz West
8/18/2016	Mary Devin
8/18/2016	Marjorie E. Wiseman
8/18/2016	Ellen

8/18/2016	Dorothy Tan
8/18/2016	Charleen Tyson
8/19/2016	Searose@comcast.net
8/19/2016	Town of Milton, Board of Selectmen
8/19/2016	Liz Kinkead
8/19/2016	Colleen MacDonald
8/19/2016	A Better City
8/19/2016	Steve West
8/19/2016	Lois Freedman
8/19/2016	Pam Sargent
8/19/2016	Paul Karoff
8/19/2016	Neill K. Ray
8/19/2016	Arlington and Belmont Representatives to the Logan CAC and Massport CAC
8/19/2016	Kathleen T. McCarthy
8/19/2016	William G. McCarthy
8/19/2016	Boston Harbor Now
8/19/2016	Andrew Schmidt
8/19/2016	Alex D. Doucette
8/19/2016	Massachusetts Department of Environmental Protection (MassDEP)
8/20/2016	Robert Banzett
8/22/2016	Association of Independent Colleges and Universities in Massachusetts (AICUM)
8/23/2016	Patricia McKinley
8/23/2016	Maria Argos Barber
8/23/2016	Joshua Acevedo
8/23/2016	Elizabeth Kay
8/25/2016	Elda Prudden
9/6/2016	Tom Carey
9/6/2016	Congressman Michael Capuano
9/7/2016	Greater Boston Chamber of Commerce
9/8/2016	Chris Marchi
9/8/2016	Steve Holt
9/8/2016	Caroline J. Mailhot
9/8/2016	Eneida Figueroa
9/8/2016	Sam Albertson
9/8/2016	Emily Hyman
9/8/2016	Peter I. Dunn
9/8/2016	Mimi L. Callum
9/8/2016	Massachusetts High Technology Council
9/8/2016	Jane O'Reilly
9/9/2016	Roy Avellaneda, Councilor at Large, Chelsea
9/9/2016	Susanna Starrett
9/9/2016	Michael, Allyson, Willa and Miles Simons
9/9/2016	Carlos Rosales
9/9/2016	Margaret Morris

9/9/2016	Kathleen McCauley
9/9/2016	Lindsay Rosenfeld
9/9/2016	John Antonellis
9/9/2016	John Casamassima
9/9/2016	Brian Gannon
9/9/2016	Celeste Ribeiro Myers
9/9/2016	Theresa Teshia Malionek
9/9/2016	Melissa Tyler
9/9/2016	Sandra Nijjar
9/9/2016	Joanne T. Pomodoro
9/9/2016	Air Impact Relief (AIR) via Aaron Toffler
9/9/2016	Alexis Pumphrey
9/9/2016	Maria Eugenia Corbo
9/9/2016	Magdalena Ayed
9/9/2016	Gail Miller
9/9/2016	Daniel Ryan
9/9/2016	Karen Sullivan
9/9/2016	John Walkey
9/9/2016	Edward, Camille & Renee MacLean
9/9/2016	Service Employees International Union (SEIU) 32BJ, District 615
9/9/2016	Alternatives for Community & Environment, Inc. (ACE)
9/9/2016	Judy Gates
9/9/2016	Mary Ellen Welch
9/9/2016	David Aiken
9/9/2016	Kannan Thiru
9/9/2016	Frederick Salvucci
9/9/2016	Neighbors United for a Better East Boston (NUBE)
9/9/2016	Angel C
9/9/2016	Rudi Seitz
9/9/2016	Alfred A. Pucillo
9/9/2016	Lydia Edwards
9/9/2016	Patricia J. D'Amore
9/9/2016	Alexis Daniels
9/9/2016	Tina Kelly
9/9/2016	Barbara McDonough
9/9/2016	Madeleine Steczynski
9/9/2016	Karen Connor
9/9/2016	Regina Marchi
9/9/2016	Roberto Verthelyi
9/9/2016	Vanessa Fazio
9/9/2016	Chrissy Holt
9/9/2016	Liz Nofziger
9/9/2016	Heather Kros
9/9/2016	June Krinsky-Rudder

9/9/2016	Kim Foltz
9/9/2016	Nancy Lee
9/9/2016	Jessica L. Curtis, JD
9/9/2016	Matthew Neave
9/9/2016	Cindy L. Christiansen
9/9/2016	Michael Passariello
9/9/2016	Elizabeth Kay
9/10/2016	Rob Pyles
9/10/2016	Jesse Borthwick
9/10/2016	Steve Passariello
9/10/2016	Carrie Van Horn
9/10/2016	John Tyler
9/10/2016	Kristen D'Avolio
9/10/2016	Craig Belaney
9/10/2016	Cindy M. López
9/10/2016	Laura Macias Grondin
9/10/2016	Sandra Downey
9/10/2016	Christopher A. Zeien
9/10/2016	Carol Doering
9/12/2016	Department of Energy Resources (DOER)
9/13/2016	Anthony M. Majahad
9/13/2016	State Senator Boncore, State Representative Madaro, and City Councilor LaMattina
9/13/2016	Mary Mitchell
9/14/2016	Olena Chuyan
9/14/2016	Julia Howington
9/16/2016	Karen Maddalena
9/16/2016	Boston Transportation Department (BTD)

MAB/PRC/prc

Comment #	Author	Topic	Comment	Response
C.2	Matthew Beaton, Secretary	Cumulative Impacts	Subsequent ESPRs and EDRs will update the cumulative impacts of passenger growth and associated ground and aircraft operations based on revised forecasts and update and revise environmental management plans to address impacts.	The upcoming *2016 Environmental Status and Planning Report (ESPR),* will include updated passenger, operations, and cargo forecasts for future year 2035. The cumulative impact of additional flights and passenger activity levels will be assessed for noise, air quality/greenhouse gas (GHG) emissions, ground access, and water quality. Environmental management plans will be updated to address anticipated impacts, as appropriate. The document will also report on the status of Section 61 Findings for recent projects.
C.3	Matthew Beaton, Secretary	Cumulative Impacts	Future [EDR/ESPR]submittals will continue to document potential impacts and trends and propose measures to implement the broad goal of maintaining or reducing Logan's overall environmental impacts, even as annual passenger volumes rise in the future.	The upcoming *2016 ESPR,* will include updated passenger, operations, and cargo forecasts for future year 2035. The cumulative impact of additional flights and passenger activity levels will be assessed for noise, air quality/GHG emissions, ground access, and water quality. Environmental management plans will be updated to address anticipated impacts, as appropriate.
C.5	Matthew Beaton, Secretary	Cumulative Impacts	The 2015 EDR Scope includes, but is not limited to, reporting on noise, air quality, and long-term parking management. The 2015 EDR and 2016 ESPR should reflect the proposed connection to the Airport Station, provide updates on the planning and design of the connection, and identify the anticipated ridership, changes in the HOV mode share, and ground access planning considerations.	The *2015 Environmental Data Report (EDR)* describes the current state of planning for the direct connection to Airport Station. The *2016 ESPR,* to be filed in late 2017 or early 2018, will also describe progress on planning and design for the proposed connection to the Airport Station, and will identify the anticipated ridership, changes in the high occupancy vehicle (HOV) mode share, and ground access planning considerations.
C.8	Certificate Secretary Matthew Beaton	Environmental Justice/Outreach	Massport has indicated it will provide a Spanish translation of the DEIR Executive Summary. I encourage Massport to continue providing translated Executive Summaries with all future MEPA filings.	Massport has included a Spanish-language version of Chapter 1, *Introduction/Executive Summary,* of the *2015 EDR* (included after the English-version).
C.9	Certificate Secretary Matthew Beaton	Regionalization	Comments on the DEIR continue to request that Massport accommodate more demand at regional airports in lieu of or in conjunction with the proposed project. I acknowledge that long- term strategies to mitigate Logan's impacts will continue to include an emphasis on diverting travel to regional airports and to rail. As indicated in the Certificate on the ENF, regional transportation will continue to be addressed through the ESPR and EDR, not through this project specific review.	This *2015 EDR* reports on Airport planning initiatives in Chapter 3, *Airport Planning,* and the regional transportation system in Chapter 4, *Regional Transportation.* The *2016 ESPR* will also report on Airport planning and regional transportation.
C.16	Certificate Secretary Matthew Beaton	Energy / GHG	I refer the Proponent to DOER's comment letter which recommends further evaluation of CHP to address Terminal E's service water loads. Massport has indicated that conversion of equipment at Logan's Central Heating and Cooling Plant will be evaluated as the equipment reaches the end of its useful life.	A discussion of the feasibility of Combined Heat and Power (CHP) for Terminal E will be included in the *2016 ESPR* .

Comment #	Author	Topic	Comment	Response
C.17	Matthew Beaton, Secretary	EDR/ESPR	I expect that further evaluation of CHP will be evaluated as part of that process and reported in future EDRs and ESPRS.	The evaluation of the CHP will be included in the *2016 ESPR* .
C.22	Matthew Beaton, Secretary	Resiliency	The DEIR notes that Massport has consulted with CZM regarding development of coastal resiliency design measures. Massport will continue consultations with CZM and MBTA and to review existing station vulnerabilities, as operations of the Blue Line and this station are important to support Massport HOV goals. Updates on this consultation and the design measures that are considered and/or incorporated into the design to improve the MBTA station's coastal resiliency should be provided in the EDR and ESPR documents.	Updates on this consultation and the design measures that are considered and/or incorporated into the design will be provided in the *2016 ESPR,* as appropriate.
C.23	Matthew Beaton, Secretary	Energy / GHG	Massport will continue to assess the applicability of emissions reduction measures to the extent practicable and report on air quality in the ESPR and the EDR.	Massport will continue to assess the applicability of emissions reduction measures and report on air quality in the ESPR and the EDR. Chapter 7, *Air Quality/Emissions Reduction,* reports on Airport emissions in 2015. The *2016 ESPR* will report on conditions in 2016 and will assess impacts through 2035.
C.24	Matthew Beaton, Secretary	Cumulative Impacts	… project will not result in any changes to the number and type of aircraft operations when compared to the Future No-Build Alternative. It indicates that demand is driven by economic and market factors; and, therefore, growth at Logan Airport will continue to occur regardless of the Terminal E project. Cumulative impacts will continue to be addressed through the ESPR/ EDR.	The EDRs and ESPRs provide a detailed assessment and reporting of the cumulative impacts of Logan Airport aviation operations and related activities. Massport is unique among state agencies and airports in the U.S. for publishing annual environmental reports specifically designed to describe, analyze, and forecast the cumulative effects of Logan Airport operations based on current and anticipated future operating conditions. This process was developed to allow individual projects at Logan Airport to be considered and analyzed in the broader, Airport-wide context. The ESPRs and EDRs also include information regarding all the projects planned or under construction at Logan Airport and provides a preview to the public and regulators of upcoming projects and activities. Subsequent ESPRs and EDRs will update the cumulative impacts of passenger growth and associated ground and aircraft operations based on revised forecasts and will update and revise environmental management plans to address impacts. Future EDRs/ESPRs will continue to document potential impacts and trends and propose measures to implement the broad goal of maintaining or reducing Logan Airport's overall environmental impacts, even as annual passenger volumes rise in the future. These annual publications will continue reporting on Massport's progress in meeting its mitigation commitments. ESPR and EDRs provide a forum and meaningful opportunities for public review of information and analysis related to airport planning and operations, Airport activities, and effects on noise, air quality, ground access and water quality.

Comment #	Author	Topic	Comment	Response
C.25	Matthew Beaton, Secretary	RNAV	The primary purpose of the RNAV procedures is to increase safety and operational efficiency. As documented in the ESPR and annual EDR submittals, implementation of several of the RNAV procedures have generated increased noise complaints in some towns surrounding Logan Airport and I have received many comment letters from residents of the Town of Hull on this issue. The procedures themselves have resulted in aircraft at higher altitudes although patterns are concentrated over certain communities. I note that the FAA is implementing the RNAV program nation-wide. This program is separate from and unrelated to the Terminal E Modernization project.	The Federal Aviation Administration (FAA) has been actively studying the noise and other environmental impacts of proposed flight path changes to Logan Airport's runways. The Boston Logan Airport Noise Study, or BLANS, has been going on since 2008 and there has been a Logan Airport Community Advisory Committee (CAC) working with the FAA and Massport on providing community representation. Detailed information from the studies can be found at: http://www.bostonoverflightnoisestudy.com. That study continues to be the appropriate forum for those discussions. For over three decades, Massport has provided an annual report on the noise environment of Logan Airport, as documented in the EDRs and ESPRs. These annual reports also provide updates on the BLANS study and other FAA initiatives. The FAA NextGen initiative, is a national effort to improve the daily operations of the entire National Airspace System. This has resulted in changes in flight track and airspace around the country with resultant changes in the noise environment. The FAA prepared an Environmental Assessment (EA) that studies the change in RNAV, which enables aircraft to fly on any desired flight path within the coverage of ground- or space-based navigation aids, within the limits of the capability of the self-contained systems, or a combination of both capabilities. RNAV aircraft have better access and flexibility for point-to-point operations.
C.26	Matthew Beaton, Secretary	Cumulative Impacts	As noted previously, the ESPR and EDRs provide a forum and meaningful opportunities for public review of information and analysis related to these issues.	Massport is committed to providing information on activity levels and forecasts, planning projects, environmental impacts, and progress on meeting mitigation commitments in the EDRs and ESPRs. These annual documents provide an opportunity for Massport to share the status of activities with the community and receive input.
C.31	Matthew Beaton, Secretary	MEPA Process	The response can also refer to future EDRs and/or ESPRs to address issues that are not within the Scope of this review.	The Secretary's Certificates for the Terminal E Modernization Project, for the Environmental Notification Form (ENF) and the Draft Environmental Assessment (EA)/Environmental Impact Report (EIR), are provided in Appendix A, *MEPA Certificates and Responses to Comments,* of this EDR. Airport-wide issues will continue to be addressed in EDRs and ESPRs.

Comment #	Author	Topic	Comment	Response
C.32	Matthew Beaton, Secretary	MEPA Process	This directive is not intended, and shall not be construed, to enlarge the scope beyond what has been expressly identified in this Certificate.	Massport is unique among state agencies and airports in the U.S. for publishing annual environmental reports specifically designed to describe, analyze, and project the cumulative effects of Logan Airport operations based on current and anticipated future operating conditions. This process was developed to allow individual projects at Logan Airport to be considered and analyzed in the broader, airport-wide context. A brief overview of that long-standing process follows. Massport has been producing annual reports for MEPA and for public review since 1979. Initially, these annual reports were called the Generic Environmental Impact Report (GEIR) and are now called Environmental Status and Planning Reports (ESPR) with interim Environmental Data Reports (EDR). These reports assess the environmental effect of overall changes in operations at Logan Airport. The reports provide an overall context, within which changes in the total environmental impacts at Logan Airport can be assessed. As stated in the Introduction to the 1999 ESPR, "While the Logan ESPR and EDRs provide the broad planning context for projects proposed for Logan Airport and future planning concepts under consideration by Massport, no specific projects can be built solely on the basis of inclusion and discussion in the 1999 ESPR." Projects that require state (MEPA) or federal (NEPA) review undergo a separate review process. In short, Massport's annual reports provide the planning context which complements the individual, project-specific filings. This *2015 EDR* and the following *2016 ESPR* will continue report on baseline and cumulative impacts of overall airport operations.

Copy of the Secretary of the Executive Office of Energy and Environmental Affairs Certificate issued for the Terminal E Modernization Project Final Environmental Assessment/Environmental Impact Report

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November 10, 2016

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
FINAL ENVIRONMENTAL IMPACT REPORT

PROJECT NAME	: Terminal E Modernization
PROJECT MUNICIPALITY	: East Boston
PROJECT WATERSHED	: Boston Harbor
EEA NUMBER	: 15434
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: October 5, 2016

As Secretary of Energy and Environmental Affairs, I hereby determine that the Final Environmental Impact Report (FEIR) submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (MEPA; M.G.L. c.30, ss.61-62I) and with its implementing regulations (301 CMR 11.00). As noted in my Certificate on the Draft EIR (DEIR) issued September 16, 2016, the DEIR fully responded to the Scope contained in the Certificate on the Environmental Notification Form (ENF) and therefore the scope of the Final EIR (FEIR) was limited to a response to comments and draft Section 61 Findings.

Comments received on the FEIR continue to identify concerns regarding existing airport operations and noise levels and potential increases with long-term growth. I have received comment letters from elected officials (including U.S. Congressman Michael E. Capuano, the Milton Board of Selectmen, and Revere Mayor Brian Arrigo), state agencies, environmental advocacy groups, businesses, and residents. The issue of cumulative airport-wide impacts, particularly noise and air quality, is not new to the review of projects at Logan Airport. As noted in past Certificates, the EIR is not intended to address broad concerns associated with airport operations and growth. The venue for addressing cumulative environmental impacts is through the Environmental Status and Planning Reports (ESPR) and Environmental Data Reports (EDR). Through these reports, Logan Airport is subject to comprehensive and regular MEPA review, including opportunities for public comment on the cumulative impacts. This regular updating and reporting on planning and cumulative impacts is unique among State Agencies. It reflects the challenge and complexity of managing and modernizing Logan Airport within a dense, urban

area. It recognizes that the proximity of communities to the Airport warrants an enhanced level of public engagement and a concerted, long-term effort to minimize and mitigate impacts.

Subsequent ESPRs and EDRs will update the cumulative impacts of passenger growth and associated ground and aircraft operations based on revised forecasts and update and revise environmental management plans to address impacts. Future submittals will continue to document potential impacts and trends and propose measures to implement the broad goal of maintaining or reducing Logan's overall environmental impacts, even as annual passenger volumes rise in the future. The next ESPR will analyze calendar year 2016 and will likely be filed in 2017 or 2018 and the next EDR will analyze calendar year 2015 and will likely be filed in the fall of 2016.

I note many comments identify a particular concern with concentrations of flight tracks due to the Federal Aviation Administration's (FAA) area navigation (RNAV) procedures. The primary purpose of the RNAV procedures is to increase safety and operational efficiency. As documented in the ESPR and annual EDR submittals, implementation of several of the RNAV procedures have generated increased noise complaints in some towns surrounding Logan Airport. The procedures themselves have resulted in aircraft at higher altitudes and concentration of flight patterns over certain communities. I note that the FAA is implementing the RNAV program nation-wide. This program is separate from and unrelated to the Terminal E Modernization project. Nonetheless, I am aware that Massport and the FAA recently signed a Memorandum of Understanding (MOU) to frame a new process for analyzing opportunities to incrementally reduce noise through changes or amendments to Performance Based Navigation, including RNAV procedures. I commend Massport and the FAA for establishing this agreement, which is a unique project between the FAA and an airport operator. Massport has indicated that this process will incorporate community outreach and public input. I expect that updates on this process will be provided in in future ESPRs and EDRs which will provide an additional forum and meaningful opportunities for public review of information related to these issues.

Over the past year, Massport has engaged in a concerted outreach effort with elected officials, municipalities, and community groups to identify and discuss potential Massport projects, including but not limited to, Terminal E. Massport created the Logan Airport Impact Advisory Group (IAG) to solicit comment and to identify and prioritize projects and programs of significance to the IAG. I commend Massport for its outreach efforts and encourage Massport to continue a productive dialogue with interested stakeholders, including through the IAG.

I have received comments that identify concerns with other potential Massport projects, including the potential parking garage identified in the DEIR, which would require an amendment to the Logan Airport Parking Freeze Regulation (310 CMR 7.30). As noted in the DEIR and previous Certificate, the potential parking garage will be subject to MEPA review pursuant to 301 CMR (6)(a)(7) because it will be constructed by a State Agency and will include construction of 1,000 or more new parking spaces. Subsequent MEPA review will include review of potential environmental impacts and development of project-specific impact avoidance, minimization, and mitigation measures.

Project Description

The project proposes modernizing Boston-Logan International Airport's John A. Volpe International Terminal (Terminal E) with a 560,000-square foot (sf) addition that corrects facility deficiencies and accommodates current and anticipated passenger volumes. The project includes three gates which previously underwent MEPA review (International Gateway Project, EEA #9791) but were not constructed, and four additional aircraft gates, passenger holdrooms, concourse, concessions, and passenger processing areas. The project includes Customs and Border Patrol (CBP) and Federal Inspection Services (FIS) facilities to replace and expand FIS facilities that were originally reviewed under MEPA (Terminal B, Pier A Improvements/Satellite FIS Facility, EEA #12235) but also not constructed. The project includes a direct pedestrian connection between Terminal E and the MBTA Blue Line Airport Station.

Terminal E was constructed in 1974 with 12 gates and served 1.4 million annual passengers. In 2014, it served approximately five million passengers. The DEIR indicated that the current level of passenger activity routinely causes severe congestion in the terminal at peak times, leading to greatly reduced customer service, and inefficient operations in the terminal and gates. According to the DEIR, gate congestion leads to airside delays and inefficiencies on the North Apron. When no gates are available, arriving aircraft and passengers are held on the apron. The DEIR indicated that aircraft must use remote parking facilities at hardstands in the North Cargo Area and passengers are bused to the terminal during peak periods when there are insufficient gates. The DEIR built upon the information presented in the ENF regarding challenges associated with current operations at Terminal E. Massport has clearly demonstrated the need for the project and made a compelling case for the expansion.

The project is proposed in two phases. Phase 1 will be constructed from 2018 – 2022 and will include construction of four new gates with associated passenger holdrooms and elevators/escalators to relieve existing deficiencies and accommodate interim growth. A partial new concourse will be constructed to allow for future expansion to a seven-gate facility at full build-out. Phase 1 will not require modifications to roadway realignment. Phase 2 will be built by 2028 and will provide three additional gates and the MBTA connection. The project will be fully constructed and operational by 2030.

The project will displace ground service equipment (GSE), other airside activities, existing surface parking, the cell phone lot, and the gas station which will be relocated within existing airport boundaries. Relocation of ground facilities that conflict with the new concourse location, including the gas station, will occur in Phase 1.

Environmental Status and Planning Report (ESPR) and Environmental Data Reports (EDRs)

The MEPA environmental review process for Logan Airport occurs on two levels: airport-wide and project-specific. The ESPR and EDR provide a "big picture" analysis of the environmental impacts of current and anticipated levels of airport-wide activities (including aircraft operations and passenger activity), and presents comprehensive strategies to avoid, minimize and mitigate impacts. The ESPR is generally updated on a five-year basis; the most recent ESPR for the year 2011 was filed in April 2013 and it contained updated passenger activity levels and aircraft operations forecasts through 2030. EDRs evaluate environmental conditions for the reporting year as compared to the previous year and are filed in the years

between ESPRs. The most recent EDR for the year 2014 was filed in October 2015. The EDR provided a comprehensive cumulative analysis of the effects of all Logan Airport activities based on actual passenger activity and aircraft operation levels in 2014 and presents environmental management plans for addressing environmental impacts. The ESPR is supplemented by (and ultimately incorporates) the EDRs and the detailed analyses and mitigation commitments that emerge from project-specific reviews. This process provides a comprehensive and continuous review of airport programs, projects, environmental impacts and associated data.

The 2015 EDR Scope includes, but is not limited to, reporting on noise, air quality, and long-term parking management. The 2015 EDR and 2016 ESPR should reflect the proposed connection to the Airport Station, provide updates on the planning and design of the connection, and identify the anticipated ridership, changes in the HOV mode share, and ground access planning considerations.

The MEPA regulations (Section 11.06(2)) indicate that during the course of an ENF review I may review any relevant information from any other source to determine whether to require an EIR, and, if so, what to require in the Scope. To provide context for this project-specific review and because many issues raised by commenters relate to airport-wide operations and impacts, this Certificate refers to documents from the ESPR process (EEA#3247/5146).

Logan Airport and Project Site

The Airport boundary encompasses approximately 2,400 acres in East Boston and Winthrop, including approximately 700 acres underwater in Boston Harbor. The Airport is surrounded on three sides by Boston Harbor and is accessible by two public transit lines and the roadway system. The airfield is comprised of six runways and approximately 15 miles of taxiway. Logan Airport has four passenger terminals, A, B, C, and E, each with its own ticketing, baggage claim, and ground transportation facilities.

Terminal E is located adjacent to the North Cargo Area, closest to the MBTA Blue Line Airport Station. Land uses in the area of the proposed project include UPS aircraft parking and loading area, the airport's Remain Over Night aircraft parking area, the North Cargo Area equipment storage area, a building occupied by United Parcel Service (UPS), the MBTA Blue Line Airport Station, airport roadways, various short-term and cell phone parking lots, and a gas station.

The project site is located within the coastal zone of Massachusetts. The entirety of the project site is comprised of previously disturbed impervious area. It is not located in Priority or Estimated Habitat as mapped by the Division of Fisheries and Wildlife's (DFW) Natural Heritage and Endangered Species Program (NHESP). The project site does not contain wetland resource areas regulated pursuant to the Wetland Protect Act and its implementing regulations (310 CMR 10.00).

The ENF identified the following projects within the vicinity of Terminal E that have been reviewed under MEPA: Terminal A Replacement (EEA#9329), Terminal E Modifications (EEA#9324), Federal Inspection Services (FIS) Facility and West Concourse Project / International Gateway (EEA#9791), and Terminal B, Pier A Improvements/Satellite FIS Facility (EEA#12235).

Permitting and Jurisdiction

The project is undergoing MEPA review and required an ENF pursuant to 301 CMR 11.03(6)(b)(6) because it will be undertaken by a State Agency and results in the expansion of an existing terminal at Logan Airport by greater than 100,000 sf.

The project requires a Sewer Permit Modification from the Boston Water and Sewer Commission (BWSC) and may require an Industrial User Permit from the Massachusetts Water Resource Authority (MWRA). The project may be subject to Massachusetts Office of Coastal Zone Management (CZM) federal consistency review.

The project requires approval by the Federal Aviation Administration (FAA) for changes to the Airport Layout Plan and, therefore, requires an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA). The project also requires a National Pollutant Discharge Elimination System (NPDES) General Permit for Construction from the U.S. Environmental Protection Agency.

Because the project will be undertaken by a State Agency, MEPA jurisdiction is broad in scope and extends to all aspects of the project that may cause Damage to the Environment, as defined in the MEPA regulations.

Environmental Impacts and Mitigation

As described in the ENF, the project includes construction of approximately 500,000 to 700,000 sf of new floor area (for a maximum 1,500,000 sf total), and will increase both water consumption and wastewater generation by approximately 25,600 gallons per day (76,800 gpd total). The project will not create new impervious area and will eliminate approximately 60 parking spaces. The DEIR indicated that the project will accommodate existing and forecasted passenger levels and operations and, therefore, will not increase passenger enplanements or vehicle trips.

Measures to avoid, minimize and mitigate project impacts include reducing air emissions, greenhouse gas (GHG) emissions, and energy consumption compared to existing conditions by improving access to gate plug-ins, pre-conditioned air, and reducing busing operations. In addition, the building is designed to act as a noise barrier to the adjacent residential areas and Memorial Stadium Park.

Review of the FEIR

The FEIR was responsive to the scope issued in the Certificate on the DEIR. It included responses to comments filed on the DEIR and revised draft Section 61 Findings that outline Massport's mitigation commitments for the project. The FEIR included an Executive Summary of the DEIR both in English and a translated version in Spanish. The FEIR included the FAA's revised draft Finding of No Significant Impact/Draft Record of Decision (Draft FONSI/DROD) which was updated since the DEIR. This Certificate applies to the MEPA review of the project.

MEPA review cannot and does not restrict the ability of the federal government to act on those aspects of the project subject to the National Environmental Act (NEPA).

The only change to the project since the review of the DEIR is incorporation of additional mitigation measures to reduce GHG emissions (described below). No other changes to project programming, layout, or anticipated environmental impacts are identified. State Agencies did not request additional MEPA review or identify further analysis that would warrant additional MEPA review.

Response to Comments

The Response to Comments contained a copy of the DEIR Certificate and a copy of each comment letters received on the DEIR. A total of 186 comment letters were provided on the DEIR, of which 120 consisted of form letters. The FEIR contained a summary table that identified each commenter, the issues identified in their comment letter, and the corresponding section(s) of the FEIR to assist in locating the response. The FEIR contained both thematic responses to frequent comments and separate responses to individual comments. I commend Massport for providing a comprehensive response to comments and recognize the time and effort that Massport has invested in the preparation of the FEIR.

Responses to individual comments were provided for state agencies, municipalities, elected officials, and key stakeholders. Thematic responses were provided for the following categories: alternatives, cumulative impacts, environmental justice, ground transportation, health effects, induced growth, MEPA process, mitigation, noise, parking, regionalization, resiliency, RNAV departure procedures, and stakeholder outreach. Many of the comments received on the DEIR identify concerns related to existing airport operations and noise levels and potential increases in impacts associated with long-term growth. As noted in past Certificates, the EIR is not intended to address broad concerns associated with airport operations and growth. The venue for addressing cumulative environmental impacts is through the Environmental Status and Planning Reports (ESPR) and Environmental Data Reports (EDR). The Response to Comments refers to future EDRS and/or ESPRs to address these issues which are not within the Scope of this review.

As required in the Scope, the response to comments section of the FEIR provided a direct response to comments from the Department of Energy Resources (DOER) that clarified the GHG reduction measures proposed for the project and included a revised GHG analysis. Based on the revised analysis, the project incorporated two additional and significant mitigation measures: a 25,000 square feet (sf) rooftop solar photovoltaic (PV) system (300 kW) and solar thermal heating of domestic hot water for public restrooms. These two measures will reduce GHG emissions by 363 tons per year (tpy) compared to the proposed as presented in the DEIR. With these additional mitigation measures, the Preferred Alternative will reduce CO_2 emissions associated with the terminal expansion by 1,390 tpy, for a total of 3,818 tpy, or a twenty-seven percent decrease. The FEIR revised the draft Section 61 findings to reflect the revised mitigation measures.

The FEIR also evaluated and quantified the potential GHG reduction associated with the following five mitigation measures: Dual Box Minimum, Fin Tube Radiation, Energy Recovery Wheel, Dynamic V8 Filtration, and additional 50,000 sf of solar PV panels. The incorporation of these measures would reduce GHG emissions by fifty-percent. Massport has committed to continue evaluating these measures as design progresses. The FEIR also included an analysis of additional wall, roof, and fenestration improvements which indicated they are not effective GHG reduction strategies for the project. It included an evaluation of solar thermal for the concession-area hot water; however this measure remains under deliberation as concession needs are still being developed.

I acknowledge and appreciate the consultation between Massport and DOER which has resulted in the identification and commitment to additional and significant GHG emission reductions.

Mitigation/Draft Section 61 Findings

The FEIR identified measures to avoid, minimize, and mitigate environmental impacts and included draft Section 61 Findings for use by State Agencies. The FEIR clarified that the timing and responsibility for implementation of each measure. The direct connection to the Airport MBTA Blue Line Station, full sound barrier benefits associated with extending the full width of the terminal, and curb improvements will be implemented during the second phase of the project. The other energy reduction and greenhouse gas reduction measures will be implemented in the first phase of the project. Measures to avoid, minimize, and mitigate environmental impacts include:

Operational Impacts
- The Terminal E expansion has been sited and will be designed to act as a noise barrier to the adjacent East Boston neighborhoods and Memorial Stadium park to the southwest of the North Apron. The new structures will have a minimum height of 45-ft above ground level.
- New gates will have electric power and pre-conditioned air to allow aircraft to plug in at gate rather than be serviced remotely to reduce need for on-board engine/auxiliary power unit operation, thereby reducing aircraft air emissions and GHG emissions.
- New gates will increase ramp efficiency and reduce movements on North Apron and the need to bus passengers between terminal and remote aircraft parking locations, thereby reducing ground transportation related air emissions and mobile source GHG emissions.
- Roadway and curb improvements which will improve vehicle flow and high-occupancy vehicle access.
- Construction of a weather-protected pedestrian connector from the Terminal to the MBTA Airport Blue Line Station (proposed as part of Phase 2).

Sustainable Design Features/Greenhouse Gas Emissions
- Project will seek LEED Certification at the Silver level rating or better and meet or exceed the goals of the MA LEED Plus program.
- Improved building envelope (wall insulation of U-0.05, roof insulation of U-0.037, improved glazing of U-0.34, and reduced window to wall ratio of 25%).
- Improved Air Handling Units.
- Efficient water loops with reduced water supply temperature and wider return temperatures to reduce demand on the pumping and fan systems.
- Reduced interior lighting power density of 0.62 W/SF and reduced exterior lighting power of 9.3 kW.

- The roof design will incorporate materials with a minimum reflectance rating of 0.70 and emittance value of at least 0.75 for a minimum of 75% of the available roof area. Roofing materials will be non-glare to reduce heat island effect.
- Final design will incorporate infrastructure for collection, storage, and handling of recyclable materials.
- Massport will establish a project-specific goal for sourcing materials extracted, harvested, recovered, and or manufactured within New England.
- The project will be designed to achieve energy efficiencies of a minimum of 20% below the MA Energy Code.
- The project will reduce operational-related GHG emissions associated with the Project by a minimum of 30%.
- The project will include water conservation devices that reduce water use by 20% below the MA Plumbing Code.
- The project will be built 'solar ready' to accommodate rooftop solar.
- The Terminal E rooftop will include a minimum 25,000 sf of rooftop solar PV (300 kW).
- Solar thermal PV system will be used to provide hot water for the restrooms.
- Project will incorporate occupancy sensors in all indoor areas to reduce electrical demand.
- Continue to evaluate feasibility of the following measures as design progresses: Energy Recovery Wheel, additional rooftop solar PV, Dual Box Minimum, and Dynamic Filtration.
- A self-certification will be provided to the MEPA office upon completion of the project construction signed by an appropriate professional (e.g. civil engineer, traffic engineer, architect, general contractor) indicating that all of the GHG mitigation measures, or equivalent measures that are designed to collectively achieve the proposed stationary source GHG emission reduction committed to in the FEIR, have been incorporated into the project.

Air Quality
- Project will result in a decrease in carbon monoxide (CO) emissions in the area of Terminal E and the associated aircraft apron by approximately 9%, nitrogen oxide (NO_x) emissions by approximately 44%, and sulfur oxides (SO_x) emissions by approximately 33%.
- Project will result in decrease of Volatile Organic Compounds (VOCs) in the project area by approximately 6% and particulate matter (PM_{10} and $PM_{2.5}$) by approximately 9% and 25%, respectively.

Construction Period Impacts
- Development of a construction waste management plan that requires diversion or reduction of construction waste by a minimum of 75%.
- Use of high efficiency space heating/cooling systems in temporary work spaces.
- Work hours will be limited to 7:00 AM to 7:00 PM unless constrained by operational conditions at the Airport. The sound levels from construction activities will employ measures to voluntarily comply with the City of Boston's noise standards.
- Soil Management Plan will be developed based on sub-surface investigations to address identification and disposal of contaminated materials.
- Implement Indoor Air Quality (IAQ) Management Plan during construction.

- Stormwater Pollution Prevention Plan will be developed to keep sediment and contaminants out of the stormwater management system during construction.
- Soil and groundwater management during construction will be conducted in accordance with the appropriate submittals (i.e., Release Abatement Measures, Immediate Response Actions, and/or Safety Management Plans) and subsurface contamination (if encountered) will be remediated in compliance with the Massachusetts Contingency Plan.
- Measures to reduce impacts from the approximately 60 daily truck trips associated with project construction include:
  - Construction-related traffic will be required to use the North Gate using only state and federal highways and the airport roadway network to keep construction-related traffic off of local East Boston roadways.
  - Use of police detail, as necessary, to manage traffic and ensure public safety.
  - Construction companies will be required to provide off-Airport parking for their employees and to provide shuttle services or other HOV service from these locations.
- The following measures will address construction phase air quality impacts:
  - Contractor will comply with MassDEP's Clean Air Construction Initiative regarding installation of emission control devices (such as diesel oxidation catalyst and/or particulate filters) on equipment;
  - Enforcement of construction vehicle anti-idling provisions;
  - Retrofitting diesel construction equipment with diesel oxidation catalysts and/or particulate filters;
  - Fugitive dust will be controlled via wetting or sweeping and all trucks hauling materials from the construction site will be covered.

Conclusion

Based on a review of the FEIR, comment letters, and consultation with State Agencies, I find that the FEIR adequately and properly complies with MEPA and its implementing regulations. Future EDRs and ESPR submittals will continue to document potential impacts and trends and propose measures to implement the broad goal of maintaining or reducing Logan's overall environmental impacts, even as annual passenger volumes rise in the future. Massport and State Agencies should forward copies of the final Section 61 Findings to the MEPA Office for publication in accordance with 301 CMR 11.12.

November 10, 2016
Date

Matthew A. Beaton

Comments received:

10/08/16 David Waite
10/10/16 Sarah James
10/10/16 Peter Houk
10/15/16 Marjorie Smith
10/18/16 Lahra Tillman

10/18/16 Maureen Wing
10/18/16 Reena Freedman
10/18/16 John Vitagliano
10/21/16 David Bowen
10/21/16 Ken Bader
10/23/16 Estella and David Keefer
10/24/16 Carolann Barrett
10/25/16 Shelia Mooney
10/27/16 Luke Preisner
10/28/16 Frederick Salvucci
10/28/16 Mary Ryan
10/31/16 Amelia Kantrovitz
10/31/16 Caslynn Carambelas and Vaishal Patel
10/31/16 Elizabeth Gazda
10/31/16 Juan Carlos Garzon
10/31/16 Stephen Raymond
10/31/16 Scott Johnson
10/31/16 Julie Vail
11/01/16 Sema Bekiroglu
11/01/16 Catherine Stacy
11/01/16 Cady Landa
11/01/16 Dominica Bonanno
11/01/16 Congressman Michael Capuano
11/01/16 Hull Neighbors for Quiet Skies
11/02/16 Tonya Saccardo
11/02/16 Robert Saccardo
11/02/16 Milton Board of Selectmen
11/02/16 Matthew Stachler, M.D., Ph.D.
11/03/16 Barbara L Lawrence
11/03/16 Magdalena Ayed
11/03/16 City of Lynn, Bill Bochnak, Massport CAC & Logan Airport Member
11/03/16 G. Bernadette Cantalupo, 156 Porter St.
11/03/16 William Schneiderman
11/04/16 Gail Miller
11/04/16 Massachusetts Department of Environmental Protection (MassDEP)
11/04/16 Chris Marchi
11/04/16 James Linthwaite
11/04/16 Catherine Stalberg
11/04/16 Mary Ellen Welch (1 of 2)
11/04/16 Mary Ellen Welch (2 of 2)
11/04/16 Department of Energy Resources (DOER)
11/04/16 Vickie Livermore
11/04/16 City of Revere, Mayor Arrigo
11/04/16 AIR Inc., Aaron Toffler
11/04/16 Deborah Hartman
11/04/16 Mimi Callum
11/04/16 Andrea Vilanova
11/04/16 Ann Jansen
11/04/16 John Casamassima
11/04/16 Alyssa Vangeli
11/04/16 Tara Ten Eyck
11/04/16 Boston Harbor Now

11/07/16 28 Form Letters from Residents of the Porter156 Condominium Association
11/07/16 Jesse Borthwick

MAB/PRC/prc

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Comment Letters and Responses

- The seven comment letters received by the Massachusetts Environmental Policy Act (MEPA) Office on the *2014 Environmental Data Report (EDR)* are reprinted here in the order shown below. As requested in the Secretary of the Executive Office of Energy and Environmental Affairs' Certificate, Massport has provided responses to substantive comments raised in the following letters:
  - Richard C. Rossi, City Manager, City of Cambridge
  - Cindy L. Christiansen, PhD., Town of Milton resident
  - Board of Selectmen of the Town of Milton, H. Thomas Hurley, David T. Burnes, and Kathleen M. Conlon
  - Jill Valdes Horwood and Julie Wormser, The Boston Harbor Association
  - Stephen H. Kaiser, PhD, City of Cambridge resident
  - Nancy S. Timmerman, P.E., consultant in Acoustics and Noise Control
  - Robert D'Amico, Boston Transportation Department

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City of Cambridge
Richard C. Rossi • City Manager

Executive Department
Lisa C. Peterson • Deputy City Manager

November 5, 2015

Matthew Beaton, Secretary
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Re: EOEA #3247 Logan Airport 2014 EDR

Dear Secretary Beaton:

The City of Cambridge is pleased to have the opportunity to submit comments on Massport's 2014 Logan Environmental Data Report (EDR).

The City of Cambridge continues to be greatly concerned about noise generated by the increasing number of flights at Logan and the use of runway 33L which increased for both arrivals and departures in 2014. These increases began in 2007, continued in 2008 and 2009, and reached 33% by 2010 but then fell due to construction at the runway ends. The levels have climbed again over the last two years, representing an increase of 33% when arrivals and departures are combined.

This increase, combined with the RNAV put in place in 2013 which concentrated the path of flights over north Cambridge, has had a significant effect on the quality of life for many in that neighborhood. The City has asked for assistance from Massport only to be told that it was in the jurisdiction of the Federal Aviation Administration (FAA). The response from FAA was that it would only entertain requests to re-review this RNAV from Massport. The City of Cambridge would like MEPA to require that Massport
cooperate with all affected communities, including Watertown, Belmont, Arlington and Somerville and 1-1
make a formal request of the FAA to look at alternatives to the RNAV, including getting flights to higher altitudes sooner after take-off than they currently do. Massport and FAA should also cooperate on ways
to reduce noise including requiring carriers at Logan to use newer, quieter technology, such as stage IV 1-2
aircraft, as well as other methods to reduce the total noise generated by flights.

I appreciate the MEPA office's consideration of these concerns and look forward to your efforts to address them. Please feel free to contact Bill Deignan at 617-349-4632 or wdeignan@cambridgema.gov if you have any questions in regard to these comments.

Very truly yours,

Richard C. Rossi

Richard C. Rossi
City Manager

City Hall • 795 Massachusetts Avenue • Cambridge • Massachusetts • 02139
617-349-4300 • fax: 617-349-4307 • tty: 617-492-0235 • www.cambridgema.gov

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Comment #	Author	Topic	Comment	Response
1-1	Richard C. Rossi, City of Cambridge, City Manager	Noise	The City of Cambridge would like MEPA to require that Massport cooperate with all affected communities, including Watertown, Belmont, Arlington and Somerville and make a formal request of the FAA to look at alternatives to the RNAV, including getting flights to higher altitudes sooner after take-off than they currently do.	The Federal Aviation Administration (FAA) has been actively studying the noise and other environmental impacts of proposed flight path changes to Logan Airport's runways. The Boston Logan Airport Noise Study, or BLANS, has been ongoing since 2008 and there has been a Logan Airport Community Advisory Committee (CAC) working with the FAA and Massport on providing community representation. Cambridge, Watertown, Belmont, Arlington, and Somerville are all member communities of the CAC. Detailed information from the studies can be found at: http://www.bostonoverflightnoisestudy.com. This study continues to be an open forum for these discussions. On October 7, 2016, Massport and the FAA signed a Memorandum of Understanding (MOU) 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.
1-2	Richard C. Rossi, City of Cambridge, City Manager	Noise	Massport and FAA should also cooperate on ways to reduce noise including requiring carriers at Logan to use newer, quieter technology, such as stage IV aircraft, as well as other methods to reduce the total noise generated by flights.	Massport does encourage the use of newer, quieter technology at Logan Airport. Over 97 percent of the 2014 fleet of operations are Stage IV or Stage IV equivalent. See Table 6-2 in the *2014 Environmental Data Report (EDR)* for percentage of commercial jet operations by Part 36 stage category. Key environmental impacts of Airport-wide activities at Logan Airport have decreased significantly in the past 15 years, even while passenger levels and other measures of activity have increased. Chapter 6, *Noise Abatement* of the *2014 EDR* documents a 50 percent decline in the number of people exposed to Day-Night Average Sound Level (DNL) 65 dB or higher. In 2005, Massport established a demand management program designed to prevent air carriers from over-scheduling Logan Airport's ability to accommodate demand. Based on pre-determined aircraft schedule thresholds, Massport will implement a peak-period surcharge designed to shift operations out of the daily peak operating periods. When needed, this will reduce airfield congestion and delay and associated noise and air emissions. 740 CMR 27.00 provides the basis for Massport to monitor published air carrier schedules and non-scheduled demand, and request that aircraft operators, with assistance from the FAA if appropriate, voluntarily adjust their schedules or intended use of the Airport to avoid runway use delays. The regulation also provides the basis upon which peak period conditions can be declared based upon the projected level of runway use delays at the Airport, and for the establishment of a peak period surcharge payable by aircraft operators. Under the regulation, Massport regularly monitors and projects aircraft operational demand based upon published schedules and other information. Annual peak period monitoring reports are published by Massport in the EDR/ESPR filings.

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November 6, 2015

The Honorable Matthew Beaton, Secretary
Executive Office of Energy and Environmental Affairs
Attn: Massachusetts Environmental Policy Act ("MEPA") Office
Anne Canaday, EEA No. 3247
100 Cambridge Street, Suite 900
Boston, MA 02114

Re: Comments to Boston-Logan International Airport 2014 Environmental Data Report
(2014 EDR), EOEA #3247

The Town of Milton appreciates your efforts to inform communities of Boston Logan International Airport's activities and environmental conditions through the 2014 Environmental Data report. Milton, a 13.5 square miles town south of Logan, is one of the most heavily burdened communities as this current and previous EDRs/ESPRs show. There are three arrival paths, 4R, 4L GPS, and 4L visual, and a very low, relative to our distance from the runway, southbound departure RNAV path from R27 over our mostly residential community. These concentrated paths direct jets and turboprops over all of our six public school buildings, over the numerous private schools in our town, and our parks, sometimes for four or five days in a row with only a five hour break from the planes during the nighttime hours. Milton also suffers from southbound 33L departures, a route that could have been made to turn further west, and the frequent arrivals and departures from aircraft that do not follow the standard flight paths.

Although there are responses to comments from my January 26, 2015 letter regarding the 2012-2013 Environmental Status and Planning Report, several have not received the attention they deserve. I also note some new concerns specific to this 2014 report.

1. The statistics in this report are questionable because of several inconsistencies. Errors like this bring into question the entire "Data Report". Here are some examples. **Please explain these.**
    1. There is a difference of 10,027 jet operations between the numbers posted on the Massport site and those reported in the 2014 EDR for the 2014 calendar year. There is a difference of 11,382 in 2013, a difference of 7,128 in 2012, and a difference of 9,866 in 2011. **Which are correct? How do these inconsistencies affect the DNL estimates?** 2-1
    2. On page 1-5 the report states that 4L was used more frequently in 2014 than in 2013. Massport data shows 4L was used for 4.7% of jets in 2014 (7,047) and 5.5% of jets in 2013 (8,093). The 2014 EDR Table 6-5 reports that 4L was used for 5% of jets in 2014 and 6% of jets in 2013 – again, a contradiction to the statement that the 4L was used more frequently in 2014 than in 2013. 2-2
2. The parallel runways 4R and 4L are approximately 1,400 feet apart. Construction of new parallel runways cannot, by law, be built this close together today. The lack of separation, the overuse of these runways, and their common use when there are strong crosswinds sets up the likelihood of a catastrophic event over Milton. I ask that future EDRs and ESPRs include
    1. **Statistics on the number of go-arounds by arrival runway ends** 2-3
    2. **The proportion of aircraft that required a go-around to land**

3. **Explanation of how go-arounds are counted in the runway use and in the estimated DNL** 2-3 Cont.

3. The report comments to my concern last year about the A380 saying that the A380 is one of the quietest aircraft in existence. This might be true with respect to engine noise but it is not true with respect to noise generated from the aircraft frame and the fact that aircraft arriving over Milton have their wheels down at approximately 8 miles out. **How is the difference in engine versus airframe noise for arrivals accounted for in your estimates of DNL?** 2-4
4. Non-compliance to FAA standards by the jets that overfly Milton continues to be a substantial problem for residents of Milton. In the EA for the 33L RNAV the 33L flightpath designates the planes to fly to CBEAR waypoint before turning south. Many planes do not follow the designated flightpath and turn before CBEAR thus flying at lower altitude over Milton. Approaches to runway 4R over Milton typically are lower than the 4R RNAV standard. Aircraft flying the 4L visual often are so low that residents report being "scared". I again request that
    1. **MASSPORT provide non-compliance statistics based on its radar data that is used to calculate DNL estimates in this report.**
    2. **Comparisons of MASSPORT DNL estimates to that of the FAA when the REAL CONTOURS software is not used.**
    3. **Massport reports the minimum, maximum, median, average, and standard deviation of the altitude used by aircraft arriving the 4L visual calculated at two Milton locations.** 2-5
    4. **Massport reports the minimum, maximum, median, average, and standard deviation of the altitude used by aircraft arriving the 4R calculated at two Milton locations.**
5. Next year's Massport Environmental Data Report should use the AEDT software for its DNL estimates, as has been required since May 2015. **I understand that there is an option in that software to output the measure of the imprecision of the DNL estimates (or the margin of error at the typical 95% confidence). I asked that, that this be added to the reports. Also, I request that the DNL estimates from the AEDT and the INS software packages be compared in your next report.** 2-6
6. The May 2014 study by Hudda, et.al. of ultrafine particle counts as far as ten miles from the heavily used arrival runways at LAX indicate a concern for the amount of ultrafine particles residents of Milton are exposed to due to the heavily used 4R and 4L arrival runways. We understand that ultrafine particles currently are not regulated. The 2014 EDR comment to the concern I raised last year is inadequate and given the fact that there have been two additional peer-reviewed studies (in Ontario and the Netherland) since the May 2014 study at LAX, it appears that the response that the ESPRs/EDRs will report on the findings of other studies has not happened. I have attached a report I created for the Chair of Milton's School Committee on 2-7 the health effects of traffic pollution on children's and adult's health. **Given that MASSPORT has the equipment to study air pollution from aircraft that overly our town, I request a study of air pollution be conducted along the 4R and 4L RNAV paths when in use for arrivals.** 2-8
7. We continue to note the unfair runway use distribution for arrivals. MASSPORT reports NE winds approximately 18% of the time and southeast winds about 17% of the time. However, runways 4R/4L arrivals receive about 35% of the jet arrivals, the recent Volpe analysis for the 4L 2-9

RNAVS used a rate of 40%, but 15R, what should be the runway of choice with SE winds, only receives about 1% of the arrivals. **How is this equitable or fair and what will MASSPORT do to fix this inequity of noise and air pollution burden forced onto our town?** 2-9 Cont.

8. The non-jet arrivals and departures over Milton also are excessive. Our community is very concerned about the pollution from these low-flying planes from their use of leaded fuel. As the flight track maps in the report show, our community receives a substantial percentage of these flights too. **We ask that MASSPORT conduct studies of lead poisoning in communities under these flight paths.** 2-10

Cindy L. Christiansen, PhD
59 Collamore St.
Milton, MA 02186
cLcMilton@gmail.com
Logan CAC representative, Milton

1 attachment
cc: Milton Board of Selectmen

Introduction: how and why this document was created

This document contains an introduction and four other parts

1. What are particulates? This section takes an article from Tufts University and reduces it to a 2-page summary.
2. Scientific references on evidence that areas under aircraft arrival paths and communities around airports have air pollution similar to that found close to highways
3. Scientific references on the assocation between air and noise pollution and children's health
4. Scientific references on the assocation between air and noise pollution and adult's health

The document is meant to give an overview of recent, high-quality scientific studies of noise and air pollution from aircraft. It shows that air pollution from airplane arrivals is similar to air pollution from highway traffic. It then reports strong evidence that exposure to this type of pollution is associated with increased risk of autism and asthma in children and in cardiovasular disease, mortality, lung cancer, and chronic obstructive pulmonary disease (COPD) in adults. Should we be concerned? Yes, concerned enough to request, support, even demand, air quality testing and studies of noise and effects of ultrafine particles on health.

There are many more health studies and findings, but (most of) the studies included here are well-regarded by experts in these fields. Although the Logan health study was not peer-reviewed, it is included because of its relevance to our location.

One topic in section 4 (adults) was included because of some residents concerns about a possible breast cancer cluster in Milton. As noted in that section, the evidence of association between pollution and breast cancer is not strong, but worth flagging as a possibility given some residents' concerns.

It is not news that pollution from engines that burn petroleum products is bad for our health.

However, questions remain as to how much of the pollution from the aircraft that fly over Milton is in our air or on our homes, cars, etc. We need studies that measure pollution to have a better understanding of this. With respect to noise pollution, we know from personal experience that many residents have anxiety, sleep-disturbance, limited outdoor time, and other physical and mental health reactions to the excessive noise from the concentrated flight paths over most of Milton.

We should not overstate these results but should continue to gather more information; it is the responsible thing to do for Milton's residents and also for the residents in cities and towns where similar burdens from planes exist.

Social justice here and elsewhere.

Big thanks to Wig Zamore, CAC representative from Somerville, for his help in identifying quality studies and for his review of the penultimate version of this document and to Michael Baumgartner for his translation of the article about the environmental study done in Germany on airplane noise.

Cindy L. Christiansen, PhD, 10/28/15; cLcmilton@gmail.com

What are Particulates?

Big Road Blues http://now.tufts.edu/articles/big-road-blues-pollution-highways
This story first appeared in the Summer 2012 issue of Tufts Medicine *magazine.* ***David Levin*** *is a freelance science writer based in Boston.* This is an abridged version of the original article. For the complete article, please see the link above.

"When it comes to air pollution, the main thing that really affects people is particulates —not gases," says Doug Brugge, the study's principal investigator and a professor of public health and community medicine at Tufts. Most of the mortality, most of the economic impact [of fine and ultrafine particulates] are coming from cardiovascular disease. It's not primarily asthma or lung cancer," says Brugge.

Because of their small size—some are just a few molecules across—tiny particulates are essentially minuscule bullets, delivering toxins deep into the body where larger particles can't reach. "The Environmental Protection Agency estimates that they cause 80,000 or 100,000 deaths a year in the United States, and maybe four million or more worldwide," Brugge says.

Over the last 30 years, growing numbers of studies have shown that smaller particulates emitted by trucks and cars barreling down our nation's highways can promote heart disease and strokes. The EPA regulates these tinier hazards, to a point, but Brugge is concerned that the agency hasn't gone far enough to safeguard the health of roadside residents.

Small, Smaller, Smallest

Fine and ultrafine particles are much smaller than the width of a human hair, with ultrafines posing the greater potential risk to human health. Particulates come in a few different flavors, each smaller than the next, and each with its own implications for public health. Coarse particulates (known as "PM10" in the public health world) measure about 10 microns across—roughly one-seventh the width of a human hair. They're mostly made up of dust from construction, vehicular tire and brake wear and the road surface itself. As particulates go, they're not as high on Brugge's hit list.

It's the really tiny stuff, he says, that poses the real danger: fine particulates (PM2.5) — particles smaller than 2.5 microns—and "ultrafines" (PM0.1), the smallest of the small, at 0.1 microns and below. These are created almost exclusively by combustion. As a car or truck engine runs, its exhaust gases condense into minuscule blobs within seconds of leaving the tailpipe. Some blobs are made up of unburned oil and gasoline; others form out of the countless chemical byproducts of burning fossil fuels.

Yet Brugge says there's reason to think that ultrafine particles, which the EPA does not regulate, are even more insidious than their larger counterparts. Unlike fine particulates (PM2.5), which don't change much from day to day, ultrafines can fluctuate dramatically over the course of a morning or afternoon, depending on the weather and how many cars and trucks are on the road. Ultrafines are also confined to a relatively small area. While fine particulates disperse over an entire city, their tinier cousins stick close to major highways, often spiking dramatically within a few hundred meters of the source.

Matters of the Heart

"Larger particles can't cross the barrier from the lungs to the bloodstream," says David Weiss, who has worked on analyzing neighborhood health surveys. "But the ultrafine particles can."

"For people who move away from the highway, it's like they quit smoking," says Wig Zamore, a longtime resident of Somerville with a master's degree in urban planning. Over the past decade, Zamore has worked with community groups on public health and clean-air issues, and is a member of the CAFEH steering committee, a group of academics and community members who help guide the study's research.

"Their risk pretty immediately starts to go down, and for the people who move closer to a highway, their risk immediately starts to go up over a matter of just a couple years," he says, citing a 2009 study by the University of British Columbia.

One City's Response

Kevin Stone, a field team member for CAFEH, has lived in the Ten Hills neighborhood for 25 years. He says that many of his neighbors simply haven't heard about the potential health risks of living near a highway. "This one friend of mine lives at the top of the hill, right next to the highway. He's got all his windows wide open, and he's saying, 'Isn't this just a great view of Boston?'" Stone laments, shaking his head. "I'm saying to myself, 'You don't even realize what you're sucking in right off of I-93. You're getting really exposed to this stuff!'" At the very least, Stone says, he'd like to see warning signs posted on the bike path that runs alongside the interstate. It's a small gesture, but it is something that would give residents an idea of what they might be breathing during rush hour.

Pollution from aircraft arrivals is similar to pollution from highways

The FAA has imposed new concentrated flight paths (called RNAVs) on Milton and on cities and towns across the country. They have not studied the health effects on people living below these paths.

Pollution from the burning of petroleum products in aircraft engines at altitudes less than 3,000 feet tends to stay in the atmosphere where we live and breathe. Planes on the arrival paths over Milton fly at less than 3,000 feet, often at 1,700 and Massport has reported that some are even lower.

The LAX study of Ultrafine Particles from Arrivals[i]

A May 2014 study found a doubling of **ultrafine particle number (UFP) concentrations** extending east more than 10 miles downwind from the LAX airport along the arrival path for the airport's two parallel runways. UFP concentrations were four times higher than background concentrations at a distance of six miles.

At its furthest point, Milton is about 10 miles from the runway ends for the parallel runways at Logan called "the 4's" (4R and 4L, for the right and the left runways). At highway 93 and Granite Ave, the arrivals are about 5 miles from the runway ends.

"LAX may be as important to LA's air quality as the freeway system," Fruin said. Scott Fruin is the senior author on the article published on this work in Environmental Science and Technology. Also, lead author, Neelakshi Hudda, said "Other airports generally have less steady wind directions, which would make these measurements more difficult," Hudda said. "Similar impacts are probably happening, but their location likely shifts more rapidly than in Los Angeles."

What does this study mean for Milton?

It is likely that Milton residents are exposed to increased concentrations of UFP from the more than 50,000 jet arrivals over our town each year. Experts expect that the dramatic finding of twice the number of UFP at 10 miles out might be a worst case scenario because other airports have more change in wind direction than the Los Angeles area typically experiences. Measuring UFP and other pollutants when the FAA uses the 4's for arrivals is needed to know for sure.

Since this study, two more have shown increases in UFP along flight paths and around airports in Toronto and the Netherlands[ii] [iii].

Planes and concentrated flight paths, similar to vehicles on major highways, have been shown to increase ultrafine particle number concentrations.

A synopsis of recent scientific findings published in respected journals related to traffic and aircraft pollution and children's health, specifically *autism, cognition, and asthma*

Traffic-Related Air Pollution, Particulate Matter, and Autism[iv]

Exposure to traffic-related air pollution, nitrogen dioxide, PM2.5, and PM10 during pregnancy and during the first year of life was associated with autism. Further epidemiological and toxicological examinations of likely biological pathways will help determine whether these associations are causal.

Does Traffic-related Air Pollution Explain Associations of Aircraft and Road Traffic Noise Exposure on Children's Health and Cognition? A Secondary Analysis of the United Kingdom Sample from the RANCH Project[v]

Air pollution exposure levels at school were moderate, were not associated with a range of cognitive and health outcomes, and did not account for or moderate associations between noise exposure and cognition. **Aircraft noise exposure** at school was significantly associated with poorer recognition memory and conceptual recall memory after adjustment for nitrogen dioxide levels. **Aircraft noise exposure** was also associated with poorer reading comprehension and information recall memory after adjustment for nitrogen dioxide levels. **Road traffic noise** was not associated with cognition or health before or after adjustment for air pollution.

Childhood Incident Asthma and Traffic-Related Air Pollution at Home and School[vi]

Asthma risk increased by about 50% with modeled traffic-related pollution exposure from roadways near homes and near schools. Traffic-related pollution exposure at school and homes may both contribute to the development of asthma.

Two other publications are worth noting

Pilot study of high-performance air filtration for classroom applications[vii]

Although most of the legislative efforts should focus on ambient PM (particulate matter) reduction policies, the installation of highly effective air filtration devices in schools may be an important mitigation measure to minimize exposure of children to indoor pollutants of outdoor origin, especially at schools located near heavily trafficked freeways, refineries, and other important sources of air toxics.

Logan Airport Health Study[viii]

Among children, study results identified respiratory effects indicative of undiagnosed asthma i.e., probable asthma); children in the high exposure area were estimated to have three to four times the likelihood of this respiratory outcome compared with children in the low exposure area.

A synopsis of recent scientific findings published in respected journals related to traffic and aircraft pollution and adult's health, specifically *Cardiovascular disease, Breast cancer (see note), Lung cancer, Mortality, and Chronic obstructive pulmonary disease (COPD)*

Cardiovascular disease and mortality

Residential exposure to aircraft noise and hospital admissions for cardiovascular diseases: multi-airport retrospective study[ix]

Averaged across all airports and using the 90th percentile noise exposure metric, a zip code with 10 dB higher noise exposure had a 3.5% higher cardiovascular hospital admission rate, after controlling for covariates. Despite limitations related to potential misclassification of exposure, the authors found a statistically significant association between exposure to aircraft noise and risk of hospitalization for cardiovascular diseases among older people living near airports.

Note: FAA's estimates of the noise metric, DNL, varies across Milton by 10 dB or more.

Aircraft noise and cardiovascular disease near Heathrow airport in London: small area study[x]

High levels of aircraft noise were associated with increased risks of stroke, coronary heart disease, and cardiovascular disease for both hospital admissions and mortality in areas near Heathrow airport in London. As well as the possibility of causal associations, alternative explanations such as residual confounding and potential for ecological bias should be considered.

Airport noise and cardiovascular disease; the link seems real: planners take note[xi]

These studies provide preliminary evidence that aircraft noise exposure is not just a cause of annoyance, sleep disturbance, and reduced quality of life but may also increase morbidity and mortality from cardiovascular disease. The results imply that the siting of airports and the consequent exposure to aircraft noise may have direct effects on the health of the surrounding population. Planners need to take this into account when expanding airports in heavily populated areas or planning new airports.

Near-Roadway Air Pollution and Coronary Heart Disease: Burden of Disease and Potential Impact of a Greenhouse Gas Reduction Strategy in Southern California[xii]

Some of this studies results: In 2008, an estimated 1,300 Coronary Heart Disease (CHD) deaths (6.8% of the total) were attributable to traffic density, 430 deaths (2.4%) to residential proximity to a major road and 690 (3.7%) to elemental carbon (EC). …These results suggest that a large burden of preventable CHD mortality is attributable to near-roadway air pollution (NRAP) and is likely to increase even with decreasing exposure by 2035 due to vulnerability of an aging population. Greenhouse gas reduction strategies developed to mitigate climate change offer unexploited opportunities for air pollution health co-benefits.

Changes in Residential Proximity to Road Traffic and the Risk of Death from Coronary Heart Disease[xiii]

Living close to major roadways was associated with increased risk of coronary mortality, whereas moving away from major roadways was associated with decreased risk.

Adult Health (continued)

Breast Cancer

Postmenopausal Breast Cancer Is Associated with Exposure to Traffic-Related Air Pollution in Montreal, Canada: A Case–Control Study[xiv]

We found evidence of an association between the incidence of postmenopausal breast cancer and exposure to ambient concentrations of NO2. Further studies are needed to confirm whether NO2 or other components of traffic-related pollution are indeed associated with increased risks.

Note: This is the only recent study showing an association between air pollution and breast cancer. It is a flag of a possible association but should not be interpreted to be a strong finding of risk at this time. Nitrogen dioxide is generally considered a good marker for the primary transportation pollutants though few think it is the main agent. The main agent is more likely particles.

Lung Cancer

Urban Air Pollution and Lung Cancer in Stockholm[xv]

The authors' results indicate that urban air pollution increases lung cancer risk and that vehicle emissions maybe particularly important.

Other publications worth noting

Logan Airport Health Study[xvi]

Among adult residents, individuals diagnosed with chronic obstructive pulmonary disease (COPD) were statistically significantly more likely to have lived in the high exposure area for three or more years.

A 2009 German environmental study of over a million people who live around airports[xvii]

Starting at a comparatively low aircraft noise of 40 decibels of continuous noise, the risk of cardiovascular diseases in men and women increases significantly and steadily. Greiser regards the legal limits and noise specifications of levels over 60 decibels, which are still deemed reasonable by airport operators, as "irresponsibly high." The lives of residents living around airports are particularly in danger when aircrafts fly over their homes at night. In fact, according to Greiser's data, women are exposed to higher health risks [than men]. Women in areas affected by noise are also more often treated for depression than women living in other areas. Even an increased leukemia and breast cancer risk was seen in women, says Greiser and calls for further investigations. It is conceivable that sleep deprivation and stress caused by aircraft noise could weaken the body's immune system and favor the spread of cancer cells. See also: http://www.researchgate.net/profile/Eberhard_Greiser3

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Health Perspect DOI: 10.1289/ehp.1408865, Advance Publication, http://dx.doi.org/10.1289/ehp.1408865

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[xvi] Logan Airport Health Study, Executive Summary, A Report From Massachusetts Department of Public Health Bureau of Environmental Health, 2014. Complete set of documents available here.

[xvii]A 2009 German environmental study of over a million people who live around airports, Tödlicher Lärm - Spiegel, Nr. 51, 14 Dezember 2009, Page 45 (German)

an increase since 2011 and 2012. In 2013, Areas affected by arrivals to Runway 33L and Runway 32 as well as areas affected by departures from Runway 27 and Runway 33L showed an increase in dwell and persistence.

Figure 6-15 Comparison of Annual Hours of Dwell Exceedance by Runway End, 2009 to 2013

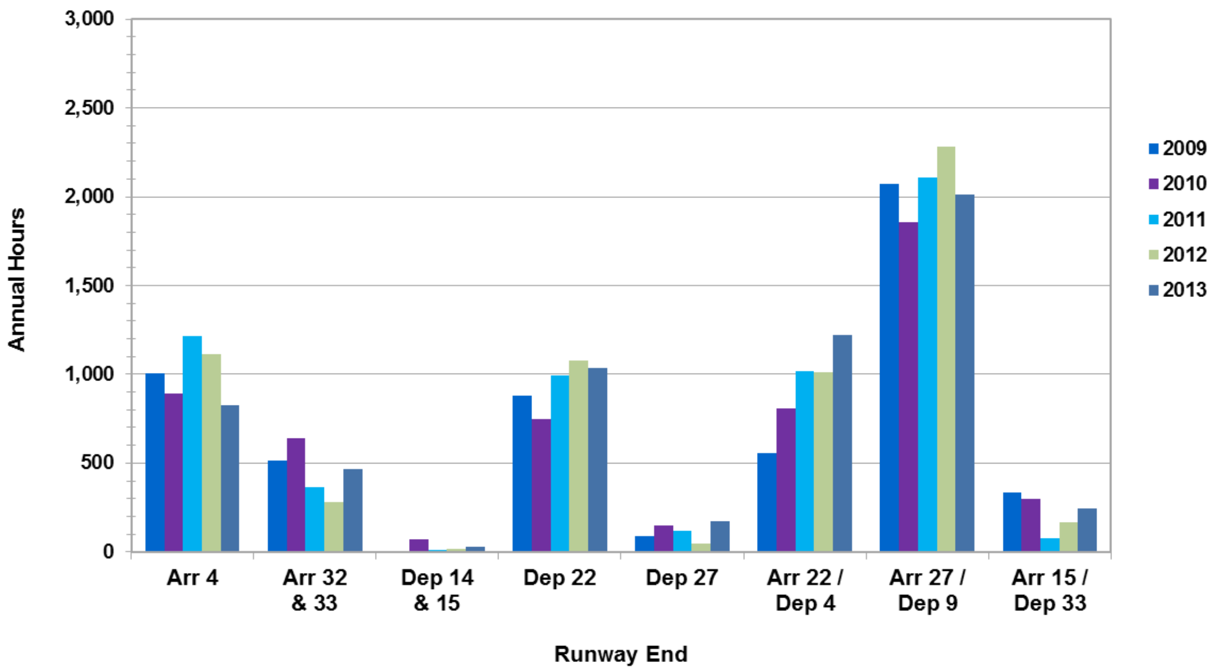


Figure 6-16 Comparison of Annual Hours of Persistence Exceedance by Runway End, 2009 to 2013

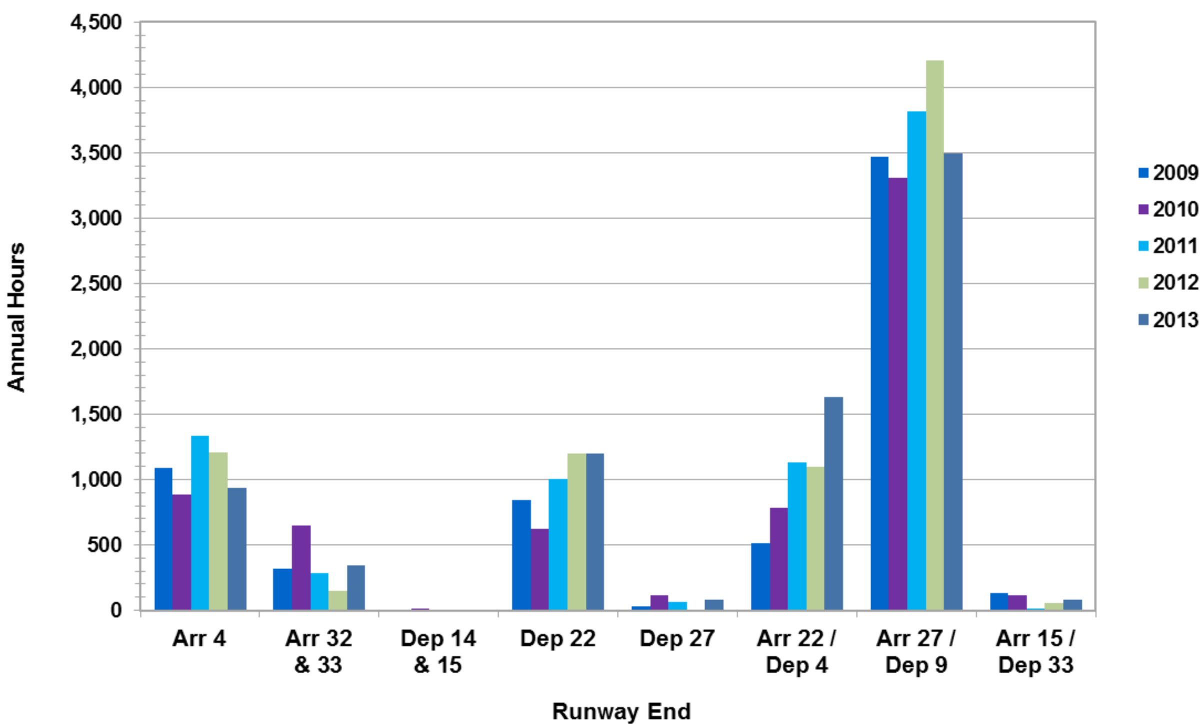


Figure 6-13 Comparison of Annual Hours of Dwell Exceedance by Runway End, 2010 to 2014

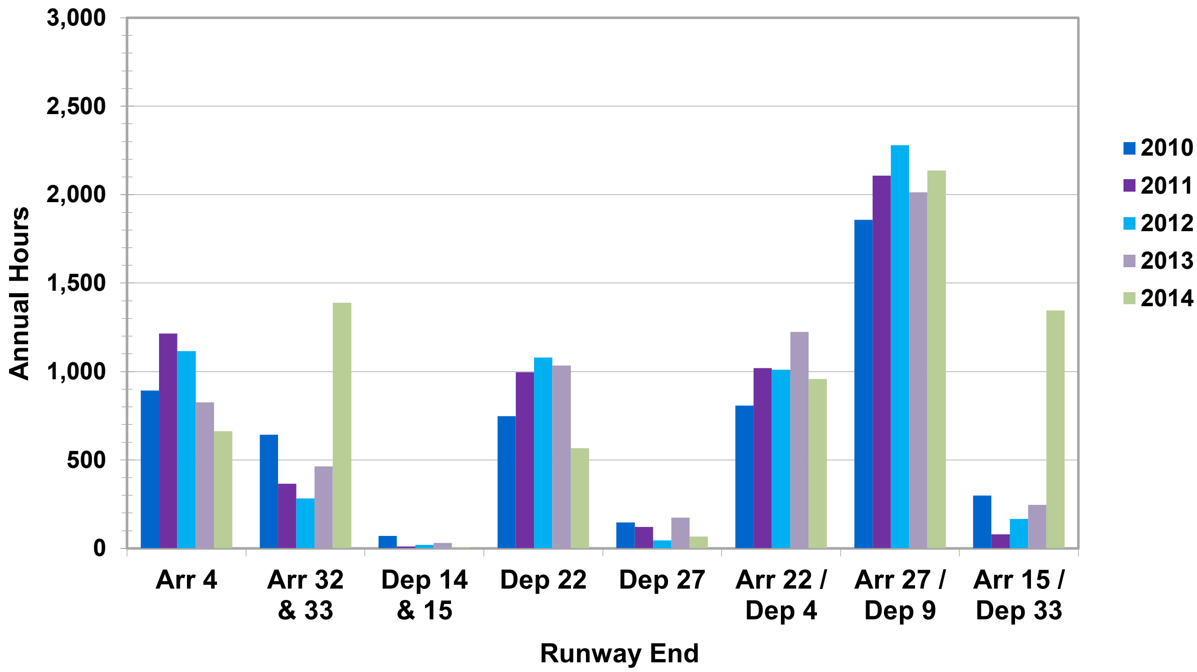
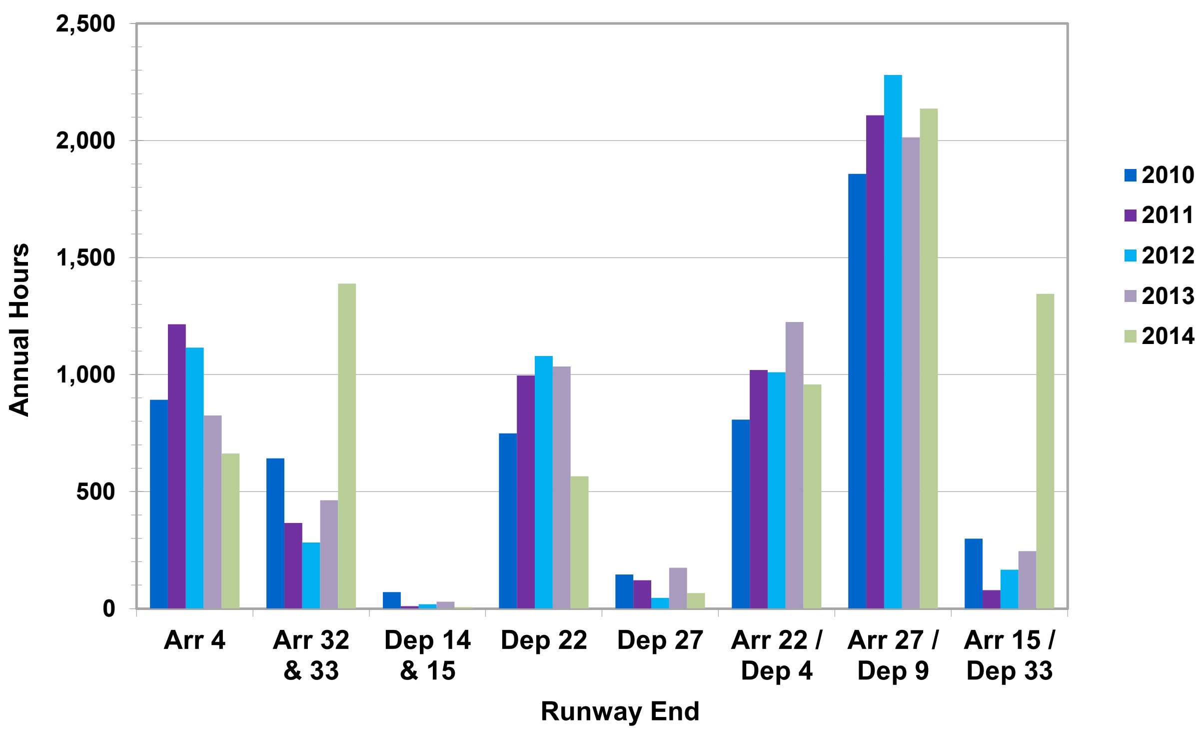


Figure 6-14 Comparison of Annual Hours of Persistence Exceedance by Runway End, 2010 to 2014



From: Cindy L. Christiansen [mailto:clcmilton@gmail.com]
Sent: Sunday, November 08, 2015 6:19 PM
To: internet, env (ENV); Canaday, Anne (EEA)
Cc: Annemarie Fagan
Subject: Re: Comments EDR 2014; Attention Anne Canaday, EEA No. 3247

I know it is past your comment deadline but this weekend I found another major problem in the dwell and persistence statistics in this years EDR. I've attached the 2 graphs from the EDR 2012-13 and from the EDR 2014.

Seems that the persistence graph in the EDR 2014 is just the dwell graph with a different vertical axis. With these 3 substantial errors and a few more minor ones, I believe Massport needs to re-do the entire report. Thank you for considering this. 2-11

++++++++++++++++
Cindy L. Christiansen, Ph.D.
59 Collamore Street
(617) 322-9323
Town Meeting Member Pct. 7

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Comment #	Author	Topic	Comment	Response
2-1	Cindy L. Christiansen, PhD., Resident Town of Milton	Activity Levels	There is a difference of 10,027 jet operations between the numbers posted on the Massport site and those reported in the 2014 EDR for the 2014 calendar year. There is a difference of 11,382 in 2013, a difference of 7,128 in 2012, and a difference of 9,866 in 2011. Which are correct? How do these inconsistencies affect the DNL estimates?	The number of operations on the Massport site comes from the Noise and Operations Monitoring System (NOMS), but a small percentage of the flights are not captured by this system. A more complete operations count is maintained by the Massport Revenue Office for billing purposes. This is the number that appears in the Environmental Data Report (EDR). The noise model uses the NOMS data since this provides a richer data set, but the results are scaled to account for the discrepancy with the Revenue Office numbers. Thus, the Day-Night Average Sound Level (DNL) represents the larger number of operations.
2-2	Cindy L. Christiansen, PhD., Resident Town of Milton	Noise	On page 1-5 the report states that 4L was used more frequently in 2014 than in 2013. Massport data shows 4L was used for 4.7% of jets in 2014 (7,047) and 5.5% of jets in 2013 (8,093). The 2014 EDR Table 6-5 reports that 4L was used for 5% of jets in 2014 and 6% of jets in 2013 – again, a contradiction to the statement that the 4L was used more frequently in 2014 than in 2013.	This inconsistency is correctly noted. The text on pages 1-15 and 6-3 in the *2014 EDR* should have stated an increase in usage of Runway 4R (30 percent versus 29 percent; see Table 6-5), not Runway 4L.
2-3	Cindy L. Christiansen, PhD., Resident Town of Milton	Noise	I ask that future EDRs and ESPRs include 1. Statistics on the number of go-arounds by arrival runway ends 2. The proportion of aircraft that required a go-around to land 3. Explanation of how go-arounds are counted in the runway use and in the estimated DNL	Go-arounds occasionally occur at Logan Airport and are counted as one arrival in the Revenue Office counts and are modeled as one arrival in the EDR. However, the custom profile system used in the noise modeling will model the initial arrival portion, then the climb out portion, level flight portion, and final descent into the Airport, taking all noise effects into account.
2-4	Cindy L. Christiansen, PhD., Resident Town of Milton	Noise	The report comments to my concern last year about the A380 saying that the A380 is one of the quietest aircraft in existence. This might be true with respect to engine noise but it is not true with respect to noise generated from the aircraft frame and the fact that aircraft arriving over Milton have their wheels down at approximately 8 miles out. How is the difference in engine versus airframe noise for arrivals accounted for in your estimates of DNL?	The Federal Aviation Administration's (FAA's) aircraft certification process includes noise measurements of aircraft engaged in actual departure and approach operations, and these measurements along with other data developed by the manufacturers provide the input data for the noise modeling software. Sound originating in the airframe (including landing gear) as well as the engines will have been captured in these measurements, and thus are accounted for in the DNL contour modeling.

Comment #	Author	Topic	Comment	Response
2-5	Cindy L. Christiansen, PhD., Resident Town of Milton	Noise	I again request that 1. MASSPORT provide non-compliance statistics based on its radar data that is used to calculate DNL estimates in this report. 2. Comparisons of MASSPORT DNL estimates to that of the FAA when the REAL CONTOURS software is not used. 3. Massport reports the minimum, maximum, median, average, and standard deviation of the altitude used by aircraft arriving the 4L visual calculated at two Milton locations. 4. Massport reports the minimum, maximum, median, average, and standard deviation of the altitude used by aircraft arriving the 4R calculated at two Milton locations.	The modeling included in the EDR is based on the actual radar data flown during the year. Therefore, if some traffic is not flying the procedure due to weather or air traffic control requests, it is captured as part of the modeling for the annual DNL contours. Modeled DNL results may differ between projects due to several factors including different models, input data, and modeling conditions. Other than compliance with the Runway 27 departure procedure (statistics can be found in Appendix H, *Noise Abatement*), Massport does not report on adherence to FAA flight procedures. Massport is currently reporting information regarding Runway 4L/4R arrivals to the Logan Airport Community Advisory Committee (CAC).
2-6	Cindy L. Christiansen, PhD., Resident Town of Milton	Noise	I understand that there is an option in that software to output the measure of the imprecision of the DNL estimates (or the margin of error at the typical 95% confidence). I asked that, that this be added to the reports. Also, I request that the DNL estimates from the AEDT and the INM software packages be compared in your next report.	There is no option in the noise model to calculate the imprecision of the DNL estimates. In 2015, the FAA introduced a new combined noise and air quality modeling tool, the Aviation Environmental Design Tool (AEDT). As of 2015, the FAA requires airports to use AEDT for National Environmental Policy Act (NEPA) projects and soundproofing eligibility. Massport undertook initial modeling of noise and air using AEDT; however, Massport has technical concerns related to the initial results at Logan Airport. Following a briefing with the FAA, it was decided that the initial AEDT results would not be published in the *2015 EDR* (pending further technical discussions with FAA's Office of Environment and Energy). Therefore, 2015 modeling for noise was performed with the FAA's Integrated Noise Model (INM) and the Emissions and Dispersion Modeling System (EDMS) for air emissions. Massport is actively evaluating the new model and working with the FAA to develop the types of Logan Airport specific adjustments for the AEDT model that have been used for many years in INM. Once approved by FAA, the adjustments will allow the model to more accurately reflect the noise environment at Logan Airport. Several of these custom adjustments cannot yet be implemented directly in AEDT and will need to be evaluated by Massport and approved by FAA. Massport has reached out to FAA for consideration and approval of these adjustments and, if completed in a timely fashion, AEDT is expected to be the official model for next year's *2016 ESPR*. Additional information on AEDT is provided in Chapter 6, *Noise Abatement*.

Comment #	Author	Topic	Comment	Response
2-7	Cindy L. Christiansen, PhD., Resident Town of Milton	Air Quality	We understand that ultrafine particles currently are not regulated. The 2014 EDR comment to the concern I raised last year is inadequate and given the fact that there have been two additional peer-reviewed studies (in Ontario and the Netherland) since the May 2014 study at LAX [Los Angeles International Airport], it appears that the response that the ESPRs/EDRs will report on the findings of other studies has not happened. I have attached a report I created for the Chair of Milton's School Committee on the health effects of traffic pollution on children's and adult's health.	Massport provides an update on the status and findings of a Massachusetts Department of Public Health Logan Airport Health Study and Massport's air quality studies in the annual EDRs and Environmental Status and Planning Reports (ESPRs). The latest update on the health studies is provided in Chapter 7, *Air Quality/Emissions Reduction*. The results of the health studies are also available on Massport's website at https://www.massport.com/about-massport/logan-airport-health-study/.
2-8	Cindy L. Christiansen, PhD., Resident Town of Milton	Air Quality	Given that MASSPORT has the equipment to study air pollution from aircraft that overfly our town, I request a study of air pollution be conducted along the 4R and 4L RNAV paths when in use for arrivals.	The FAA has been actively studying the noise and other environmental impacts of proposed flight path changes to Logan Airport's runways. The FAA conducts its own environmental review of RNAV procedures under NEPA.
2-9	Cindy L. Christiansen, PhD., Resident Town of Milton	Noise/Air Quality	We continue to note the unfair runway use distribution for arrivals. MASSPORT reports NE winds approximately 18% of the time and southeast winds about 17% of the time. However, runways 4R/4L arrivals receive about 35% of the jet arrivals, the recent Volpe analysis for the 4L RNAVS used a rate of 40%, but 15R, what should be the runway of choice with SE winds, only receives about 1% of the arrivals. How is this equitable or fair and what will MASSPORT do to fix this inequity of noise and air pollution burden forced onto our town?	The FAA has been actively studying the noise and other environmental impacts of proposed flight path changes to Logan Airport's runways. The Boston Logan Airport Noise Study, or BLANS, has been ongoing since 2008 and there has been a Logan Airport Community Advisory Committee (CAC) working with the FAA and Massport on providing community representation. Detailed information from the studies can be found at: http://www.bostonoverflightnoisestudy.com. This study continues to be an open forum for these discussions. On October 7, 2016, Massport and the FAA signed a Memorandum of Understanding (MOU) 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.
2-10	Cindy L. Christiansen, PhD., Resident Town of Milton	Air Quality	The non-jet arrivals and departures over Milton also are excessive. Our community is very concerned about the pollution from these low-flying planes from their use of leaded fuel. As the flight track maps in the report show, our community receives a substantial percentage of these flights too. We ask that MASSPORT conduct studies of lead poisoning in communities under these flight paths.	The FAA and the Environmental Protection Agency (EPA) are partnering to phase out leaded jet fuel used for small aircraft: https://www.faa.gov/about/initiatives/avgas/. The amount of Avgas dispensed at the Airport has generally decreased from year to year over the last decade. In 2015, the volume of Avgas dispensed declined by 81 percent when compared to the volume dispensed in 2005. In terms of total aviation fuel (Jet A and Avgas) dispensed at the Airport in 2015, Avgas represented 0.003 percent of the total volume. All non-jets (general aviation, air carrier, and cargo) made up 15 percent of the total operations in 2015. General aviation non-jets made up 2 percent of total aircraft operations in 2015.

Comment #	Author	Topic	Comment	Response
2-11	Cindy L. Christiansen, PhD., Resident Town of Milton	Noise	Seems that the persistence graph in the EDR 2014 is just the dwell graph with a different vertical axis. With these 3 substantial errors and a few more minor ones, I believe Massport needs to re-do the entire report. Thank you for considering this.	The persistence plot is incorrect. An accurate plot was produced internally, but was incorrectly copied to the final document. The corrected graphics have been provided by request and the data will be correctly reported in the *2015 EDR* .

COMMONWEALTH OF MASSACHUSETTS

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MEMBER

November 5, 2015

The Honorable Matthew Beaton, Secretary
Executive Office of Energy and Environmental Affairs
Attn: Massachusetts Environmental Policy Act ("MEPA") Office
Anne Canaday, EEA No. 3247
100 Cambridge Street, Suite 900
Boston, MA 02114

Re: Comments of the Town of Milton on the Boston-Logan International Airport 2014 Environmental Data Report (2014 EDR)

Dear Secretary Beaton,

The Board of Selectmen of the Town of Milton ("Milton") is pleased to provide the following comments in response to the Boston-Logan International Airport 2014 Environmental Data Report ("2014 EDR"):

1. Background and Impact of Logan Operations in Milton

Milton is a predominantly residential community with a population of 27,000, which is racially diverse (71 % white, 20 % African American). Comprised of only 13.3 square miles, Milton bears the brunt of heavy air traffic arriving and departing Boston-Logan International Airport through three (3) RNAVs (designated as 4R, 27 and 33L), with two more RNAVs proposed by the FAA this year (4L visual and 4L instrument). Because it is mostly comprised of single-family homes with backyards, people often choose to live in Milton to raise their families. Thus, the tremendous amount of aircraft noise imposed on the town severely diminishes the quality and standard of living, as residents report they are unable to enjoy either their homes and properties, or Milton's recreational areas and open spaces.

Ultimately, Milton seeks fairness and equity in the distribution of airplane operations and the impacts of those operations. We believe that Milton receives a disproportionate impact of airplane operations in the Boston-Logan area. The skies over Milton are already saturated with
airplanes, often from very early morning until very late at night. Implementation of two new 3-1
RNAVs over Milton (4L visual and 4L instrument) will increase the existing inequity. We request that the Secretary work with Massport, Milton and the CAC and establish an effective process to remedy this problem.

The arrival flight path for the heavily used arrival runways 4R/4L (30% 4R, 5% 4L – Table 6-5) were narrowed and concentrated into RNAV routes and the impact on residents has been severe. Additional routing changes to Runway 27 departures were made in March 2013 that also affected areas of Milton. The FAA relied upon a Categorical Exclusion, circumventing full environmental assessment, to implement the runway 27 RNAV in March 2013, which concentrated flight paths over a narrow area, rather than a more equitable distribution. Because this RNAV overflies Milton at low altitudes beginning sometimes before 5:00 A.M., departures from runway 27 cause substantial adverse effects on those under or near it in Milton. The 2014 EDR fails to note that Milton is affected by Runway 27 departures. 3-2

The runway 33L departure RNAV was routed over West Milton in June 2013, despite objections from more than 1,000 residents and elected officials. The 2014 EDR fails to note that Milton is affected by Runway 33L departures. 3-3

The FAA is relying upon a Categorical Exclusion again, to establish and implement two new 4L RNAVS – 4L instrument and 4L visual. Milton objects to this repeated and incorrect use of the Categorical Exclusions, and has set forth its detailed reasoning in a June 29, 2015 comment letter to the FAA. In sum, the Categorical Exclusion fails to take into account the cumulative impact of three (3), let alone five (5), RNAVS operating over Milton. The ongoing RNAVs implementation is disruptive to and within Milton. As the data set forth below indicates, there has been a 25-fold increase in noise complaints recorded from Milton since 2012. That disruption (and the number of complaints recorded) will only be exacerbated by the implementation of two more RNAVs over Milton. Also, Milton has several schools, which are highly sensitive communities, which are under the concentrated RNAV flight paths and impacted by the ongoing RNAV implementations. 3-4

In the last several years, more data has been provided which indicates airplane noise in overflown communities disrupts sleep patterns, which has been shown to result in adverse human health impacts. The noise from airplane overflights can also negatively impacts property values. Fewer buyers are willing to purchase a home in an area with known noise impacts, and prices can be suppressed.

Anecdotal data from Milton residents indicate that the noise from airplanes in Milton is clearly heard above background noise in both commercial and residential areas. Additionally, these noise events disrupt conversations both indoors and outside, and disrupt sleep. As elected officials, we hear frequently from Milton residents who suffer from interrupted sleep, anxiety and a reduced quality of life because of the noise pollution caused by very frequent – and some days continuous – flights over Milton at low altitudes. We cannot overstate the seriousness of the health problems that these RNAVs cumulatively pose for Milton residents, and the adverse cumulative environmental impact that the RNAVs and the low flying planes have on our entire community. 3-5

2. Increased Noise Complaints Reported.

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Table 6-17 demonstrates that no single community makes as many complaints on the Noise Complaint Line as Milton. According to 2014 EDR, Milton had the highest number of total calls from any town in 2014--2,669 recorded complaints. The second largest was Hull with 1,855 recorded complaints.

Complaints on the Massport complaint line from Milton have increased from an average of 9 per month in 2012, to an average of 160 per month in 2013, to an average of 222 per month in 2014. That represents a *25-fold increase in noise complaints.*[1] Even more troubling, based on data available on the Massport website, but not presented in the 2014 EDR, the noise complaints are not just limited to the summer months, but continue growing in volume in every month of the year as the Boston Logan Airport throughput increases because of routing efficiencies due to the implementation of RNAV procedures. Of the 34 months of complaint data recorded since 2012, the number of complaints recorded in each month except for five (mostly winter) months, has exceeded the total number of complaints recorded in 2012.

Heavily used recreational areas in Milton such as Houghton's Pond, normally enjoyed by thousands of Milton and Boston residents in the summer, and the Ponkapoag Trail in the Blue Hills reservation, have also been severely impacted with the concentration of and alterations in the 4R flight path with many low flying planes now traversing these important regional recreational facilities. These new "highways in the sky" are creating noise levels that prevent enjoyment of these natural settings. According to the Massachusetts Department of Conservation and Recreation, the Blue Hills is home to 50 prehistoric sites, 15 historic structures listed on the National Register of Historic Places, and a National Historic Landmark- the Blue Hills Meteorological Observatory. Increased noise is incompatible with these locations and their mission to provide green space and outdoor recreation.

3. Increased Nighttime Operations.

The 2014 EDR acknowledges that nighttime operations at Logan – defined as from 10:00 P.M. to 7:00 A.M. - have increased significantly. Total use during nighttime hours increased by 5% in 2014 compared to 2013, and has increased by almost 12% since 2010 (Table 6-3).

We request that the Secretary work with Massport and Milton to implement additional late night aircraft restrictions, similar to those set forth in 740 CMR 24.04, which are more protective of Milton and its residents. In particular, it is important to discuss restrictions on RNAV usage and routes that overfly residential neighborhoods, including spreading the routes further so that the nighttime noise is less concentrated in residential neighborhoods, or moving routes over the ocean during certain periods of time. 3-6

4. Disproportionate Distribution of Aircraft.

The 2014 EDR describes the Preferential Runway Advisory System ("PRAS") as being:

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[1] Noise complaints for 2015 have only been tabulated through September, and average 165 monthly. So far, the number of complaints recorded in 2015 has been similar to the number of complaints in January-May of 2014 and have greatly exceeded the number of complaints recorded in January-May of 2013 and 2012.

> a set of short-term and long-term runway use goals that include the use of a computer program that recommends to FAA air traffic controllers, runway configurations that will meet weather and demand requirements and provide an **equitable distribution** of Logan Airport's noise impacts on surrounding communities. The two primary objectives of the PRAS goals are to distribute noise on an annual basis, and to provide short-term relief from continuous operations over the same neighborhoods at the ends of the runways.

2014 EDR, page 6-17 (emphasis added).

The report indicates that the system experienced a technical malfunction that was not corrected. Because it was not meeting its goals, presumably because it was not functioning, the Logan Airport CAC voted to abandon the PRAS goals in 2012. However, no other guidelines were put in its place, and Massport still reports runway usage with respect to the PRAS goals (Table 6-6). The PRAS goals offer at least some picture of what a fair distribution of aircraft traffic might look like using one particular tool, i.e. differential runways (being mindful that these PRAS goals were created well before RNAV concentrated flight routes were implemented). Thus, at this stage, only achieving balanced runway usage would not be sufficient to relieve those under the RNAVs although it would be a step in the right direction.

We note that while the PRAS goal for arrivals on runways 4R/4L is 21.1%, the 2014 effective usage is reported at 28.1%. When added to the impacts from the southbound 27 departures (3.4% of all departures) and 33L departures (2.3% of all departures)[2], Milton is impacted by much of the daily airline traffic moving in and out of Logan, and in a greater proportion than was initially planned or expected, based on the PRAS goals.

5. **Mitigation.**

The 2014 EDR indicates that "100% of residences exposed to noise levels greater than DNL 65 dB in 2014 are eligible to participate in Massport's residential sound insulation program." 2014 EDR, Figure page 6-3. We submit that this is simply an inadequate standard for participation in Massport mitigation programs. It is clear that the 65 DNL standard is antiquated, inadequate to protect public health, and does not adequately protect sensitive subpopulations. It does not address the acute highs in airport noise impacts actually experienced by residents, but lumps all noise together in 24-hour annual averages. Milton is not alone in this contention. That this measure is inadequate to measure impacts, particularly in metro areas surrounding airports, is a significant issue being raised by communities around the country, including New York City, Washington DC, Chicago, Los Angeles, and Phoenix. 3-7

Even if the DNL standard would be retained, there is consensus developing, supported by WHO data and used on many other countries, that the important regulatory value is 55dB, not 65 dB. Modeled data for Milton indicates that the DNL is 54.5dB in Cunningham Park (the only noise monitor in the Town). Based on this value, Milton should qualify for residential sound 3-8

[2] This Milton overflight information for runways 27 and 33L departures was reported to the Milton CAC representative by Massport staff on 8/5/14 via email.

insulation/mitigation funding. We request the ability to participate in this program for Milton schools, and for all Milton residences. We would appreciate your assistance in working with Massport to make these measures and this funding available within Milton. 3-8 Cont.

6. Air Pollution and Public Health.

We note that the 2014 EDR only discussed air pollution from airport operations in the context of the actual operations of Logan airport, on Logan property. We believe that this perspective is overly narrow. Recent studies at LAX (Hudda, et al., May 2014) found ultrafine particle counts as far as ten miles from heavily used arrival runways. We request that Massport, in conjunction with the Department of Public Health ("DPH") and the Department of Environmental Protection ("DEP") conduct noise and air pollution studies in communities like Milton, that receive a substantial number of low-flying arrival aircrafts. This work would be consistent with the East Boston neighborhood study completed by DPH in 2014.[3] 3-9

7. Conclusion and Request for Assistance.

Thank you for your attention to and consideration of our comments on the 2014 EDR. We believe that there can be solutions available to remedy and mitigate the ongoing impact of Logan operations on the residents of Milton. We request that the Secretary work with Massport, Milton, the CAC, and other effected communities to help establish a process to remedy the multiple impacts discussed above. We would appreciate a time to meet with you and your staff to personally discuss the concerns we have outlined here, as well as our suggestions for improvements going forward. 3-10

Sincerely,

Board of Selectmen of the Town of Milton

J. Thomas Hurley, Chairman

David T. Burnes, Secretary

Kathleen M. Conlon, Member

[3] The report of that study may be found here:
http://www.mass.gov/eohhs/docs/dph/environmental/investigations/logan/logan-airport-health-study-final.pdf

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cc: Congressman Stephen F. Lynch
Congressman Michael E. Capuano
U.S. Senator Elizabeth A. Warren
U.S. Senator Edward J. Markey
State Senator Brian A. Joyce
State Representative Walter F. Timilty
State Representative Daniel R. Cullinane
Milton Board of Health
Milton Airplane Noise Advisory Committee
Milton CAC Representative Cindy L. Christiansen
Milton CAC Representative (Alternate) David Godine
Milton Logan Representative Caroline A. Kinsella
Karis L. North, Esq.

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Comment #	Author	Topic	Comment	Response
3-1	Board of Selectmen of the Town of Milton	Noise	Ultimately, Milton seeks fairness and equity in the distribution of airplane operations and the impacts of those operations. We believe that Milton receives a disproportionate impact of airplane operations in the Boston-Logan area. The skies over Milton are already saturated with airplanes, often from very early morning until very late at night. Implementation of two new RNAVs over Milton (4L visual and 4L instrument) will increase the existing inequity. We request that the Secretary work with Massport, Milton and the CAC and establish an effective process to remedy this problem.	The Federal Aviation Administration (FAA) has been actively studying the noise and other environmental impacts of proposed flight path changes to Logan Airport's runways. The Boston Logan Airport Noise Study, or BLANS, has been ongoing since 2008 and there has been a Logan Airport Community Advisory Committee (CAC) working with the FAA and Massport on providing community representation. Detailed information from the studies can be found at: http://www.bostonoverflightnoisestudy.com. This study continues to be an open forum for these discussions. Milton is an active member in the CAC. On October 7, 2016, Massport and the FAA signed a Memorandum of Understanding (MOU) 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.
3-2	Board of Selectmen of the Town of Milton	Noise	Because this RNAV overflies Milton at low altitudes beginning sometimes before 5:00 A.M., departures from runway 27 cause substantial adverse effects on those under or near it in Milton. The 2014 EDR fails to note that Milton is affected by Runway 27 departures.	The list reflects the closest communities to the runway, not all communities overflown by the various procedures.
3-3	Board of Selectmen of the Town of Milton	Noise	The runway 33L departure RNAV was routed over West Milton in June 2013, despite objections from more than 1,000 residents and elected officials. The 2014 EDR fails to note that Milton is affected by Runway 33L departures.	The list reflects the closest communities to the runway, not all communities overflown by the various procedures.

Comment #	Author	Topic	Comment	Response
3-4	Board of Selectmen of the Town of Milton	Noise	The FAA is relying upon a Categorical Exclusion again, to establish and implement two new 4L RNAVS - 4L instrument and 4L visual. Milton objects to this repeated and incorrect use of the Categorical Exclusions, and has set forth its detailed reasoning in a June 29, 2015 comment letter to the FAA. In sum, the Categorical Exclusion fails to take into account the cumulative impact of three (3), let alone five (5), RNAVS operating over Milton. The ongoing RNAVs implementation is disruptive to and within Milton. As the data set forth below indicates, there has been a 25-fold increase in noise complaints recorded from Milton since 2012. That disruption (and the number of complaints recorded) will only be exacerbated by the implementation of two more RNAVs over Milton. Also, Milton has several schools, which are highly sensitive communities, which are under the concentrated RNAV flight paths and impacted by the ongoing RNAV implementations.	Please see the response to Comment 3-1 regarding processes underway between Massport, the FAA, and the CAC regarding these issues. The FAA NextGen initiative is a national effort to improve the daily operations of the entire National Airspace System. This has resulted in changes in flight track and airspace around the country with resultant changes in the noise environment. The FAA prepared an Environmental Assessment (EA) that studies the change in RNAV, which enables aircraft to fly on any desired flight path within the coverage of ground- or space-based navigation aids, within the limits of the capability of the self-contained systems, or a combination of both capabilities. RNAV aircraft have better access and flexibility for point-to-point operations.
3-5	Board of Selectmen of the Town of Milton	Noise	Anecdotal data from Milton residents indicate that the noise from airplanes in Milton is clearly heard above background noise in both commercial and residential areas. Additionally, these noise events disrupt conversations both indoors and outside, and disrupt sleep. As elected officials, we hear frequently from Milton residents who suffer from interrupted sleep, anxiety and a reduced quality of life because of the noise pollution caused by very frequent - and some days continuous - flights over Milton at low altitudes. We cannot overstate the seriousness of the health problems that these RNAVs cumulatively pose for Milton residents, and the adverse cumulative environmental impact that the RNAVs and the low flying planes have on our entire community.	For over three decades, the Logan Airport Environmental Data Reports (EDRs) and Environmental Status and Planning Reports (ESPRs) have tracked noise conditions at Logan Airport, providing annual noise contours and the population located with the FAA-defined noise level of Day-Night Average Sound Level (DNL) 65 dB which is considered to be incompatible with residential land use. Since 1990, the population living within areas DNL 65 dB and above has dropped from 44,142 to 14,097. Massport has an extensive sound insulation program which has treated over 11,515 impacted dwellings since the start of the program in 1996. In addition to DNL, Massport is sensitive to continuous exposure of communities to overflight noise. Massport monitors the Dwell and Persistence metrics that capture this exposure, and has consulted with the FAA to adjust runway use duration with this in mind. See Chapter 6, *Noise Abatement,* and Appendix H, *Noise Abatement,* for additional information.

Comment #	Author	Topic	Comment	Response
3-6	Board of Selectmen of the Town of Milton	Noise	We request that the Secretary work with Massport and Milton to implement additional late night aircraft restrictions, similar to those set forth in 740 CMR 24.04, which are more protective of Milton and its residents. In particular, it is important to discuss restrictions on RNAV usage and routes that overfly residential neighborhoods, including spreading the routes further so that the nighttime noise is less concentrated in residential neighborhoods, or moving routes over the ocean during certain periods of time.	The FAA has been actively studying the noise and other environmental impacts of proposed flight path changes to Logan Airport's runways. The Boston Logan Airport Noise Study, or BLANS, has been ongoing since 2008 and there has been a Logan Airport Community Advisory Committee (CAC) working with the FAA and Massport on providing community representation. Detailed information from the studies can be found at: http://www.bostonoverflightnoisestudy.com. This study continues to be an open forum for these discussions. The FAA NextGen initiative is a national effort to improve the daily operations of the entire National Airspace System. This has resulted in changes in flight track and airspace around the country with resultant changes in the noise environment. The FAA prepared an EA that studies the change in RNAV, which enables aircraft to fly on any desired flight path within the coverage of ground- or space-based navigation aids, within the limits of the capability of the self-contained systems, or a combination of both capabilities. RNAV aircraft have better access and flexibility for point-to-point operations. On October 7, 2016, Massport and the FAA signed an MOU to frame the process for analyzing opportunities to reduce noise through changes or amendments to 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.
3-7	Board of Selectmen of the Town of Milton	Noise	The 2014 EDR indicates that "100% of residences exposed to noise levels greater than DNL 65 dB in 2014 are eligible to participate in Massport's residential sound insulation program." 2014 EDR, Figure page 6-3. We submit that this is simply an inadequate standard for participation in Massport mitigation programs. It is clear that the 65 DNL standard is antiquated, inadequate to protect public health, and does not adequately protect sensitive subpopulations. It does not address the acute highs in airport noise impacts actually experienced by residents, but lumps all noise together in 24-hour annual averages.	Massport follows FAA requirements and thresholds, which dictates eligibility for residential sound insulation. Dwellings are eligible for sound insulation when exposed to DNL 65 dB or higher. This noise threshold is a national standard.

Comment #	Author	Topic	Comment	Response
3-8	Board of Selectmen of the Town of Milton	Noise	Even if the DNL standard would be retained, there is consensus developing, supported by WHO [World Health Organization] data and used on many other countries, that the important regulatory value is 55 dB, not 65 dB. Modeled data for Milton indicates that the DNL is 54.5 dB in Cunningham Park (the only noise monitor in the Town). Based on this value, Milton should qualify for residential sound insulation/mitigation funding. We request the ability to participate in this program for Milton schools, and for all Milton residences. We would appreciate your assistance in working with Massport to make these measures and this funding available within Milton.	Massport has an extensive sound insulation program that complies with current FAA regulations. The FAA has ongoing studies and research related to noise exposure and sound insulation. The FAA is currently researching the noise exposure threshold. Should this result in future changes to FAA regulations, Massport will continue to follow FAA requirements and thresholds.
3-9	Board of Selectmen of the Town of Milton	Noise/Air Quality	We request that Massport, in conjunction with the Department of Public Health ("DPH") and the Department of Environmental Protection ("DEP") conduct noise and air pollution studies in communities like Milton, that receive a substantial number of low-flying arrival aircrafts. This work would be consistent with the East Boston neighborhood study completed by DPH in 2014.	Massport provides an update on the status and findings of a Massachusetts Department of Public Health (MassDPH) Logan Airport Health Study and Massport's air quality studies in the annual EDRs and ESPRs. The latest update on the health studies is provided in Chapter 7, *Air Quality/Emissions Reduction.* The results of the health studies are also available on Massport's website at https://www.massport.com/about-massport/logan-airport-health-study/. MassDPH conducted the Logan Airport Health Study in May 2014. The study area consisted of areas surrounding the airport including Milton. The study concluded that "Air dispersion modeling of airport related emissions using a state-of-the-art model indicates that the highest predicted pollutant concentrations associated with airport related operations are near the perimeter of Logan Airport and fall off rapidly with increased distance." The study categorized surrounding communities by "high," "medium," and "low" exposure; Milton was categorized as "low exposure" in Figure 4-5 of the health study.
3-10	Board of Selectmen of the Town of Milton	Noise/Air Quality	We request that the Secretary work with Massport, Milton, the CAC, and other effected communities to help establish a process to remedy the multiple impacts discussed above. We would appreciate a time to meet with you and your staff to personally discuss the concerns we have outline here, as well as our suggestions for improvements going forward.	Massport engaged Town of Milton representatives and community members through extensive meetings over the past several years. Noise is a national issue and Massport actively engages with FAA to address concerns. On October 7, 2016, Massport and the FAA signed an MOU to frame the process for analyzing opportunities to reduce noise through changes or amendments to 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 appropriate forum for further noise issues and discussions continues to be through the Massport CAC.

The Boston Harbor Association
A Voice for the Harbor

November 6, 2015

Secretary Matthew A. Beaton
Executive Office of Energy and Environmental Affairs
MEPA Office
100 Cambridge Street, Ste 900
Boston, MA 02114

Attn: Ann Canaday, EEA No. 3247

Re: Boston-Logan International Airport 2014 Environmental Data Report, EOEA #3247

Dear Secretary Beaton,

On behalf of The Boston Harbor Association, thank you for the opportunity to comment on the Boston-Logan 2014 Environmental Data Report submitted on October 7, 2015.

In reviewing the Environmental Data Report EDR, the Boston Harbor Association focused on specific issues of interest including impacts on the local community, climate change preparedness, climate change mitigation, effects of deicing procedures, and potential snow dumping into Boston Harbor. Our staff was present during the consultation session held on October 20, 2015 at which time both Massport and its partners responded to questions and comments presented by TBHA staff. Our comments follow:

Airport Planning

Logan Airport has been one of the fastest growing major U.S airports over the last four years. The airport serves as a major domestic origin and destination market and acts as the primary international gateway for the New England region. In the short term, Logan is projected to reach 32.9 million passengers this year and 34 million in 2016.

Terminal E Enhancements and Modernization Project.

Massport plans to extend the existing International Terminal E to include 4-6 additional gates in an extended concourse, new passenger handling and hold rooms, as well as potential Border Patrol facilities. This modernization project was initially part of the

International Gateway West Concourse Project, which was granted a license in 1996 but never constructed due to a decreased demand for air travel following September 11 attacks.

The facility will function as a noise barrier, with the key feature of creating the first direct pedestrian connection from the MBTA Blue Line Airport Station to the terminal complex at Logan Airport. We strongly support providing easier, more direct public transportation routes to the airport to encourage passengers to consider these options when traveling to Logan, therefore minimizing the harmful automobile emissions and traffic congestions to nearby communities. We are in receipt of Massport's Environmental Notification Form for the modernization of Terminal E and look forward to conducting a more detailed review of the proposal.

Buffer Areas/Open Spaces. We applaud Massport's efforts to construct and maintain open spaces and airport buffer areas. The newly created nearly 2-acre Neptune Road Edge Area Buffer located between the MBTA Blue line and Bennington Street provides a natural escape for the surrounding community. For many years, East Boston had one of the lowest percentages of open space of any neighborhood in the city; this buffer area adds to the green spaces already created by Massport and will serve to recognize the historic significance of Neptune Road and its residents who fought to protect the neighborhood.

In August, local residents celebrated the opening of the new Logan Square Dog Park. The park contains various dog-friendly features, including a paved dog run, an exercise ramp, and water fountains. Dog parks provide safe places for both animals and people to interact.

We encourage Massport to continue working with local residents and advocates to ensure that the open spaces and buffer areas provide meaningful, high-quality spaces that benefit surrounding neighborhoods. Undoubtedly, Logan Airport operations have a negative impact on East Boston in terms of traffic congestion, noise, and air quality; we are highly supportive of all efforts Massport engages in to increase benefits to the East Boston community including but not limited to increased open spaces, better programming of open areas, enhanced Harborwalk sections, and innovative public amenities.

Transportation

Passenger traffic at New England airports in 2014 represented the highest passenger traffic level for the region since 2008. The increase was largely driven by continued growth at Logan Airport with a total number of air passengers increasing to 31.6 million annual air passengers in 2014. Even though passenger activity levels have increased, aircraft operations have actually decreased in the past year.

International passenger traffic at Logan Airport has continued to grow over the past several years and demand is projected to increase at a faster rate than domestic passenger demand. In 2014, international annual numbers increased from 4.4 million to 4.9 million. TBHA suggests surveying international passenger ground transportation preferences to see how the use of shared rides and public transportation can be optimized for this growing group of travelers. 4-1

Ground Access to and from Logan Airport. With increasing air travelers and continuation of the Massport parking freeze, pick up/drop off vehicle trips have gradually ticked up. We concur with Massport's assertion that this is the least desirable mode of transportation as more vehicle trips translate to increased vehicle miles traveled and attendant emissions. Because this mode of travel generates up to four vehicle trips per air passenger, increased pick up/drop off activity has the opposite effect of what the Logan Airport Parking Freeze regulation was initially intended to achieve.

We understand Massport has considered revisiting the terms of the parking freeze to alleviate increased automobile emissions affecting air quality both locally and regionally. TBHA is open to working with Massport on alternative modes of transit and continues to strongly support increasingly innovative transportation alternatives.

We commend Massport for their efforts to encourage public transit use by continuing the pilot program for free access to the Silver Line at Logan Airport. We recommend making this a permanent program and increasing the fleet size to further alleviate automobile use to and from Logan. 4-2 The Back Bay Logan Express service initiated in 2014 continues to gain popularity, providing three scheduled trips per hour between the Hynes Convention Center, Copley Square Station, and Logan Airport. We encourage Massport to monitor use and enhance public awareness of this express service. 4-3

Water Transportation to and from Logan Airport. Annual ridership and activity levels for water transportation on MBTA ferry is not available in the current EDR. (Table 5-8, Environmental Data Report). We would like to see a more detailed survey of MBTA ferry use. 4-4 The EDR states that in the 2013 ground access survey, water transportation accounted for less than 1% of the mode share to Logan Airport. (2013 Logan Airport Air Passenger Ground Access Survey). We commend Massport for the courtesy shuttle bus service between the Logan dock, the MBTA Airport station, and all terminals as well as the employee subsidy for those that commute by ferry. We believe this is a great initiative and strongly encourage Massport to work together with MBTA officials to generate additional price motivators and to significantly increase the in-terminal marketing of water transportation. 4-5 Finally, we urge Massport to not only maintain the current ferry schedule but to also expand off-peak services. We believe a more robust water transportation system is a great opportunity to better serve passengers--and highlight the beauty of the city--between downtown and Logan. 4-6

We understand planning for passenger access is a key issue for Massport moving forward. Massport should continue to address airport-wide planning efforts to create a better balance of HOV/transit/shared-ride alternatives, on-site parking, reduced pick up/drop off trips, and a significantly more robust water transportation system. We look forward to seeing Massport progress towards achieving this balance using the data collected via its upgraded Automated Traffic Monitoring Systems (ATMS). 4-7

Water Quality/Environmental Compliance

Resiliency. Much of Massport's critical infrastructure is in relatively low-lying coastal areas. We commend Massport for beginning to plan and prepare for the impacts of sea level rise, storm surges, and other climate-related threats. In 2014, Massport released The Disaster and Infrastructure Resiliency Planning Study (DIRP) which included a hazard analysis, modeling sea-level rise and storm surge, projections of temperature/precipitation, and anticipated increases in extreme weather events; this study provides recommendations for short-term adaptation strategies to make Massport's facilities more resilient to likely effects of climate change. Massport has also launched a public website which contains a variety of graphics and descriptions of adaptation and sustainability efforts. We highly encourage Massport to not only study the past effects of climate change but to be forward-thinking in construction and mitigation efforts to prevent the harmful impacts of sea level rise and other climate change related events. 4-8

Snow Removal and Dumping Plan. With another cold and snowy winter predicted for the New England region, we ask that Massport consider distributing a detailed snow removal and dumping plan to interested advocates and members of the public. At the public consultation session held on October 20th, Massport staff indicated that the snow removal plan remains unchanged from the previous calendar year and any snow dumped directly into the Boston Harbor would be strictly from runways with little to no debris. Our concern is that with expected increased snowfall and overflowing snow farms, Logan may once again consider the unwanted alternative of dumping snow into Boston Harbor. 4-9

Massport staff indicated that deicing procedures for the new larger aircrafts occur
mainly in the center of the airport at the gates and not near the water, with the
exception of one area near the end of the east runway. The current EDR does not
include a list of chemicals used in the deicing process. Moreover, while our staff was
able to find stormwater testing results as recent as September 2015, we were unable to
locate the results of recent stormwater testing for deicing chemicals on the Massport
website. TBHA remains uncertain of the toxicity level of the deicing chemicals and
requests that Massport provide more recent test sample results for deicing chemicals in 4-10
the stormwater system, specifically of the north and west outfalls which directly drain to
the adjacent Harbor. Finally, we encourage Massport to continue deicing procedures a
safe distance away from the harbor to minimize potential runoff and contamination of 4-11
the water and marine life.

Thank you again for the opportunity to comment.

Sincerely,

Jill Valdes Horwood
Waterfront Policy Analyst

Julie Wormser
Executive Director

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Comment #	Author	Topic	Comment	Response
4-1	The Boston Harbor Association	Ground Access	TBHA suggests surveying international passenger ground transportation preferences to see how the use of shared rides and public transportation can be optimized for this growing group of travelers.	Massport conducts a triennial air passenger survey to analyze trends in air passenger travel behavior and to inform our high-occupancy vehicle (HOV) programs. The most recent survey was completed in the spring of 2016. The results of this survey will provide updated information about passenger characteristics which will inform ground access programs in the years to come. Results will be shared in the *2016 Environmental Status and Planning Report (ESPR).*
4-2	The Boston Harbor Association	Ground Access	We commend Massport for their efforts to encourage public transit use by continuing the pilot program for free access to the Silver Line at Logan Airport. We recommend making this a permanent program and increasing the fleet size to further alleviate automobile use to and from Logan.	Massport continues to support this program for free access to the Silver Line at Logan Airport. Massport will work with its partners at the Massachusetts Bay Transportation Authority (MBTA) to increase the Silver Line capacity.
4-3	The Boston Harbor Association	Ground Access	We encourage Massport to monitor use and enhance public awareness of this express service [Silver Line].	The Silver Line is an important element of Massport's HOV program. Massport conducts annual ridership counts on the Silver Line to monitor use of the service and works to enhance public awareness of this service. This includes wayfinding and variable message boards.
4-4	The Boston Harbor Association	Ground Access	We would like to see a more detailed survey of MBTA ferry use. The EDR states that in the 2013 ground access survey, water transportation accounted for less than 1% of the mode share to Logan Airport. (2013 Logan Airport Air Passenger Ground Access Survey).	The *2013 Logan Airport Air Passenger Ground Access Survey* only asks for information on how arriving air passengers accessed Logan Airport. More detailed information would be provided by the system operator, the MBTA.
4-5	The Boston Harbor Association	Ground Access	We believe this is a great initiative [encouraging water transportation to and from the Airport] and strongly encourage Massport to work together with MBTA officials to generate additional price motivators and to significantly increase the in-terminal marketing of water transportation	Comment noted.
4-6	The Boston Harbor Association	Ground Access	Finally, we urge Massport to not only maintain the current ferry schedule but to also expand off-peak services. We believe a more robust water transportation system is a great opportunity to better serve passengers--and highlight the beauty of the city--between downtown and Logan.	Comment noted. Massport continues to support the water transportation system. Ferry Service and schedules are provided by the MBTA. Massport will continue to coordinate with the MBTA on transportation options.

Comment #	Author	Topic	Comment	Response
4-7	The Boston Harbor Association	Ground Access	We understand planning for passenger access is a key issue for Massport moving forward. Massport should continue to address airport-wide planning efforts to create a better balance of HOV/transit/shared-ride alternatives, on-site parking, reduced pick up/drop off trips, and a significantly more robust water transportation system. We look forward to seeing Massport progress towards achieving this balance using the data collected via its upgraded Automated Traffic Monitoring Systems (ATMS).	Massport continues to invest in and maintain its Automated Traffic Monitoring System to provide accurate data on traffic patterns and to inform airport planning. Massport also continues to implement a comprehensive ground transportation strategy designed to optimize transit and shared-ride options for travel to and from Logan Airport and minimize vehicle trips by providing convenient transit, shuttle, and pedestrian connections at the Airport. Massport invests in and operates Logan Airport with a goal of increasing the number of passengers arriving by transit or other HOV/ shared-ride modes. Logan Airport continues to rank at the top of U.S. airports maintaining a nearly 30 percent HOV mode share. Programs include Logan Express bus service, free Silver Line boardings, water shuttle service, and free, frequent shuttle bus service to and from the Blue Line subway station. Massport provides priority, designated curb areas at all Airport terminals, to support the use of HOV/transit modes, including privately-operated scheduled buses and shared-ride vans. Future EDRs and ESPRs will provide ongoing updates on the Automated Traffic Monitoring System.
4-8	The Boston Harbor Association	Water Quality/ Environmental Compliance	We highly encourage Massport to not only study the past effects of climate change but to be forward-thinking in construction and mitigation efforts to prevent the harmful impacts of sea level rise and other climate change related events.	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 adaptation strategies to make Massport's facilities more resilient to the likely effects of climate change. The study was completed and a request for proposals for implementing its recommendations was issued in September 2014; work commenced 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 its Floodproofing Design Guide; and has developed a resilience framework that will provide consistent metrics for the short- and long-term resilience 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 Guidelines were published in November 2014 and revised in April 2015. These plans will be updated, as appropriate.

Comment #	Author	Topic	Comment	Response
4-9	The Boston Harbor Association	Water Quality/ Environmental Compliance	With another cold and snowy winter predicted for the New England region, we ask that Massport consider distributing a detailed snow removal and dumping plan to interested advocates and members of the public. At the public consultation session held on October 20th, Massport staff indicated that the snow removal plan remains unchanged from the previous calendar year and any snow dumped directly into the Boston Harbor would be strictly from runways with little to no debris. Our concern is that with expected increased snowfall and overflowing snow farms, Logan may once again consider the unwanted alternative of dumping snow into Boston Harbor.	Massport only considers dumping of snow in the Harbor in emergency situations and as a last resort. As such, this coming winter we have added additional snow melter capacity and will be able to melt over 3,100 tons/hour of snow. This is a 14 percent increase over last year.
4-10	The Boston Harbor Association	Water Quality/ Environmental Compliance	TBHA remains uncertain of the toxicity level of the deicing chemicals and requests that Massport provide more recent test sample results for deicing chemicals in the stormwater system, specifically of the north and west outfalls which directly drain to the adjacent Harbor.	Appendix J, *Water Quality/Environmental Compliance and Management,* reports on 2015 deicing monitoring results in Tables J-13 and J-14. Results are inclusive of the North and West Outfalls.
4-11	The Boston Harbor Association	Water Quality/ Environmental Compliance	Finally, we encourage Massport to continue deicing procedures a safe distance away from the harbor to minimize potential runoff and contamination of the water and marine life.	Massport will continue to conduct deicing procedures in a safe and environmentally sound manner.

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Stephen H. Kaiser
191 Hamilton St.
Cambridge Mass. 02139

To : Matthew Beaton, Secretary of Energy and Environmental Affairs
Attention : Ann Canaday, MEPA office File No. 3247

From : Stephen H. Kaiser, PhD

Comment on the Environmental Data Report for 2014, by Massport

Massport's Environment Data Report and the Environmental Status and Planning Report have become a tradition in Boston for a government agency to report publicly on its progress every year. The effort has several unique features worthy of note.

The reports and the website become a library of EDR reports from 2010 to 2014 covering five years' worth of information. The reports contain more that simply data. They are a source for policy and planning, as well as progress towards stated objectives. It follows a familiar format which is carried over from year to year and -- unlike many websites -- in not subject to sudden and confusing format changes.

The EDR becomes an important reference document for internal use by Massport as well as other agencies and the public. EIRs and other studies tend to be forgotten quickly after MEPA approval, while most EIRs are prepared without reference to any earlier studies, as if a bibliography were unimportant. The EDR contains not only sources references but also a moving five-year reference to both present and past EDR efforts. The general program is a ten-year look back and a ten-year look-forward.

The report helps to generate increased confidence -- unspoken or otherwise -- among the public to the continued work of Massport. This effort is in contrast to the MBTA which has suffered in recent years from reduced credibility in its public pronouncements and in general respect for the job it is doing, The EDR is the kind of document that the MBTA should be producing every year -- and is not.

At a time when many government agencies are struggling to provide public services, Massport is a primary representative of a stable and productive example of the authority form of government. In this regard, Massport is joined by the Mass Water Resources Authority, which has established itself in 30 years as a capable and efficient supplier of public services. The primary difference is that the MWRA is carrying an extraordinary debt load, while the finances of Massport appear to be fairly stable.

Not all the Massport effort is positive. Massport's website for Environmental progress and planning shows data that is primarily based on the 2007-2008 period. This information needs updating. 5-1

The EDR has over the years reflected a strong planning priority in favor of mass transit. Indeed a search of the word "transit" appears about 75 times in the report. Massport has properly identified transit as the most critical form of ground transportation, at least in terms of potentials for improvement. The established highway system is what it is and is not likely to provide any significant improvements to handle the region's (and Massport's) likelihood of growth and resulting greater transportation demands.

It is noteworthy that in many areas of greater Boston much commercial development is occurring totally independent of the actual levels of transportation capacity and especially congestion and delay. "Transit-Oriented Development" because a very shallow concept if it measures only a site's proximity to existing transit. The City of Cambridge is beginning to show evidence of planning for better transit to properly serve its new and expanding development. By contrast, Somerville and Boston have yet to join together in a united effort to work towards a better transit future with greater capacity and reliability.

For all its support of transit as a prevailing priority, the EDR does not include the types of transit information helpful in identifying the quality of existing transit service. 5-2 For example, on both the Blue and Silver Lines, on-time performance is a vital measurement in general, and the erratic service on many MBTA train and bus lines needs to be documented in such a way that the proper authorities can see to it that the trains and buses run on time, with a minimum of delay and randomness in service. The result will be an increase in usable capacity and quality of service which will surely be appreciated by citizens of East Boston as well as patrons and employees of Massport. If Massport would take the daily train statistics for the Blue Line and provide open, 5-3 statistical analysis of headway variations, that would be a positive contribution to today's dialogue about how to Fix the T. I would note that the Blue Line has traditionally been the most reliable of rail transit lines, with the Red Line and especially the Orange Line at much lower levels of reliability. 5-3 Cont.

The potentials for improved capacity and service have historically been achieved in times of particular crisis, most notably during World War II when rationing of materials placed a priority on people riding transit. At the end of the war, trains were running in and out of Harvard Station at three times the frequency of current Red Line trains. In earlier years, Boston, New York and Chicago all achieved two minute headways on subway lines, and London has just announced it has cut headways in half -- from about five minutes to 2/5 minutes. Boston during the war ran 90 second headways. Today Moscow runs 75 seconds. Where is the T?

When headways are cut in half, that doubles the capacity of the rail line (or bus) and reduces the average wait time at stations or bus stops by half. If trains run twice as frequently, there is less chance of Logan travelers being late for their flights.

The great potentials of our Boston transit system is that we do not need to invest tens of billions of dollars in a massive reworking of the rail system. Each track is capable of carrying 40,000 passengers an hour, yet today the alleged "capacity" of the Red Line is only about 13,000 passengers an hours. It should be a simple task to replicate what our transit system did 70 years ago : there will need to be signal and power upgrades. Vast improvements are possible in transit service, for a relatively small investment. Simply getting the trains to run on time can be done for virtually no cost.

Massport is in effect a user of transit, with a vital interest in service efficiency and reliability. This interest is both internal and external -- local as well as regional. 5-4 Anything Massport does at any level to improve transit can result in benefits for the general public, even those no specific business at Logan Airport. This positive objective is seeking improvements "for the common good," as required of all government entities at Article 7 of the Declaration of Rights of the state Constitution.

One particular transit study would be valuable to Massport as a transit planning contribution. The MBTA plans to extend the Silver Line north into Chelsea, but there could be lessened service (and increased delays) for airport patrons. Should Silver Line service frequencies be improved to handle rider demand when Silver Line service is extended? A similar study for the Green Line Extension (and related 18 million square feet of development) has yet to be considered, let alone completed.

Sincerely,

Stephen H. Kaiser, PhD
Mechanical Engineer

Comment #	Author	Topic	Comment	Response
5-1	Stephen H. Kaiser, PhD	General	Not all the Massport effort is positive. Massport's website for Environmental progress and planning shows data that is primarily based on the 2007-2008 period. This information needs updating.	Comment noted. Massport now provides current and recent Environmental Data Reports (EDRs) and Environmental Status and Planning Reports (ESPRs) online at: https://www.massport.com/environment/environmental-reporting/. The EDR and ESPR provide the latest environmental data for Logan Airport. See the *2015 EDR* and all previous EDRs and ESPRs on the Massport website linked above.
5-2	Stephen H. Kaiser, PhD	Ground Access	For all its support of transit as a prevailing priority, the EDR does not include the types of transit information helpful in identifying the quality of existing transit service. For example, on both the Blue and Silver Lines, on-time performance is a vital measurement in general, and the erratic service on many MBTA train and bus lines needs to be documented in such a way that the proper authorities can see to it that the trains and buses run on time, with a minimum of delay and randomness in service.	Comment noted. Massport will share this comment with the Massachusetts Bay Transportation Authority (MBTA).
5-3	Stephen H. Kaiser, PhD	Ground Access	If Massport would take the daily train statistics for the Blue Line and provide open, statistical analysis of headway variations, that would be a positive contribution to today's dialogue about how to Fix the T. I would note that the Blue Line has traditionally been the most reliable of rail transit lines, with the Red Line and especially the Orange Line at much lower levels of reliability.	Comment noted. Massport will share this comment with the MBTA.
5-4	Stephen H. Kaiser, PhD	Ground Access	Massport is in effect a user of transit, with a vital interest in service efficiency and reliability. This interest is both internal and external -- local as well as regional. Anything Massport does at any level to improve transit can result in benefits for the general public, even those no specific business at Logan Airport.	Comment noted. Massport will share this comment with the MBTA.

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Nancy S. Timmerman, P.E.
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October 30, 2015

The Honorable Matthew A. Beaton, Secretary
Executive Office of Energy and Environmental Affairs
Attn: MEPA Office
Anne Canaday, EOEA No. 3247
100 Cambridge Street, Suite 900
Boston, MA 02114

Subject: EOEA #3247-Boston-Logan Airport 2014 Environmental Data Report (EDR)

Dear Secretary Beaton:

These comments are being transmitted by email.

I have reviewed the 2014 Environmental Data Report (EDR), EOEA #3247 and offer the following comments and questions.

On page 1-13, it the EDR notes that VMT (vehicle miles traveled) on airport has decreased in 2014. Since parking cannot increase, due to the parking freeze, vehicle pick-up/drop-off **will** increase as passengers increase. It was noted that on-airport parking was limited 40/52 weeks of the year.

On page 1-14, the Preferential Runway Advisory System (PRAS) is cited as a (apparently current) noise abatement measure. How can this be cited when the system has been "turned off" since 2007? 6-1

On page 1-20, noise abatement is included in the sustainability plan. Since Massport cannot implement any noise abatement practices - only the Federal Aviation Administration (FAA) can- this is an empty promise. 6-2

Regarding the Logan Airport Greenway Connector Project on page 3-2, does Massport provide security for users of this pedestrian/bikepath? 6-3

Regarding the new bus fleet for the Rental Car Center (RCC) on page 3-4, how big was the rental car (diesel bus) fleet before Massport constructed the RCC? 6-4

In Figure 5-6 (page 5-16), why were there more parking exits in 2000 than in 2014? The parking freeze has been in place the whole time, and passenger numbers are up. 6-5

On page 6-3, paragraph 1, there is a typographical error. Runway 5R - 33L should read Runway 15R - 33L. 6-6

On page 6-36, in the discussion of the comparison between modeled and measured noise levels for 2013 and 2014, it is stated that the average difference will always be a positive number. There is no physical reason why the difference between modeled and measured should be biased. This observation (because that is what it is) just shows that there is a system error between the modeling and the measurements. 6-7

In Tables 6-14 and -15 (pages 6-46 and 6-47), regarding Time Above for and average day and night, it is scary to note that there are minutes above an 85 dBA treshhold (like a truck) at night. No wonder people are complaining. The column headings in Table 6-15 are incorrect for 2013. 6-8

On page 6-51, it states that Table 6-17 has complaints for the ten highest communities. There are more than ten communities listed in the table. 6-9

The FAA's use of a DNL of 65 dBA for airport impact (while the law) does not address the approximately 12,500 calls from routine use of this major airport. Most of the people affected are well outside a DNL of 65 dBA. 6-10

Thank you for giving me the opportunity to comment on this report.

Sincerely,

Nancy S. Timmerman, P.E.

cc: S. Dalzell, Massport
Letter to MEPA Office/EOEA #3247--2014EDR

Comment #	Author	Topic	Comment	Response
6-1	Nancy S. Timmerman, P.E., Consultant in Acoustics and Noise Control	Noise	On page 1-14, the Preferential Runway Advisory System (PRAS) is cited as a (apparently current) noise abatement measure. How can this be cited when the system has been "turned off" since 2007?	Massport will continue to report on PRAS until a new system is adopted. During Phase 2 of the on-going Boston-Logan Airport Noise Study (BLANS), the Logan Airport Community Advisory Committee (CAC) voted to abandon PRAS because it had not achieved the intended noise abatement. Phase 3 of the BLANS is focusing on the development of an updated Runway Use Program. Operational tests of a new program began in November 2014 and are planned to continue through September 2016. For this *2015 EDR* , Massport continues to present the annual comparison data to the PRAS goals.
6-2	Nancy S. Timmerman, P.E., Consultant in Acoustics and Noise Control	Noise	On page 1-20, noise abatement is included in the sustainability plan. Since Massport cannot implement any noise abatement practices - only the Federal Aviation Administration (FAA) can- this is an empty promise.	Massport works collaboratively with the Federal Aviation Administration (FAA) and community groups, such as the Logan Airport CAC, to address noise-related issues. The FAA has been actively studying the noise and other environmental impacts of proposed flight path changes to Logan Airport's runways. The Boston Logan Airport Noise Study, or BLANS, has been ongoing since 2008 and the Logan Airport CAC has been working with the FAA and Massport on providing community representation. Detailed information from the studies can be found at: http://www.bostonoverflightnoisestudy.com. This study continues to be an open forum for these discussions. On October 7, 2016, Massport and the FAA signed a Memorandum of Understanding (MOU) 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.
6-3	Nancy S. Timmerman, P.E., Consultant in Acoustics and Noise Control	Ground Access	Regarding the Logan Airport Greenway Connector Project on page 3-2, does Massport provide security for users of this pedestrian/bike path?	Massport has installed cameras, lighting, and call boxes along Massport's Logan Airport Greenway Connector which begins at the terminus of Bremen Street Park and ends at the Wood Island Overlook adjacent to Short Street, East Boston. These measures are extended along the Narrow Gauge Connector section, constructed by City of Boston, to Constitution Beach.
6-4	Nancy S. Timmerman, P.E., Consultant in Acoustics and Noise Control	Ground Access	Regarding the new bus fleet for the Rental Car Center (RCC) on page 3-4, how big was the rental car (diesel bus) fleet before Massport constructed the RCC?	As published in the *2011 Environmental Status and Planning Report (ESPR),* there were 94 primarily diesel rental car buses before the Rental Car Center was constructed. In 2012, Massport purchased 50 alternative fuel buses (32 diesel-electric hybrid buses and 18 CNG buses), which replaced the 94 buses previously in service.
6-5	Nancy S. Timmerman, P.E., Consultant in Acoustics and Noise Control	Ground Access	In Figure 5-6 (page 5-16), why were there more parking exits in 2000 than in 2014? The parking freeze has been in place the whole time, and passenger numbers are up.	Figure 5-16 in the *2014 Environmental Data Report (EDR)* shows the change over time in short-term (less than 4 hours) versus long-term parking tickets issued. The higher number of total tickets is reflective of the substantially higher short-term parking that was occurring during the early 2000s. Short-term parking has been reduced on-Airport by a change in fee structure. The shift from short-term to long-term parking is environmentally beneficial.

Comment #	Author	Topic	Comment	Response
6-6	Nancy S. Timmerman, P.E., Consultant in Acoustics and Noise Control	Noise	On page 6-3, paragraph 1, there is a typographical error. Runway 5R - 33L should read Runway 15R - 33L.	Correction noted.
6-7	Nancy S. Timmerman, P.E., Consultant in Acoustics and Noise Control	Noise	On page 6-36, in the discussion of the comparison between modeled and measured noise levels for 2013 and 2014, it is stated that the average difference will always be a positive number. There is no physical reason why the difference between modeled and measured should be biased. This observation (because that is what it is) just shows that there is a system error between the modeling and the measurements.	It is stated that, in general, the average will typically be a positive value. This is due to the modeled values almost always being higher at many of the more distant noise measurement locations. Noise monitors at locations further from the Airport have a more difficult time identifying aircraft noise events whereas the modeling includes all of the aircraft noise events. This issue with noise measurements is also discussed on page 6-36 in the *2014 EDR* .
6-8	Nancy S. Timmerman, P.E., Consultant in Acoustics and Noise Control	Noise	In Tables 6-14 and -15 (pages 6-46 and 6-47), regarding Time Above for and average day and night, it is scary to note that there are minutes above an 85 dBA threshold (like a truck) at night. No wonder people are complaining. The column headings in Table 6-15 are incorrect for 2013.	Correction noted.
6-9	Nancy S. Timmerman, P.E., Consultant in Acoustics and Noise Control	Noise	On page 6-51, it states that Table 6-17 has complaints for the ten highest communities. There are more than ten communities listed in the table.	The table is listing the top ten communities for each year (2013 and 2014). If the top ten for each year was completely different there would be 20 communities listed.
6-10	Nancy S. Timmerman, P.E., Consultant in Acoustics and Noise Control	Noise	The FAA's use of a DNL of 65 dBA for airport impact (while the law) does not address the approximately 12,500 calls from routine use of this major airport. Most of the people affected are well outside a DNL of 65 dBA.	Massport is aware of the concern from communities well outside the Day-Night Average Sound Level (DNL) 65 dB contours and works with the FAA to improve the noise environment

BOSTON
TRANSPORTATION
DEPARTMENT

ONE CITY HALL SQUARE • ROOM 721
BOSTON, MASSACHUSETTS 02201
617-635-4680 • FAX 617-635-4295

NOV 16 2015 late

November 4, 2015

The Honorable Matthew Beaton, Secretary
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, Massachusetts 02114

Re: Boston-Logan International Airport 2014 Environmental Data Report (2014 EDR)- EEA #3247

Dear Secretary Beaton:

The Boston Transportation Department (BTD) has reviewed the above document and is pleased to submit the following comments for your review.

Although this is primarily an environmental document, BTD would like to comment on traffic related issues that could potentially affect East Boston residents.

The Massachusetts Port Authority (MPA) has worked hard to minimize the environmental impacts associated with the increase in aircraft operations and ground traffic. The current policy of airlines to use larger aircraft to satisfy market demand with less flights has worked well in Boston and other major cities around the country. However, as shown in your most recent Monthly Airport Traffic Summary, this trend appears to be changing as the Boston market continues its rapid growth. Aircraft operations at Logan Airport increased by 1.2% from January to September of this year to 279,753 operations vs. 276,369 for the same period in 2014. We believe this trend shows no signs of changing anytime soon. In fact, in our opinion, this trend will continue well into the foreseeable future. While the **2014 EDR** focuses primarily on environmental impacts, BTD is concerned on the vehicular impacts airport growth will have on the local streets in East Boston and surrounding communities. Therefore, our concerns which focus on airport ground traffic related impacts network with environmental impacts, since it's clear as traffic volume increases so will the air quality in the close-in communities decrease. 7-1

MARTIN J. WALSH, Mayor

Page 2, 2014 Environmental Data Report

Our comments pertaining directly to the **2014 EDR** are as follows:

Page 2-19, Paragraph 1 (Aviation Activity Forecasts)

BTD would like to request clarification where the document states, "The refined forecast reflects the most up-to-date short-term (2015 and 2016) and long-term (2035) activity outlooks."We believe the 2035 may be listed in error. The latest date pertaining to the long-term forecast in the **EDR** appears to be 2020. 7-2

Page 3-4, Point #4 (Martin A. Coughlin Bypass Road)

Local residents, along with city and elected officials, worked hard with Massport for many years to construct this important bypass road with the hope it would give relief to East Boston residents from the many commercial vehicles exiting and entering Logan Airport, especially heavy trucks. Unfortunately, it has not worked as well as expected. There have been many drivers that have experienced difficulty in finding or even knowing about this important option for access/egress to Logan Airport.

BTD would like to request that Massport expand their airport information, as well as their roadway system signage, to inform drivers of this valuable asset that not only improves airport traffic flow, but more importantly, reduce traffic and air quality impacts in East Boston. 7-3

Pages 5-1, 5-2 and 5-3, Re: Ground Access

BTD is pleased Massport has complied with the Logan Airport/East Parking Freeze criteria. The transfer of Park & Fly lots from East Boston to the airport and the transfer of 4,427 employee spaces to off-site locations has resulted in less traffic, as well as improved air quality and noise impacts in the community. We also believe the Logan Express Bus Service has been a success and helps dramatically in curtailing ground access issues.

BTD agrees with Massport on the issue of diverted parking operations to both on the airport (locations not included in the Freeze area) and off-airport parking locations resulting in additional drop-off/pick-up activity as a direct result of compliance with the Logan Airport/ East Boston Parking Freeze. While BTD clearly understands the challenge Massport must face under this legislation, we also hope Massport does not attempt to increase the number of commercial spaces allowed by law. The parking freeze was not only developed to reduce emissions, it was also designed to eradicate the park & fly lots in the East Boston Community and relocate them on the airport as well. Thus far, this program has worked as intended. 7-4

Page 3, 2014 Environmental Data Report

BTD supports Massport in the attempt to improve the shortfall of parking spaces at Logan Airport. However, Massport must develop innovative programs to expand their High Occupancy Vehicle (HOV) operations, Logan Express Bus Service, Blue and Silver Line accommodations, water transportation and employee parking demand in order to address this serious problem prior to any consideration on the expansion of the number of spaces allowed under the Parking Freeze. 7-4 Cont.

Pages 5-29 & 5-30, Regarding Ground Access Planning Considerations

As we know, the Massport ground access goal is to attain a 35.2% passenger HOV mode share when the annual air passenger levels reach 37.5 million. The criteria for this HOV mode share was completed in the early 1990s and in subsequent environmental documents became a declared goal for ground access to Logan Airport. Unfortunately, the latest survey conducted in 2013 revealed an HOV mode share of 28% which has remained consistent with past surveys dating back to 2004. While this may demonstrate how Logan Airport has been able to maintain its HOV mode share despite increases in air passenger levels, it also questions whether or not the goal of 35.2% HOV mode share when passenger levels reach 37.5 million is attainable. 7-5

BTD is willing to work with Massport and other government agencies to achieve the goals and objectives of the East Boston/Logan Airport Parking Freeze, and while we understand that Logan is the only airport with a parking freeze, it must also be understood that it is an airport abutting heavily populated neighborhoods that impact people everyday, both on the ground and in the air. 7-6

If you have any questions, please feel free to call me at 617-635-3076.

Sincerely,

Robert D'Amico
Senior Planner

BOSTON TRANSPORTATION DEPARTMENT
ONE CITY HALL SQUARE / ROOM 721 • BOSTON, MA 02201 • 617-635-4680

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Comment #	Author	Topic	Comment	Response
7-1	Boston Transportation Department	Ground Access	We believe this trend [increase in aircraft operations] shows no signs of changing anytime soon. In fact, in our opinion, this trend will continue well into the foreseeable future. While the 2014 EDR focuses primarily on environmental impacts, BTD is concerned on the vehicular impacts airport growth will have on the local streets in East Boston and surrounding communities. Therefore, our concerns which focus on airport ground traffic related impacts network with environmental impacts, since it's clear as traffic volume increases so will the air quality in the close-in communities decrease.	Massport works to minimize the impacts on local streets in East Boston and surrounding communities through all aspects of our ground access program. We believe that these efforts have been a success, considering that while passengers volumes increased by 5.7 percent from 2014 to 2015, Annual Average Daily Traffic (AADT) remained nearly constant and in fact decreased by 0.5 percent in 2015. Trips accessing the airport are funneled to a few gateway roads in order to minimize vehicular impacts on local streets. Where opportunities, exist, Massport has made changes to airport access to limit connections to local streets, such as closing the Maverick Street Gate. Massport collects ongoing traffic data on its gateways as well as at intersections throughout the airport roadway network in order to monitor changes in airport ground access.
7-2	Boston Transportation Department	Activity Levels	BTD would like to request clarification where the document states, "The refined forecast reflects the most up-to-date short-term (2015 and 2016) and long-term (2035) activity outlooks." We believe the 2035 may be listed in error. The latest date pertaining to the long-term forecast in the EDR appears to be 2020.	Correction noted; 2035 was listed in error. The *2011 Environmental Status and Planning Report (ESPR)* forecasted until 2030.
7-3	Boston Transportation Department	Ground Access	BTD would like to request that Massport expand their airport information, as well as their roadway system signage, to inform drivers of this valuable asset [Martin A. Coughlin Bypass Road] that not only improves airport traffic flow, but more importantly, reduce traffic and air quality impacts in East Boston.	Comment noted.
7-4	Boston Transportation Department	Ground Access	While BTD clearly understands the challenge Massport must face under this [Parking Freeze] legislation, we also hope Massport does not attempt to increase the number of commercial spaces allowed by law. The parking freeze was not only developed to reduce emissions, it was also designed to eradicate the park & fly lots in the East Boston Community and relocate them on the airport as well. Thus far, this program has worked as intended. BTD supports Massport in the attempt to improve the shortfall of parking spaces at Logan Airport. However, Massport must develop innovative programs to expand their High Occupancy Vehicle (HOV) operations, Logan Express Bus Service, Blue and Silver Line accommodations, water transportation and employee parking demand in order to address this serious problem prior to any consideration on the expansion of the number of spaces allowed under the Parking Freeze.	Comment noted.

Comment #	Author	Topic	Comment	Response
7-5	Boston Transportation Department	Ground Access	The criteria for this HOV mode share was completed in the early 1990s and in subsequent environmental documents became a declared goal for ground access to Logan Airport. Unfortunately, the latest survey conducted in 2013 revealed an HOV mode share of 28% which has remained consistent with past surveys dating back to 2004. While this may demonstrate how Logan Airport has been able to maintain its HOV mode share despite increases in air passenger levels, it also questions whether or not the goal of 35.2% HOV mode share when passenger levels reach 37.5 million is attainable.	Massport continues to implement a comprehensive ground transportation strategy designed to maximize transit and shared-ride options for travel to and from Logan Airport and minimize vehicle trips by providing convenient transit, shuttle, and pedestrian connections at the Airport. Massport invests in and operates Logan Airport with a goal of increasing the number of passengers arriving by transit or other high-occupancy vehicle (HOV)/shared-ride modes. Logan Airport continues to rank at the top of U.S. airports in terms of HOV/transit mode share. Programs include Logan Express bus service, free outbound Silver Line boardings, water shuttle service, and free, frequent shuttle bus service to and from the Blue Line subway station. Massport provides priority, designated curb areas at all Airport terminals, to support the use of HOV/transit modes, including privately-operated scheduled buses and shared-ride vans. The most recent *Logan Airport Air Passenger Ground Access Survey* was completed in the spring of 2016 and results will be presented in the *2016 ESPR*.
7-6	Boston Transportation Department	Ground Access	BTD is willing to work with Massport and other government agencies to achieve the goals and objectives of the East Boston/Logan Airport Parking Freeze, and while we understand that Logan is the only airport with a parking freeze, it must also be understood that it is an airport abutting heavily populated neighborhoods that impact people everyday, both on the ground and in the air.	Comment Noted.

C

Proposed Scope for the *2016 ESPR*

PROJECT NAME: Logan Airport 2016 Environmental Status and Planning Report (ESPR)

PROJECT LOCATION: Logan International Airport, East Boston, Massachusetts

EOEA NUMBER: 3247

PROJECT PROPONENT: Massachusetts Port Authority (Massport)

Massport respectfully submits this proposed scope for the *Logan Airport 2016 Environmental Status and Planning Report (ESPR)* for public review and comment. The *2016 ESPR* would follow the *2015 Environmental Data Report (EDR),* which was filed in December 2016. As directed by the Secretary of the Executive Office of Energy and Environmental Affairs (EEA), Massport will continue to use this process to evaluate the cumulative impacts associated with Logan Airport activities through preparation of an ESPR approximately every five years with data updates annually through the EDRs. This ESPR will provide the most recent passenger and operations forecasts for Logan Airport through 2035 and compare to historic trends. Massport will continue to post the full EDR/ESPR documents on the Massport website (http://www.massport.com/environment).

Purpose of the Logan Airport *2016 ESPR*

For over three decades, the Logan Airport EDRs and ESPRs have provided information to agencies and the public on planning activities, aircraft operations and passenger activity levels, and Massport initiatives at Logan Airport. The *2016 ESPR* will provide an update on conditions at Logan Airport for calendar year 2016. The ESPR will continue to serve as a background/context against which projects at Logan Airport can be evaluated. It will also report on the cumulative effects of Logan Airport operations and activities, compared to previous years, as appropriate and to future forecast year 2035.

The EDR/ESPR process was developed to allow individual projects at Logan Airport to be considered and analyzed in the broader, Airport-wide context. The EDRs and ESPRs serve as the baseline analyses for project-specific environmental reviews and provide a forum for updates on Massport's mitigation program. As stated in the introduction to the *1999 ESPR*, "while the Logan ESPR and EDRs provide the broad planning context for projects proposed for Logan Airport and future planning concepts under consideration by Massport, no specific projects can be built solely on the basis of inclusion and discussion in the *1999 ESPR."* By providing the Airport-wide context for air quality, noise, ground transportation, and water quality, the EDRs/ESPRs help focus the review processes for state Environmental Notification Forms (ENFs) and, if necessary, Environmental Impacts Reports (EIRs). In this manner, Massport ensures that segmented project review does not occur in the context of Massachusetts Environmental Policy Act (MEPA) review of projects at Logan Airport. The EDRs/ESPRs also provide context for federal National Environmental Policy Act (NEPA) reviews by the Federal Aviation Administration (FAA) serving as the lead federal agency. In short, the EDRs/ESPRs provide a planning context which complements the individual project-specific filings. As directed in the Secretary's Certificate on the Terminal E Modernization Project ENF, the EDR/ESPR will continue to be the forum to address cumulative, Airport-wide impacts.

Contents of the *2016 ESPR*

Generally, the *2016 ESPR* will follow the format of the *2011 ESPR*, presenting an overview of the role of Logan Airport in the regional planning context. The *2016 ESPR* will report on 2016 passenger and aircraft operation activity levels. This will be followed by a status report on Massport's proposed planning initiatives, projects, and mitigation. In this way, Massport will provide necessary background information to allow the reviewer to understand the environmental policies and planning which form the context of the environmental reporting, technical studies, and environmental mitigation initiatives at Logan Airport.

In addition, the ESPR will report on updated passenger and operations activity forecasts for Logan Airport and Massport's other airports, Hanscom Field and Worcester Regional Airport. The new forecast will use 2016 as the base year and projected activity forecasts forward to calendar year 2035. In addition, the *2016 ESPR* will use the results of the *2016 Logan Airport Air Passenger Ground Access Survey* and the Long-term Parking Management Plan to inform future access planning.

The technical studies in the *2016 ESPR* will include reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, water quality and environmental management, and project mitigation tracking. Sustainability initiatives are included throughout the document. Each chapter's contents are described below.

Chapter 1. Introduction/Executive Summary

This chapter of the *2016 ESPR* will include:

- Highlights of 2016 planning and environmental conditions;
- Overview of Logan Airport and its environmental, geographic, and regulatory context;
- Overview of the EDR/ESPR cycle;
- Highlights of passenger activity levels and aircraft operations;
- Description of the analysis framework for the environmental reporting and technical studies to be conducted;
- Overview of the Logan Airport planning initiatives and projects;
- Overview of sustainability initiatives at Logan Airport; and
- Organization of the *2016 ESPR*.

A Spanish version of the Executive Summary for the *2016 ESPR* will be prepared and included in the document.

Chapter 2. Activity Levels

The primary purpose of this chapter will be to report on airport activity levels for 2016, including:

- Aircraft operations, including fleet mix and scheduled airline services at Logan Airport;
- Domestic and international passenger activity levels;
- Cargo and mail volumes;
- Compare 2016 aircraft operations, cargo/mail operations, and passenger activity levels to 2015 activity levels; and
- Report on national aviation trends in 2016 and compare to trends at Logan Airport.

This chapter will also report on Massport's forecasts that become the basis for the planning and impact sections that follow and for Massport's planning initiatives over the next few years. Future year analyses will be based on the new 2035 forecast. This chapter will update the aircraft operations and passenger activity forecasts, and will provide a discussion of analysis methodologies and assumptions, including anticipated fleet mix changes and other trends in the aviation industry. The section will report on the following:

- Compare 2016 operations to historic trends and forecasts for planning horizon year 2035;
- Present updated forecasts of Logan Airport's passenger volume, aircraft operations, and fleet mix; and
- Compare forecast activity levels to historic trends, prior Logan Airport forecasts, and FAA forecasts for Logan Airport and the U.S. industry.

Chapter 3. Airport Planning

Massport continues to assess planning strategies for improving Logan Airport's operations and services in a safe, secure, more efficient, and environmentally sensitive manner. As owner and operator of Logan Airport, Massport also must accommodate and guide tenant development. This chapter will describe the status of planning initiatives for the following areas:

- Terminal Area;
- Airside Area;
- Service and Cargo Areas;
- Roadways and Airport Parking; and
- Airport Buffers and Landscaping.

Massport is planning for the ongoing improvement of Logan Airport facilities as well as enhancing access to and from the Airport. The chapter will report on the status of projects implemented within the boundaries of

Logan Airport either by Massport, its tenants, or other state entities. The chapter will also report on the status and effectiveness of the ground access related changes including roadway and parking projects, which consolidate and direct airport-related traffic to centralized locations and minimize airport-related traffic on external streets in adjacent neighborhoods.

Chapter 4. Regional Transportation

The *2016 ESPR* will describe Logan Airport's role in the region's intermodal transportation system by reporting on the following:

Regional Airports

- 2016 regional airport operations, passenger activity levels, and schedule data within an historical context;
- Status of plans and new improvements as provided by the regional airport entities;
- Ground access improvements to the regional airports; and
- The role that Worcester Regional Airport and Hanscom Field play in the regional aviation system and Massport's efforts to promote these airports.

Regional Transportation System

- Massport's role in managing regional aviation facilities;
- Massport's cooperation with other transportation agencies to promote efficient regional highway and transit operations; and
- Report on metropolitan and regional rail initiatives and ridership.

Chapter 5. Ground Access to and from Logan Airport

The chapter will report on 2016 conditions and provide a comparison to those of 2015 for the following:

- Logan Airport Parking Freeze;
- High occupancy vehicle (HOV) ridership (including Blue Line, Silver Line, Scheduled, Unscheduled, Water Transportation, and Logan Express);
- Logan Airport Employee Transportation Management Association (Logan TMA) services;
- Logan Airport gateway volumes;
- On-Airport traffic volumes/vehicle miles traveled (VMT);
- Parking demand and management (including rates and duration statistics);

- Status of proposed ground access planning and the connection to the Airport Station associated with the planned Terminal E Modernization Project, anticipated Massachusetts Bay Transportation Authority (MBTA) ridership, and possible changes in HOV mode share;
- Status of long-range ground access management strategy planning; and
- Results of the *2016 Logan Airport Air Passenger Ground Access Survey*.

This chapter will also report on future year conditions for 2035 for the following ground transportation indicators:

- Traffic volumes;
- On-Airport VMT; and
- Parking demand.

This chapter will also present a discussion of the following topics:

- Update on parking conditions;
- Massport's cooperation with other transportation agencies to increase transit ridership to and from Logan Airport via the Blue Line and Silver Line;
- Report on Logan Express usage and efforts to increase capacity and usage;
- Report on water transportation to and from Logan Airport; and
- Report on results of ongoing ground access studies, as relevant.

Chapter 6. Noise Abatement

This chapter will provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, and the updates in noise modeling. The chapter will report on 2016 conditions and compare those conditions to those of 2015 for the following:

- Fleet Mix, including Stage II, Recertified (Hushkitted) Stage III, newly manufactured Stage III, and qualifying Stage IV aircraft;
- Nighttime operations;
- Runway utilization (report on aircraft and airline adherence with runway utilization goals); and
- Flight tracks.

In 2015, the FAA introduced a new combined noise and air quality modeling tool, the Aviation Environmental Design Tool (AEDT) that is to be used for all airport projects. This new tool is a software system that dynamically models aircraft performance in space and time to produce fuel burn, emissions, and noise information. Massport is actively evaluating the new model and working with the FAA to develop Logan Airport specific adjustments for the AEDT model. The adjustments would allow the model to properly reflect the noise environment at Logan Airport. Several of these custom adjustments cannot be implemented directly in AEDT and will need to be evaluated by Massport and approved by FAA. Massport has reached out to FAA for consideration and approval of these adjustments and if completed in a timely fashion, pending those discussions, AEDT is expected to be the official model for next year's *2016 ESPR*.

This chapter will report on the following:

- Changes in annual noise contours and noise-impacted population;
- Measured versus modeled noise values, including reasons for differences and any improvements attributable to the models deployed;
- Cumulative Noise Index (CNI);
- Times-Above for 65, 75, and 85 dBA threshold values/Dwell and Persistence of noise levels; and
- Flight track monitoring noise reports.

This chapter will present a discussion of analysis methodologies and assumptions, including forecast fleet mix and runway use assumptions, and report on future year conditions for 2035 for the following noise indicators:

- Runway utilization;
- Day-Night Average Sound Level (DNL) noise contours; and
- Population counts.

The chapter will also report on noise abatement efforts, results from Boston-Logan Airport Noise Study (BLANS), and provide a status update on the noise and operations monitoring system.

Chapter 7. Air Quality/Emissions Reductions

This chapter will begin with an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, and the changes in air quality modeling. The chapter will provide discussion on progress on the national and international levels to decrease air emissions. The chapter will also discuss analysis methodologies and assumptions and report on 2016 conditions using the FAA's new AEDT model, if appropriate. Massport is actively evaluating the new model and working with the FAA to develop Logan Airport specific adjustments for the AEDT model. Massport has reached out to the FAA for consideration and approval of model adjustments and if completed in a timely fashion, AEDT is expected to be the official model for next year's *2016 ESPR*. If resolved, the *2016 ESPR* will compare results to the most recent version of the Emissions Dispersion Modeling System (EDMS) that has been used in recent EDR/ESPR filings. The Environmental

Protection Agency (EPA) required motor vehicle emissions modeling tool (MOtor Vehicle Emission Simulator (MOVES[1]) will continue to be used to assess vehicular emission on airport roadways. The chapter will include:

- Emissions inventory for carbon monoxide (CO);
- Emissions inventory for oxides of nitrogen (NO_x);
- Emissions inventory for volatile organic compounds (VOCs);
- Emissions inventory for particulate matter (PM); and
- NO_x emissions by airline.

This chapter will also report on the following ongoing air quality efforts for 2016:

- Massport's and tenant's alternative fuel vehicle programs; and
- The status of Logan Airport air quality studies undertaken by Massport or others, as available.

This chapter will include Massport's voluntary inventory of greenhouse gas (GHG) emissions from Logan Airport in 2016. GHG emissions will be quantified for aircraft, ground service equipment (GSE), motor vehicles and stationary sources using emission factors and methodologies outlined in the *Greenhouse Gas Emissions Policy and Protocol* issued by EEA and the Transportation Research Board's *Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories* (Airport Cooperative Research Program (ACRP) Report 11, Project 02-06). The results of the 2016 GHG emissions inventory will be compared to the 2015 results.

This chapter will present a discussion of analysis methodologies and assumptions and report on future year condition for 2035 for the following air quality indicators:

- Emissions inventory for CO;
- Emissions inventory for NO_x;
- Emissions inventory for VOCs;
- Emissions inventory for PM; and
- Emissions Inventory for GHGs.

This chapter will also include an update on Massport's efforts to encourage the use of single engine taxiing under safe conditions. This chapter will also provide an update on the feasibility of combined heat and power (CHP) use for Terminal E and updates to progress made in designing the energy systems for the facility.

1 MOVES replaces the previous model for deriving on-road mobile source emissions, MOBILE6.2; the Massachusetts Department of Environmental Protection (MassDEP) directed that MOVES should be used for the EDR analysis for consistency with the State Implementation Plan (SIP) and MassDEP's methodologies.

Chapter 8. Water Quality/Environmental Compliance and Management

This chapter will report on the 2016 status of:

- National Pollutant Discharge Elimination System (NPDES) Permit and monitoring results for Logan Airport's outfalls and the Fire Training Facility;
- Jet fuel usage and spills;
- Massachusetts Contingency Plan (MCP) activities;
- Tank management;
- Update on the environmental management plan; and
- Fuel spill prevention.

The chapter will also present a discussion of the following topics:

- Future stormwater management improvements (if any); and
- Future MCP and tank management activities.

Chapter 9. Project Mitigation Tracking

This chapter will report on the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have undergone MEPA review and other commitments and have commenced construction. The status of mitigation commitments made in the Section 61 Findings for the following projects will be reported:

- West Garage/Central Garage (EOEA 9790);
- International Gateway (EOEA 9791);
- Logan Airside Improvements Planning Project (EOEA 10458);
- Terminal A Replacement Project (EOEA 12096);
- Southwest Service Area Redevelopment Program/Rental Car Center (EOEA 14137);
- Logan Runway Safety Area Improvements Project (EOEA 14442); and
- Terminal E Modernization Project (EEA 15434).

This chapter will update the status of Massport's mitigation commitments and will also identify projects for which mitigation is complete.

Appendices

MEPA Documentation

These appendices will include a copy of the Secretary's Certificate and comment letters received on the *2015 EDR*. Individual responses to items raised in the Secretary's Certificate on the *2015 EDR* and comments in reviewers' letters will be provided. A distribution list for the *2016 ESPR* (indicating those receiving documents or CDs) will be provided. The document will also contain copies of any MEPA Certificates or documentation issued for projects at Logan Airport in 2016 .

Supporting Technical Documentation

Supporting technical appendices will be provided as necessary.

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Distribution

This *2015 Environmental Data Report (EDR)* has been distributed to federal, state, and city agencies and to parties listed in this appendix. The list includes those entities that the Massachusetts Environmental Policy Act (MEPA) requires as part of the review of the document, representatives of governmental agencies, commenters on the *2014 EDR*, and community groups concerned with Airport activities. The 'C' indicates that Massport sent a compact disc (CD) and the 'P' indicates that Massport sent a printed copy.

The *2015 EDR* is also available on Massport's website at www.massport.com and electronically on CD. Limited CD or printed copies of the *2015 EDR* may be requested from Michael Gove, Massport, Logan Office Center, One Harborside Drive, Suite 200S, East Boston, MA 02128, telephone (617) 568-3546, email: mgove@massport.com. Printed and electronic copies of this report are available for review at the following public libraries:

	Library	Address		Library	Address
P,C	Boston Public Library Main Branch	700 Boylston Street Boston, MA 02116	P,C	Boston Public Library Charlestown Branch	179 Main Street Charlestown, MA 02129
P,C	Boston Public Library Connolly Branch	433 Centre Street Jamaica Plain, MA 02130	P,C	Boston Public Library East Boston Branch	365 Bremen Street East Boston, MA 02128
P,C	Bedford Public Library	7 Mudge Way Bedford, MA 01730	P,C	Boston Public Library South Boston Branch	646 East Broadway South Boston, MA 02127
P,C	Chelsea Public Library	569 Broadway Chelsea, MA 02150	P,C	Cary Memorial Library	1874 Massachusetts Avenue Lexington, MA 02420
P,C	Lincoln Public Library	3 Bedford Road Lincoln, MA 01773	P,C	Concord Public Library	129 Main Street Concord, MA 01742
P,C	Quincy Public Library Thomas Crane Branch	40 Washington Street Quincy, MA 02169	P,C	Milton Public Library Main Branch	476 Canton Avenue Milton, MA 02186
P,C	Winthrop Public Library	2 Metcalf Square Winthrop, MA 02151	P,C	Revere Public Library	179 Beach Street Revere, MA 02151
P,C	Medford Public Library	111 High St. Medford, MA 02155	P,C	State Transportation Library	10 Park Plaza, Suite 4160 Boston, MA 02116
P,C	Somerville Public Library	79 Highland Avenue Somerville, MA 02143	P,C	Everett Public Library	410 Broadway Everett, MA 02149
P,C	Cambridge Main Library	449 Broadway Cambridge, MA 02138			

Some parties listed below have been provided a hard copy of the document along with a CD of the complete document. A second group of parties have been provided with a CD only.

Commenters on the *2014 EDR*

P,C	Cindy L Christiansen, PhD. Logan CAC Representative, Milton 59 Collamore St. Milton, MA 02186	P,C	Kathleen M. Conlon, Chair Milton Board of Selectmen 42 Reedsdale Road Milton, MA 02186	P,C	David T. Burnes, Secretary Milton Board of Selectmen 24 Garfield Road Milton, MA 02186
P,C	J. Thomas Hurley, Member Milton Board of Selectmen 714 Blue Hill Avenue Milton, MA 02186	P,C	Julie Wormser, Executive Director The Boston Harbor Association 374 Congress Street, Suite 307 Boston, MA 02210	P,C	Richard C. Rossi, City Manager City of Cambridge 795 Massachusetts Avenue Cambridge, MA 02139
P,C	Stephen H. Kaiser, PhD. 191 Hamilton Street Cambridge, MA 02139	P,C	Nancy S. Timmerman, P.E. Consultant in Acoustics and Noise Control 25 Upton Street Boston, MA 02118	P,C	Robert D'Amico Boston Transportation Department One City Hall Square, Room 721 Boston, MA 02201

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P,C	The Honorable Richard E. Neal U.S. House of Representatives 300 State Street, Suite 200 Springfield MA, 01105	P,C	The Honorable Seth Moulton U.S. House of Representatives 21 Front Street Salem, MA 01970	P,C	The Honorable William R. Keating U.S. House of Representatives Two Court Street Plymouth, MA 02360
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P,C	The Honorable Elizabeth Warren 2400 JFK Federal Building 15 New Sudbury Street Boston, MA 02203	P,C	The Honorable Ed Markey JFK Federal Building, Suite 975 15 New Sudbury Street Boston, MA 02203		

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- **United States Army Corps of Engineers**
- **United States Postal Service**

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- **United States Fish and Wildlife Service**

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C	Representative William M Straus Chair, Joint Committee on Transportation Massachusetts State House, Room 134 Boston, MA 02133	C	Senator Linda Dorcena Forry Massachusetts State House, Room 419 Boston, MA 02133	C	Representative Nick Collins Massachusetts State House, Room 26 Boston, MA 02133
C	Representative Daniel J. Ryan Massachusetts State House, Room 136 Boston, MA 02133	P,C	Representative Adrian Madaro Massachusetts State House, Room 544 Boston, MA 02133		

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C Tito Jackson District Councilor, 7 Boston City Council Boston, City Hall Boston, MA 02201	C Josh Zakim District Councilor, 8 Boston City Council Boston, City Hall Boston, MA 02201	C Mark Ciommo District Councilor, 9 Boston City Council Boston, City Hall Boston, MA 02201
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C Luis Tejada, Councilor District 2 Chelsea City Hall 500 Broadway Chelsea, MA 02150	C Matthew Frank, Councilor District 3 Chelsea City Hall 500 Broadway Chelsea, MA 02150	C Enio Lopez, Councilor District 4 Chelsea City Hall 500 Broadway Chelsea, MA 02150
C Judith Garcia, Councilor District 5 Chelsea City Hall 500 Broadway Chelsea, MA 02150	C Giovanni A. Recupero, Councilor District 6 Chelsea City Hall 500 Broadway Chelsea, MA 02150	C Yamir Rodriguez Chelsea City Hall Councilor District 7 500 Broadway Chelsea, MA 02150
C Dan Cortell District 8, Council President Chelsea City Hall 500 Broadway Chelsea, MA 02150	C Stephen N. Sarikas Chelsea Conservation Commission Chelsea City Hall 500 Broadway Chelsea, MA 02150	C Luis Prado, MSPIH Director, Department of Health and Human Services Chelsea City hall 500 Broadway Chelsea, MA 02150
C John DePriest Director of Planning and Development and Chelsea Conservation Commission City of Chelsea 500 Broadway, Room 101 Chelsea, MA 02150		
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■ **Town of Winthrop**		
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■ **Town of Winthrop Continued**		
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c Richard Boyajian, Councilor-At-Large Winthrop Town Hall One Metcalf Square Winthrop, MA 02152	c Paul Varone Councilor- Precinct 1 Winthrop Town Hall One Metcalf Square Winthrop, MA 02152	c James Letterie, Vice President Councilor- Precinct 2 Winthrop Town Hall One Metcalf Square Winthrop, MA 02152
c Nicholas DelVento Councilor- Precinct 3 Winthrop Town Hall One Metcalf Square Winthrop, MA 02152	c Heather Engman Councilor- Precinct 4 Winthrop Town Hall One Metcalf Square Winthrop, MA 02152	c Russell Sanford Councilor- Precinct 5 Winthrop Town Hall One Metcalf Square Winthrop, MA 02152
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c Renel Fredericksen Board of Selectmen 16 Lincoln Road Lincoln, MA 01773		

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Massport Community Advisory Committee (CAC)

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[P,C] John Nucci 99 Orient Avenue East Boston, MA 02128	[P,C] Robert D'Amico 39 Maple Avenue Nahant, MA 01908	[P,C] Frederick Sannella 36 Goodwin Avenue Revere, MA 02151
[P,C] Gary Banks 128 Indian Trail Scituate, MA 02066	[P,C] Wig Zamore 13 Highland Avenue #3 Somerville, MA 02143	[P,C] Terrence McAteer 266 Pine Street South Weymouth, MA 02190
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[C] Sergio Jaramillo, President Chelsea Chamber of Commerce 308 Broadway Chelsea, MA 02150	[C] Rod Hobson 31 Deep Run Cohasset, MA 02025	

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Mary Ellen Welch 225 Webster Street East Boston, MA 02128	Bernadette Cantalupo 156 Porter Street East Boston, MA 02128	Aaron Toffler AIR Inc. 34 Kimball Street Needham, MA 02492
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Fran Riley 193 Trenton Street East Boston, MA 02128	Patricia D'Amore 95 Webster Street East Boston, MA 02128	

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c Elaine Hurley Pines Riverside Association c/o 21 River Avenue Revere, MA 02151	c Joseph James Friends of Rumney Marsh 10 Rice Avenue Revere, MA 02151	c Michael Kelleher Revere Beach Assoc. 681 Revere Beach Boulevard Revere, MA 02151
c Kristina Nappi, President Point of Pines Beach Assoc. c/o 66 Bickford Avenue Revere, MA 02151	c Rose LaQuaglia Oak Island Civic Association 5 Oak Island Road Revere, MA 02151	c Carl Shalachman 72 Whitin Ave Revere, MA 02151
c Bob Upton Revere Chamber of Commerce 108 Beech Street Revere, MA 02151	c Jim Page 162 Endicott Avenue Revere, MA 02151	c Joanne McKenna Revere City Council – Ward 1 830 Winthrop Street Revere, MA 02151
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c Mr. William Spain President Castle Island Association PO Box 342 South Boston, MA 02127	c Seaport Alliance for a Neighborhood Design 300 Summer Street Boston, MA 02210	c Joe Rogers Fort Point Neighborhood Association 21 Wormwood Street South Boston, MA 02127
c Gary Murad St. Vincent's Neighborhood Association 147 B Street South Boston, MA 02127		
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■ **West Roxbury Community**

C	Larry Boran 40 Vershire Street West Roxbury, MA 02132	C	Carl Corcy 88 Bellevue Street West Roxbury, MA 02132	C	Keith Davison 37 Hastings Street, #206-ME West Roxbury, MA 02132

■ **Other Communities**

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C	Philip Johenning 23 Parkwood Drive Milton, MA 02186				

■ **Organizations and Other Interested Parties**

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C	John E. Drew President, Drew Company, Inc. 2 Seaport Lane, Floor 9 Boston, MA 02210	C	Jim Matthews, President & CEO National Assoc. of Railroad Passengers 505 Capital Court, NE, Suite 300 Washington, DC 20002-7706	C	Adam Mitchell Save That Stuff Inc. 100 Terminal Street Charlestown, MA, 02129
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C	Stephen Schultz Engel & Schultz, LLP One Federal Street, Suite 2120 Boston, MA 02110	P,C	Kathy Abbott, President and CEO Boston Harbor Now 15 State Street #1100 Boston, MA 02210	C	Eugene Benson, Executive Director Massachusetts Association of Conservation Commissions 10 Juniper Road Belmont, MA 02178
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■ **Organizations and Other Interested Parties Continued**

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C Somerville Transportation Equity Partnership 51 Mt. Vernon St. Somerville, MA 02145	C Mystic View Task Force PO Box 441979 Somerville, MA 02144	C Darrin McAuliffe Manager-Secretary, Rider Oversight Committee 45 High Street Boston, MA 02110

Technical Appendices

- Appendix E, Activity Levels
- Appendix F, Regional Transportation
- Appendix G, Ground Access
- Appendix H, Noise Abatement
- Appendix I, Air Quality/Emissions Reduction
- Appendix J, Water Quality/Environmental Compliance and Management
- Appendix K, 2015 and 2016 Peak Period Pricing Monitoring Report
- Appendix L, Reduced/Single Engine Taxiing at Logan Airport Memoranda

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E

Activity Levels

This appendix provides detailed tables in support of Chapter 2, *Activity Levels*:

- Table E-1 Logan Airport Historical Air Passenger and Operations Data
- Table E-2 Logan Airport Changes in Domestic Passenger Operations by Carrier
- Table E-3 Logan Airport Changes in International Passenger Operations by Carrier
- Table E-4 Logan Airport Scheduled Passenger Departures by Destination

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Table E-1 Logan Airport Historical Air Passenger and Operations Data

Year	Operations	Air Passengers	Year	Operations	Air Passengers
1980	258,167	14,722,363	1998	507,449	26,526,708
1981	251,961	14,827,684	1999	494,816	27,052,078
1982	244,468	15,867,722	2000	487,996	27,726,833
1983	288,956	17,848,797	2001	463,125	24,474,930
1984	318,959	19,417,971	2002	392,079	22,696,141
1985	349,518	20,448,424	2003	373,304	22,791,169
1986	363,995	21,862,718	2004	405,258	26,142,516
1987	414,968	23,369,002	2005	409,066	27,087,905
1988	407,479	23,732,959	2006	406,119	27,725,443
1989	388,797	22,272,860	2007	399,537	28,102,455
1990	424,568	22,878,191	2008	371,604	26,102,651
1991	430,403	21,450,143	2009	345,306	25,512,086
1992	474,378	22,723,138	2010	352,643	27,428,962
1993	493,093	23,579,726	2011	368,987	28,909,267
1994	458,623	24,468,178	2012	354,869	29,236,087
1995	466,327	24,192,095	2013	361,339	30,218,970
1996	456,226	25,134,826	2014	363,797	31,634,445
1997	482,542	25,567,888	2015	372,930	33,449,580

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Table E-2 Logan Airport Changes in Domestic Passenger Operations by Carrier

Airline	2000	2005	2010	2011	2012	2013	2014	2015	2014-2015 Change	2014-2015 Percent Change
Scheduled Jet Carriers	**233,993**	**190,991**	**203,052**	**207,369**	**203,376**	**211,176**	**214,854**	**225,629**	**10,775**	**5.0%**
AirTran Airlines	3,090	14,580	13,672	12,869						
Alaska Airlines		1,088	1,733	1,757	1,873	2,661	3,090	3,027	-63	-2.0%
America West Airlines	5,116	4,467								
American Airlines[1]	30,821	27,712	21,313	18,943	20,962	22,535	58,222	56,623	-1,599	-2.7%
American Trans Air	1,448	2,294								
Continental Airlines	16,894	13,546	10,869							
Delta Air Lines[2]	52,954	36,388	28,980	25,429	23,270	21,139	23,614	30,705	7,091	30.0%
Frontier Airlines	1,052		1,094		275					
Independence Air		4,676								
JetBlue		15,069	49,981	58,737	63,210	73,374	76,247	79,364	3,117	4.1%
Midway Airlines	4,096									
Midwest Airlines	3,726	3,570	1,961	2,786						
Northwest Airlines	13,147	9,685								
People Express							170			
Southwest Airlines[3]			13,727	17,413	23,667	23,701	21,967	21,542	-425	-1.9%
Spirit Airlines			3,023	3,054	3,365	2,721	2,945	4,896	1,951	66.2%
Sun Country Airlines	723		313	509	596	926	1,027	1,414	387	37.7%
Trans World Airlines	6,280									
United Airlines[4]	28,092	18,304	16,314	26,425	25,636	25,214	24,374	24,632	258	1.1%
US Airways[5]	66,554	39,612	36,678	36,421	36,633	35,613				
Virgin America			3,394	3,026	3,889	3,292	3,198	3,426	228	7.1%
Regional/Commuter Carriers	**160,041**	**137,203**	**94,535**	**89,586**	**79,790**	**79,922**	**76,682**	**70,274**	**-6,408**	**-8.4%**
America West Express	1,267									
American Eagle	62,140	37,394	15,291	6,669	4	4	5	52		
Cape Air	31,026	25,018	35,899	35,940	37,184	37,194	35,080	35,994	914	2.6%
Continental Connection			1,809	1,199	131					
Continental Express		12,544	529	902	385					
Delta Connection	15,438	26,557	18,445	23,243	20,925	20,848	20,265	15,466	-4,799	-23.7%
MidAtlantic Express										
Midwest/Republic			258							
Northwest Airlink		5,034								
PenAir					2,268	4,384	4,382	3,747	-635	-14.5%
Republic Airlines						58	53	34	-19	-35.8%
United Express		3,178	2,802	2,763	4,342	5,829	5,628	4,699	-929	-16.5%
US Airways Express	50,170	27,478	19,502	18,870	14,551	11,605	11,269	10,282	-987	-8.8%
Non-Scheduled Operations (Incl. Charter)	**1,008**	**325**	**501**	**106**	**181**	**200**	**164**	**176**	**12**	**7.3%**
Total Domestic Operations	**395,042**	**328,519**	**298,117**	**297,061**	**283,347**	**291,298**	**291,700**	**296,079**	**4,379**	**1.5%**

Source: Massport

Notes: Excludes general aviation and all-cargo operations.

Table E-3 Logan Airport Changes in International Passenger Operations by Carrier

Airline	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2014-2015 Change	2014-2015 Percent Change
Scheduled Jet Carriers	**27,427**	**29,284**	**26,457**	**26,079**	**26,804**	**24,550**	**22,081**	**22,834**	**22,768**	**22,065**	**20,771**	**24,973**	**25,633**	**23,301**	**25,065**	**28,225**	**3,160**	**12.6%**
Aer Lingus	1,160	1,247	1,120	1,173	1,096	1,016	1,020	1,221	1,347	1,268	1,097	1,130	1,273	1,513	1,933	1,973	40	2.1%
Aeromexico					649	534	210	131								345	345	n/a
Air Canada	10,047	10,109	8,982	8,526	6,846	5,782	3,950	3,377	3,215	2,988	3,895	4,125	4,517	1,747	1,084	1,686	602	55.5%
Air France	1,046	1,118	1,250	1,306	1,362	1,334	1,207	957	902	911	995	1,013	974	955	899	910	11	1.2%
Air Jamaica		443	617	610	662	349												
Air One									140									
Alitalia	729	707	724	690	894	986	810	886	667	638	624	604	530	542	550	562	12	2.2%
American Airlines[1]	4,657	5,097	5,237	5,415	5,175	4,672	4,824	4,700	4,115	3,167	2,422	2,149	1,901	447	344	571	227	66.0%
Astraeus												100						
British Airways	2,159	1,944	1,986	2,103	2,080	2,151	2,190	2,160	2,134	2,116	2,082	2,161	2,149	2,573	2,678	2,575	-103	-3.8%
Canadian Airlines	417																	
Cathay Pacific																279	279	n/a
Copa Airlines														347	730	646	-84	-11.5%
Delta Air Lines[2]	733	1,345	1,022	724	736	749	851	829	848	1,935	1,675	3,280	2,531	2,851	3,008	3,122	114	3.8%
El Al																152	152	n/a
Emirates															600	914	314	52.3%
Finnair						44	49	66	48	47								
FlyGlobespan								225										
Hainan Airlines															280	744	464	165.7%
Iberia Airlines								304	466	500	435	445	441	404	332	336	4	1.2%
Icelandair	726	696	834	882	892	811	807	869	821	777	816	928	938	1,120	1,227	1,287	60	4.9%
Japan Airlines													474	646	731	728	-3	-0.4%
JetBlue							555	1,363	1,839	2,293	2,262	5,173	5,902	6,138	6,348	6,488	140	2.2%
Korean Air Lines	314																	
LACSA Airlines			154	114	14													
Lufthansa	1,140	1,090	1,452	1,357	1,526	1,564	1,522	1,515	1,667	1,722	1,657	1,734	1,784	1,723	1,712	1,687	-25	-1.5%
Northwest Airlines	744	729	738	732	730	727	734	1,081	1,438									
Norwegian Air Shuttle																34	34	n/a
Olympic Airways	256	166																
Sabena	724	596																
SATA International Airlines						315	334	393	360	372	403	400	412	466	533	542	9	1.7%
SWISS International	926	1,152	728	718	714	704	708	727	722	664	720	725	716	720	722	711	-11	-1.5%
TACA				220	363	327	236											
TACV - Cabo Verde				53	157	154	139	165	154	210	240	236	234	214	186	60	-126	-67.7%
TAP - Air Portugal	200																	
Trans World Airlines		1,283																
Turkish Airlines															452	726	274	60.6%
United Airlines	728	840	722															
US Airways				732	2,048	1,607	1,208	1,133	1,155	1,722	667	49	146	186				
VG Airlines			164															
Virgin Atlantic Airways	721	722	727	724	860	724	727	732	730	735	707	721	711	709	716	702	-14	-2.0%
Wow Air																445	445	n/a
Regional/Commuter Carriers	**15,594**	**14,776**	**11,760**	**10,803**	**11,784**	**13,112**	**12,922**	**15,474**	**12,770**	**11,805**	**12,494**	**12,153**	**12,270**	**14,378**	**14,720**	**14,153**	**-567**	**-3.9%**
Air Canada Regional	4,088	2,912	2,850	2,747	5,060	5,120	7,676	8,499	8,478	7,542	7,065	6,803	7,058	9,563	10,364	10,024	-340	-3.3%
American Eagle Airlines	8,975	8,919	4,545	3,598	3,306	4,637	2,712	3,312	3,311	2,783	2,480	2,206						
Delta Connection	2,531	2,945	4,365	4,458	3,418	3,355	2,534	3,663	981	865	81	1	1,489	1,082	56	38	-18	-32.1%
Porter Airlines										615	2,868	3,143	3,723	3,733	4,300	4,091	567	15.2%
Non-Scheduled Operations	**2,141**	**1,892**	**1,184**	**1,313**	**1,467**	**1,068**	**727**	**527**	**375**	**320**	**305**	**300**	**268**	**277**	**185**	**248**	**63**	**34.1%**
Total International Operations	**45,162**	**45,952**	**39,401**	**38,195**	**40,055**	**38,643**	**35,730**	**38,835**	**35,913**	**34,198**	**33,570**	**37,426**	**38,171**	**37,956**	**39,970**	**42,626**	**2,656**	**6.6%**

Note: Excludes general aviation and all-cargo operations.
Source: Massport

Table E-4 Logan Airport Scheduled Passenger Departures by Destination

Destination Airport	Code	2000	2005	2010	2011	2012	2013	2014	2015	2014-2015 Change	2014-2015 Percent Change
Domestic		**210,068**	**163,684**	**149,962**	**152,303**	**143,871**	**147,078**	**149,208**	**152,210**	**3,002**	**2.0%**
New York La Guardia	LGA	11,872	13,350	11,705	11,489	9,564	9,255	9,056	9,352	296	3.3%
Washington National	DCA	8,474	10,680	9,419	9,793	8,543	8,360	8,645	8,678	33	0.4%
Philadelphia	PHL	11,785	7,014	6,548	7,985	6,301	7,305	8,092	7,971	-121	-1.5%
Chicago O'Hare	ORD	10,063	7,412	7,403	7,635	7,461	7,733	7,822	7,401	-421	-5.4%
New York J F Kennedy	JFK	9,899	4,985	7,054	5,969	5,428	5,919	6,139	6,745	606	9.9%
New York Newark	EWR	5,206	5,626	3,666	4,608	5,228	5,702	5,532	5,366	-165	-3.0%
Atlanta	ATL	7,110	6,003	5,548	5,569	5,574	5,501	5,454	5,192	-261	-4.8%
Baltimore	BWI	1,773	5,029	7,053	6,755	5,910	5,737	5,060	4,897	-163	-3.2%
Los Angeles	LAX	3,647	2,655	3,382	3,164	3,544	3,603	4,080	4,456	376	9.2%
Nantucket	ACK	5,022	3,452	3,884	3,382	3,469	3,601	3,567	4,311	744	20.9%
San Francisco	SFO	3,526	2,591	3,711	3,884	4,198	4,038	4,305	4,272	-33	-0.8%
Charlotte	CLT	2,758	3,288	4,180	3,976	3,991	3,911	3,916	3,920	4	0.1%
Detroit	DTW	2,937	2,827	2,353	2,437	2,314	2,340	3,354	3,875	521	15.5%
Raleigh/Durham	RDU	3,775	4,110	3,259	2,867	3,059	3,313	3,634	3,598	-37	-1.0%
Dallas/Fort Worth	DFW	5,002	3,544	2,938	2,781	3,790	4,147	3,705	3,406	-300	-8.1%
Orlando	MCO	4,914	3,517	3,179	3,580	3,496	3,399	2,883	3,057	173	6.0%
Minneapolis	MSP	3,078	1,791	1,927	2,031	2,062	2,200	2,322	2,737	415	17.9%
Martha's Vineyard	MVY	3,863	2,231	3,218	2,829	2,774	2,740	2,793	2,731	-62	-2.2%
Denver	DEN	2,628	1,990	2,812	2,640	2,518	2,433	2,446	2,611	165	6.7%
Richmond	RIC	1,537	1,404	1,431	1,525	1,481	1,723	2,450	2,603	153	6.2%
Miami	MIA	2,068	2,072	2,238	2,555	2,610	2,555	2,551	2,520	-30	-1.2%
Washington Dulles	IAD	8,625	6,139	4,625	3,910	3,014	2,974	2,714	2,505	-209	-7.7%
Pittsburgh	PIT	3,086	2,021	2,312	3,179	2,498	2,641	2,678	2,457	-221	-8.3%
Fort Lauderdale/Hollywood	FLL	3,327	3,065	2,370	2,517	2,371	2,379	2,173	2,258	85	3.9%
Buffalo	BUF	950	1,226	2,181	2,183	2,264	2,468	2,433	2,203	-231	-9.5%
Cleveland	CLE	2,797	1,260	1,369	1,326	1,455	1,501	1,260	2,070	810	64.3%
Provincetown	PVC	2,023	1,659	2,410	2,086	2,054	1,982	1,929	1,957	28	1.4%
Houston Intercontinental	IAH	1,995	1,752	1,717	1,697	1,704	1,789	1,822	1,831	9	0.5%
Fort Myers	RSW	949	1,525	1,587	1,620	1,738	1,806	1,734	1,742	8	0.5%
West Palm Beach	PBI	1,674	1,126	1,450	1,380	1,161	1,235	1,389	1,650	261	18.8%
Seattle/Tacoma	SEA	458	610	1,001	993	1,051	1,378	1,607	1,625	19	1.2%
Phoenix	PHX	1,386	944	1,348	1,895	1,773	1,413	1,557	1,569	12	0.8%
Chicago Midway	MDW	868	1,339	1,756	1,751	1,690	1,617	1,542	1,531	-10	-0.7%
Lebanon	LEB			1,734	1,460	1,464	1,460	1,460	1,460	0	0.0%
Rockland	RKD	1,152	1,374	1,301	1,279	1,282	1,279	1,279	1,372	93	7.3%
Augusta	AUG	584	621	1,000	1,187	1,091	1,248	1,248	1,248	0	0.0%
Cincinnati	CVG	2,235	2,637	1,364	1,308	1,272	1,269	1,239	1,218	-21	-1.7%
Indianapolis	IND	765	2,076	1,121	977	936	895	844	1,181	337	39.9%
Tampa	TPA	2,502	1,946	1,246	1,255	1,266	1,195	1,182	1,177	-5	-0.4%
Las Vegas	LAS	1,098	1,679	756	904	737	813	819	1,162	343	41.9%
Bar Harbor	BHB	1,196	1,154	815	1,030	1,213	1,283	1,156	1,095	-61	-5.3%
Albany	ALB	3,433	1,073	647	2,180	1,523	1,183	1,095	1,095	0	0.0%
Saranac Lake	SLK		800	1,174	1,157	1,222	1,157	1,095	1,095	0	0.0%
Rutland	RUT	1,259	643	1,095	1,148	1,160	1,095	1,095	1,095	0	0.0%
Columbus	CMH	2,708	2,114	972	1,048	972	871	844	1,081	237	28.1%
San Diego	SAN	366	365	571	535	476	859	1,030	1,052	21	2.1%
Presque Isle	PQI	1,835	1,017	991	991	993	991	991	991	0	0.0%
Houston Hobby	HOU						664	1,325	978	-347	-26.2%

Table E-4 Logan Airport Scheduled Passenger Departures by Destination

Destination Airport	Code	2000	2005	2010	2011	2012	2013	2014	2015	2014-2015 Change	2014-2015 Percent Change
Rochester	ROC	3,644	1,181	908	886	889	878	882	886	4	0.5%
Milwaukee	MKE	1,189	2,182	2,213	1,941	1,069	880	674	854	180	26.7%
Hyannis	HYA	2,274	1,059	1,165	1,047	1,028	705	731	787	56	7.6%
Jacksonville	JAX		428	365	544	619	593	984	767	-217	-22.0%
Plattsburgh International	PBG			1,025	899	623	639	787	756	-32	-4.0%
St. Louis	STL	2,187	1,461	934	713	815	748	722	722	0	0.0%
Nashville	BNA	642				153	588	628	688	61	9.7%
Kansas City	MCI	597	241	313	536	571	515	669	661	-8	-1.2%
Salt Lake City	SLC	1,094	730	669	438	370	584	597	617	21	3.5%
Syracuse	SYR	3,876	1,762	991	964	784	626	617	578	-39	-6.3%
Portland	PDX			352	440	528	615	494	519	26	5.2%
Austin	AUS			365	365	366	352	352	444	91	26.0%
Myrtle Beach	MYR	105	265	365	365	366	378	383	383	0	0.0%
Charleston	CHS		61				398	474	365	-109	-23.0%
New Orleans	MSY		191	348	304	335	339	344	365	21	6.2%
Savannah	SAV		78					306	365	59	19.3%
Harrisburg	MDT	1,307	886	551	574	540	469	434	325	-109	-25.0%
Long Beach	LGB		853	459	296	292	274	270	292	22	8.1%
Akron/Canton	CAK		730	475	488	497	557	457	287	-170	-37.2%
Westchester County	HPN	6,065	2,256						263	263	n/a
San Jose	SJC	842	245	232	292	227	205	214	223	9	4.1%
Sarasota/Bradenton	SRQ		30	82	242	248	348	181	212	31	17.1%
Dallas Love Field	DAL								153	153	n/a
Atlantic City Pomona Field	ACY			536	326	355	123	153	166	13	8.7%
Oakland	OAK		853	195	105	83	83	83	88	4	5.1%
Sacramento	SMF								48	48	n/a
Islip	ISP	4,222	1,581				293	324		-324	-100.0%
Norfolk	ORF	838	1,032		511	667	613	71		-71	-100.0%
Newport News	PHF		671	549	549	60		31		-31	-100.0%
Memphis	MEM	972	1,034	1,048	1,029	688	313				
Bangor	BGR	6,644	2,946								
Greensboro	GSO	415	1,120								
Trenton	TTN										
Watertown	ART										
Burlington	BTV	5,913	1,632								
Allentown/Bethlehem	ABE	780	626								
Louisville	SDF										
Manchester	MHT										
Massena	MSS										
Dayton	DAY										
Plattsburgh	PLB										
Portland (ME)	PWM	6,267	1,394								
Wilkes-Barre Scranton	AVP	584	420								
Columbia	CAE										
Ithaca	ITH	872									
Elmira/Corning	ELM	441									
Hartford	BDL										
Binghamton	BGM										
Providence	PVD	91									

Table E-4 Logan Airport Scheduled Passenger Departures by Destination

Destination Airport	Code	2000	2005	2010	2011	2012	2013	2014	2015	2014-2015 Change	2014-2015 Percent Change
International		**23,711**	**19,837**	**18,764**	**19,641**	**19,540**	**19,093**	**20,372**	**21,765**	**1,393**	**6.8%**
Toronto Pearson	YYZ	3,691	3,876	3,603	3,737	3,529	3,306	2,715	2,799	84	3.1%
Toronto Island Apt	YTZ			1,535	1,687	2,009	2,009	2,310	2,236	-74	-3.2%
Montreal-Trudeau	YUL	3,401	2,578	2,008	2,021	2,009	1,833	1,948	2,047	99	5.1%
London Heathrow	LHR	2,187	2,133	2,331	2,833	2,642	2,134	2,069	2,026	-43	-2.1%
San Juan	SJU	1,750	1,237	1,294	1,130	1,031	1,038	1,018	1,068	50	4.9%
Paris De Gaulle	CDG	898	853	710	946	619	784	780	916	136	17.4%
Reykjavik Keflavik Apt	KEF	393	361	404	531	467	561	614	854	240	39.1%
Halifax	YHZ	3,210	1,891	852	744	745	704	704	700	-4	-0.6%
Dublin	DUB	223		348	457	480	605	653	653	0	0.0%
Ottawa	YOW	2,575	864	744	696	623	652	635	630	-5	-0.8%
Amsterdam	AMS	366	365	457	553	558	575	536	579	43	8.1%
Frankfurt	FRA	580	575	548	544	572	545	532	536	4	0.8%
Bermuda	BDA	550	518	532	540	511	501	523	536	13	2.5%
Dubai	DXB							306	457	151	49.3%
Aruba	AUA	9	338	407	426	405	408	417	417	0	0.1%
Santo Domingo	SDQ		174	305	275	358	339	401	365	-36	-8.9%
Zurich	ZRH	523	356	365	365	366	365	365	365	0	0.0%
Tokyo Narita	NRT					236	352	365	365	0	0.0%
Istanbul	IST							236	365	129	54.6%
Munich	MUC		210	313	335	357	348	357	357	0	0.0%
Shannon	SNN	366	737	213	118	144	166	348	352	4	1.1%
Panama City	PTY							365	334	-31	-8.4%
Beijing	PEK							136	287	152	111.6%
Rome Leonardo Da Vinci-Fiumicino	FCO		135	313	314	266	271	258	271	13	5.1%
Cancun	CUN		207	307	270	217	225	273	264	-9	-3.4%
Santiago	STI				92	201	214	248	206	-42	-17.0%
Ponta Delgada	PDL	30	39	165	170	148	179	209	196	-13	-6.2%
Saint Thomas	STT	78	108	125	117	156	173	176	184	8	4.4%
Punta Cana	PUJ			95	92	139	134	160	174	13	8.3%
Mexico City	MEX		234						166	166	n/a
Madrid	MAD			218	231	222	209	166	166	0	0.0%
Hong Kong	HKG								140	140	n/a
Nassau	NAS		100	180	134	142	108	139	136	-3	-2.3%
Providenciales	PLS	4	43	39	26	69	52	82	86	4	4.5%
Shanghai Pudong	PVG								83	83	n/a
Tel Aviv	TLV								75	75	n/a
Saint Maarten	SXM			39	43	61	61	52	56	4	8.5%
Montego Bay	MBJ		238	126	52	69	56	73	56	-17	-23.4%
Lisbon	LIS	44		26	26	48	39	39	44	4	10.9%
Terceira	TER	44		17	17	17	17	17	31	13	76.2%
Praia	RAI		9	121	122	109	104	92	30	-61	-67.0%
Port Au Prince	PAP								26	26	n/a
Grand Cayman	GCM		31	17		9	26	26	26	0	0.0%
St. Lucia Hewanorra	UVF							9	26	17	196.7%
Liberia	LIR							9	26	17	196.7%
Puerto Plata	POP	4						9	26	17	196.7%
Barbados	BGI								9	9	n/a

Table E-4 Logan Airport Scheduled Passenger Departures by Destination

Destination Airport	Code	2000	2005	2010	2011	2012	2013	2014	2015	2014-2015 Change	2014-2015 Percent Change
Fort-de-France	FDF								9	9	n/a
Pointe-a-Pitre	PTP								9	9	n/a
Sao Vicente	VXE			4		4					
Charlottetown	YYG										
Helsinki	HEL										
Milan Malpensa	MXP	366	343								
Fredericton	YFC		686								
Quebec	YQB	1,229	30								
Manchester	MAN	26	241								
Glasgow	GLA										
Connaught	NOC										
Stockholm Arlanda	ARN										
Las Palmas	LPA										
San Salvador	SAL		178								
Vancouver	YVR	366	62								
Ilha Do Sal	SID		56								
Nykoping	NYO		31								
Lerwick Sumburgh Apt	LSI										
Freeport	FPO										
London Gatwick	LGW	362									
Brussels	BRU	362									
Gander	YQX										
Athens	ATH	74									
Total Scheduled Carrier Operations		**233,779**	**183,520**	**168,726**	**171,945**	**163,411**	**166,171**	**169,579**	**173,974**	**4,395**	**2.6%**

Source: OAG Schedules.

F

Regional Transportation

This appendix provides detailed tables in support of Chapter 4, *Regional Transportation*:

- Table F-1 Aircraft Operations by Classification for New England's Airports, 2000 to 2015
- Table F-2 Percentage Change in Aircraft Operations by Classification for New England's Airports, 2000 to 2015

Scheduled Passenger Operations by Market and Carrier for New England's Regional Airports

- Table F-3 Bradley International Airport, Connecticut
- Table F-4 T.F. Green Airport, Rhode Island
- Table F-5 Manchester-Boston Regional Airport, New Hampshire
- Table F-6 Portland International Jetport, Maine
- Table F-7 Burlington International Airport, Vermont
- Table F-8 Bangor International Airport, Maine
- Table F-9 Tweed-New Haven Airport, Connecticut
- Table F-10 Worcester Regional Airport, Massachusetts
- Table F-11 Hanscom Field, Massachusetts
- Table F-12 Portsmouth International Airport, New Hampshire

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Table F-1 Aircraft Operations by Classification for New England's Airports, 2000 to 2015

Airport	Bradley International	T.F. Green	Manchester-Boston Regional	Portland International Jetport	Burlington	Bangor	Tweed-New Haven	Worcester Regional	Portsmouth International	Hanscom Field[2]	Subtotal	Logan Airport[3]	Total
2000													
Commercial	132,062	103,750	61,506	47,609	45,745	21,446	5,260	4,029	6,104	6,572	434,083	452,763	886,846
General Aviation[1]	31,863	52,184	45,740	56,571	59,377	34,831	56,200	46,518	31,601	204,512	619,397	35,233	654,630
Military & Other	5,811	2,764	586	2,072	10,241	26,507	328	495	9,973	1,287	60,064	0	60,064
Total	169,736	158,698	107,832	106,252	115,363	82,784	61,788	51,042	47,678	212,371	1,113,544	487,996	1,601,540
2001													
Commercial	128,638	100,606	61,669	47,770	47,261	18,286	4,581	5,631	4,485	6,414	425,341	434,386	859,727
General Aviation[1]	30,478	45,095	44,358	62,014	61,986	35,230	56,092	45,464	30,148	197,770	608,635	28,739	637,374
Military & Other	5,913	2,635	607	2,259	11,821	26,623	437	917	8,221	1,252	60,685	0	60,685
Total	165,029	148,336	106,634	112,043	121,068	80,139	61,110	52,012	42,854	205,436	1,094,661	463,125	1,557,786
2002													
Commercial	113,194	96,595	62,346	45,899	38,929	24,412	3,827	4,062	5,059	6,603	400,926	366,476	767,402
General Aviation[1]	27,838	45,473	29,549	57,720	59,679	35,711	62,163	52,277	28,333	210,221	608,964	25,596	634,560
Military & Other	6,085	2,587	376	2,162	12,167	27,297	593	418	8,220	1,424	61,329	0	61,329
Total	147,117	144,655	92,271	105,781	110,775	87,420	66,583	56,757	41,612	218,248	1,071,219	392,072	1,463,291
2003													
Commercial	103,917	84,301	68,184	42,658	38,293	25,626	3,705	868	4,552	2,956	375,060	344,644	719,704
General Aviation[1]	27,115	42,878	29,552	44,036	50,461	36,706	54,224	55,972	24,866	190,789	556,599	28,660	585,259
Military & Other	4,214	2,496	324	1,449	11,466	32,938	776	378	7,720	1,142	62,903	0	62,903
Total	135,246	129,675	98,060	88,143	100,220	95,270	58,705	57,218	37,138	194,887	994,562	373,304	1,367,866
2004													
Commercial	108,823	83,496	75,360	46,474	41,719	24,970	4,501	0	3,981	4,308	393,632	374,022	767,654
General Aviation[1]	32,269	34,878	27,438	41,547	54,709	29,884	58,881	61,343	25,962	175,301	542,212	31,236	573,448
Military & Other	4,100	346	749	1,338	12,404	29,676	1,010	530	7,797	1,195	59,145	0	59,145
Total	145,192	118,720	103,547	89,359	108,832	84,530	64,392	61,873	37,740	180,804	994,989	405,258	1,400,247
2005													
Commercial	119,048	88,374	76,342	42,661	43,987	25,976	6,137	2,727	3,197	3,627	412,076	377,830	789,906
General Aviation[1]	33,341	28,138	26,369	36,191	49,888	30,016	60,893	62,743	25,446	165,424	518,449	31,236	549,685
Military & Other	3,701	241	479	1,405	11,468	24,154	1,063	519	7,669	904	51,603	0	51,603
Total	156,090	116,753	103,190	80,257	105,343	80,146	68,093	65,989	36,312	169,955	982,128	409,066	1,391,194

Table F-1 Aircraft Operations by Classification for New England's Airports, 2000 to 2015

Airport	Bradley International	T.F. Green	Manchester-Boston Regional	Portland International Jetport	Burlington	Bangor	Tweed-New Haven	Worcester Regional	Portsmouth International	Hanscom Field[2]	Subtotal	Logan Airport[3]	Total
2006													
Commercial	111,341	81,282	67,326	38,663	41,342	23,466	5,177	3,793	3,981	3,057	379,428	374,675	754,103
General Aviation[1]	34,548	25,510	25,074	35,572	44,471	29,848	51,702	56,770	25,962	167,560	497,017	31,444	528,461
Military & Other	4,348	229	738	1,536	9,299	22,359	1,157	609	7,797	1,433	49,505	0	49,505
Total	150,237	107,021	93,138	75,771	95,112	75,673	58,036	61,172	37,740	172,050	925,950	406,119	1,332,069
2007													
Commercial	107,097	80,525	69,134	41,450	39,928	22,571	4,594	3,162	4,270	3,477	376,208	370,905	747,113
General Aviation[1]	29,308	22,984	23,959	31,724	47,521	25,542	51,200	61,296	27,000	160,992	481,526	28,632	510,158
Military & Other	5,097	242	644	1,384	9,528	20,949	944	879	8,017	1,438	49,122	0	49,122
Total	141,502	103,751	93,737	74,558	96,977	69,062	56,738	65,337	39,287	165,907	906,856	399,537	1,306,393
2008													
Commercial	98,194	73,096	63,505	40,834	37,832	19,282	4,013	2,553	1,347	104	340,760	347,784	688,544
General Aviation[1]	22,908	19,470	16,198	31,869	46,391	27,143	44,642	43,763	31,051	164,195	447,630	23,820	471,450
Military & Other	3,637	187	840	974	9,688	20,449	243	886	7,993	1,590	46,487	0	46,487
Total	124,739	92,753	80,543	73,677	93,911	66,874	48,898	47,202	40,391	165,889	834,877	371,604	1,206,481
2009													
Commercial	82,021	62,233	54,336	35,909	31,153	16,485	3,096	2,527	422	0	288,182	333,064	621,246
General Aviation[1]	19,586	19,438	14,354	25,473	32,872	19,558	37,722	41,700	25,161	148,696	384,560	12,242	396,802
Military & Other	2,726	260	1,163	778	8,628	16,267	486	17	6,851	1,215	38,391	0	38,391
Total	104,333	81,931	69,853	62,160	72,653	52,310	41,304	44,244	32,434	149,911	711,133	345,306	1,056,439
2010													
Commercial	80,418	60,128	53,971	35,035	29,538	16,190	3,201	1,629	1,516	0	281,626	337,961	619,587
General Aviation[1]	18,759	21,096	13,636	24,776	36,106	20,142	31,884	41,843	25,674	161,942	395,858	14,682	410,540
Military & Other	3,028	347	933	446	4,776	15,525	381	572	7,707	1,795	35,510	0	35,510
Total	102,205	81,571	68,540	60,257	70,420	51,857	35,466	44,044	34,897	163,737	712,994	352,643	1,065,637
2011													
Commercial	86,838	57,194	51,379	35,157	29,166	16,177	3,367	2,017	1,717	750	283,762	340,757	624,519
General Aviation[1]	16,483	21,774	12,497	21,453	42,562	19,503	33,919	44,050	27,056	160,840	400,137	28,230	428,367
Military & Other	3,630	369	874	533	5,890	13,220	310	634	8,158	1,409	35,027	0	35,027
Total	106,951	79,337	64,750	57,143	77,618	48,900	37,596	46,701	36,931	162,999	718,926	368,987	1,087,913

Table F-1 Aircraft Operations by Classification for New England's Airports, 2000 to 2015

Airport	Bradley International	T.F. Green	Manchester-Boston Regional	Portland International Jetport	Burlington	Bangor	Tweed-New Haven	Worcester Regional	Portsmouth International	Hanscom Field[2]	Subtotal	Logan Airport[3]	Total
2012													
Commercial	79,704	50,301	45,379	33,118	27,067	14,826	3,936	1,639	502	635	257,107	326,755	583,862
General Aviation[1]	15,589	24,781	12,504	20,864	42,352	18,069	34,775	42,655	30,186	164,841	406,616	28,114	434,730
Military & Other	3,726	434	1,073	584	7,079	11,503	416	740	7,917	738	34,210	0	34,210
Total	99,019	75,516	58,956	54,566	76,498	44,398	39,127	45,034	38,605	166,214	697,933	354,869	1,052,802
2013													
Commercial	78,213	48,340	43,572	31,076	26,814	14,707	4,094	1,586	560	253	249,215	334,657	583,872
General Aviation[1]	15,192	24,729	11,432	20,021	40,413	15,535	28,794	32,888	28,951	153,706	371,661	26,682	398,343
Military & Other	2,558	435	1,224	471	6,972	11,045	423	593	7,573	529	31,823	0	31,823
Total	95,963	73,504	56,228	51,568	74,199	41,287	33,311	35,067	37,084	154,488	652,699	361,339	1,014,038
2014													
Commercial	79,060	44,351	38,674	29,538	26,057	14,428	4,795	2,368	8,278	256	247,805	337,381	585,186
General Aviation[1]	14,752	29,490	12,293	16,535	40,858	15,548	26,273	29,138	24,440	133,437	342,764	26,416	369,180
Military & Other	2,665	1,036	908	560	6,842	11,567	529	956	7,621	602	33,286	0	33,286
Total	96,477	74,877	51,875	46,633	73,757	41,543	31,597	32,462	40,339	134,295	623,855	363,797	987,652
2015													
Commercial	76,425	42,417	38,060	30,415	25,178	13,618	6,316	2,414	8,547	220	243,610	344,764	588,374
General Aviation[1]	14,402	22,700	12,934	17,916	41,576	16,487	27,711	35,711	26,848	127,467	343,752	28,166	371,918
Military & Other	2,680	430	811	567	5,912	10,684	685	889	7,499	592	30,749	0	30,749
Total	93,507	65,547	51,805	48,898	72,666	40,789	34,712	39,014	42,894	128,279	618,111	372,930	991,041

Source: Massport, Federal Aviation Administration (FAA) Tower Counts, and individual airport records

1 Includes itinerant and local general aviation (GA) operations at the regional airports. There are no local (touch-and-go training) operations at Logan Airport.

2 Commercial operations at Hanscom Field include scheduled commercial operations only; other air taxi operations counted as GA.

3 Operations at Logan Airport include international operations.

Table F-2 Percentage Change in Aircraft Operations by Classification for New England's Airports, 2000 to 2015

Airport	Bradley International	T.F. Green	Manchester-Boston Regional	Portland International Jetport	Burlington	Bangor	Tweed-New Haven	Worcester Regional	Portsmouth International	Hanscom Field[2]	Subtotal	Logan Airport[3]	Total
2000 to 2001													
Commercial	(2.59%)	(3.03%)	0.27%	0.34%	3.31%	(14.73%)	(12.91%)	39.76%	(26.52%)	(2.40%)	(2.01%)	(4.06%)	(3.06%)
General Aviation[1]	(4.35%)	(13.58%)	(3.02%)	9.62%	4.39%	1.15%	(0.19%)	(2.27%)	(4.60%)	(3.30%)	(1.74%)	(18.43%)	(2.64%)
Military & Other	1.76%	(4.67%)	3.58%	9.03%	15.43%	0.44%	33.23%	85.25%	(17.57%)	(2.72%)	1.03%	-	1.03%
Total	(2.77%)	(6.53%)	(1.11%)	5.45%	4.95%	(3.20%)	(1.10%)	1.90%	(10.12%)	(3.27%)	(1.70%)	(5.10%)	(2.73%)
2001 Percent of Total	10.59%	9.52%	6.85%	7.19%	7.77%	5.14%	3.92%	3.34%	2.75%	13.19%	70.27%	29.73%	100.00%
2001 to 2002													
Commercial	(12.01%)	(3.99%)	1.10%	(3.92%)	(17.63%)	33.50%	(16.46%)	(27.86%)	12.80%	2.95%	(5.74%)	(15.63%)	(10.74%)
General Aviation[1]	(8.66%)	0.84%	(33.39%)	(6.92%)	(3.72%)	1.37%	10.82%	14.99%	(6.02%)	6.30%	0.05%	(10.94%)	(0.44%)
Military & Other	2.91%	(1.82%)	(38.06%)	(4.29%)	2.93%	2.53%	35.70%	(54.42%)	(0.01%)	13.74%	1.06%	-	1.06%
Total	(10.85%)	(2.48%)	(13.47%)	(5.59%)	(8.50%)	9.09%	8.96%	9.12%	(2.90%)	6.24%	(2.14%)	(15.34%)	(6.07%)
2002 Percent of Total	10.05%	9.89%	6.31%	7.23%	7.57%	5.97%	4.55%	3.88%	2.84%	14.91%	73.21%	26.79%	100.00%
2002 to 2003													
Commercial	(8.20%)	(12.73%)	9.36%	(7.06%)	(1.63%)	4.97%	(3.19%)	(78.63%)	(10.02%)	(55.23%)	(6.45%)	(5.96%)	(6.22%)
General Aviation[1]	(2.60%)	(5.71%)	0.01%	(23.71%)	(15.45%)	2.79%	(12.77%)	7.07%	(12.24%)	(9.24%)	(8.60%)	11.97%	(7.77%)
Military & Other	(30.75%)	(3.52%)	(13.83%)	(32.98%)	(5.76%)	20.67%	30.86%	(9.57%)	(6.08%)	(19.80%)	2.57%	-	2.57%
Total	(8.07%)	(10.36%)	6.27%	(16.67%)	(9.53%)	8.98%	(11.83%)	0.81%	(10.75%)	(10.70%)	(7.16%)	(4.79%)	(6.52%)
2003 Percent of Total	9.89%	9.48%	7.17%	6.44%	7.33%	6.96%	4.29%	4.18%	2.72%	14.25%	72.71%	27.29%	100.00%
2003 to 2004													
Commercial	4.72%	(0.95%)	10.52%	8.95%	8.95%	(2.56%)	21.48%	(100.00%)	(12.54%)	45.74%	4.95%	8.52%	6.66%
General Aviation[1]	19.01%	(18.66%)	(7.15%)	(5.65%)	8.42%	(18.59%)	8.59%	9.60%	4.41%	(8.12%)	(2.58%)	8.99%	(2.02%)
Military & Other	(2.71%)	(86.14%)	131.17%	(7.66%)	8.18%	(9.90%)	30.15%	40.21%	1.00%	4.64%	(5.97%)	-	(5.97%)
Total	7.35%	(8.45%)	5.60%	1.38%	8.59%	(11.27%)	9.69%	8.14%	1.62%	(7.23%)	0.04%	8.56%	2.37%
2004 Percent of Total	10.37%	8.48%	7.39%	6.38%	7.77%	6.04%	4.60%	4.42%	2.70%	12.91%	71.06%	28.94%	100.00%
2004 to 2005													
Commercial	9.40%	5.84%	1.30%	(8.20%)	5.44%	4.03%	36.35%	-	(19.69%)	(15.81%)	4.69%	1.02%	2.90%
General Aviation[1]	3.32%	(19.32%)	(3.90%)	(12.89%)	(8.81%)	0.44%	3.42%	2.28%	(1.99%)	(5.63%)	(4.38%)	0.00%	(4.14%)
Military & Other	(9.73%)	(30.35%)	(36.05%)	5.01%	(7.55%)	(18.61%)	5.25%	(2.08%)	(1.64%)	(24.35%)	(12.75%)	-	(12.75%)
Total	7.51%	(1.66%)	(0.34%)	(10.19%)	(3.21%)	(5.19%)	5.75%	6.65%	(3.78%)	(6.00%)	(1.29%)	0.94%	(0.65%)
2005 Percent of Total	11.22%	8.39%	7.42%	5.77%	7.57%	5.76%	4.89%	4.74%	2.61%	12.22%	70.60%	29.40%	100.00%

Table F-2 Percentage Change in Aircraft Operations by Classification for New England's Airports, 2000 to 2015

Airport	Bradley International	T.F. Green	Manchester-Boston Regional	Portland International Jetport	Burlington	Bangor	Tweed-New Haven	Worcester Regional	Portsmouth International	Hanscom Field[2]	Subtotal	Logan Airport[3]	Total
2005 to 2006													
Commercial	(6.47%)	(8.02%)	(11.81%)	(9.37%)	(6.01%)	(9.66%)	(15.64%)	39.09%	24.52%	(15.72%)	(7.92%)	(0.84%)	(4.53%)
General Aviation[1]	3.62%	(9.34%)	(4.91%)	(1.71%)	(10.86%)	(0.56%)	(15.09%)	(9.52%)	2.03%	1.29%	(4.13%)	0.67%	(3.86%)
Military & Other	17.48%	(4.98%)	54.07%	9.32%	(18.91%)	(7.43%)	8.84%	17.34%	1.67%	58.52%	(4.07%)	-	(4.07%)
Total	(3.75%)	(8.34%)	(9.74%)	(5.59%)	(9.71%)	(5.58%)	(14.77%)	(7.30%)	3.93%	1.23%	(5.72%)	(0.72%)	(4.25%)
2006 Percent of Total	11.28%	8.03%	6.99%	5.69%	7.14%	5.68%	4.36%	4.59%	2.83%	12.92%	69.51%	30.49%	100.00%
2006 to 2007													
Commercial	(3.81%)	(0.93%)	2.69%	7.21%	(3.42%)	(3.81%)	(11.26%)	(16.64%)	7.26%	13.74%	(0.85%)	(1.01%)	(0.93%)
General Aviation[1]	(15.17%)	(9.90%)	(4.45%)	(10.82%)	6.86%	(14.43%)	(0.97%)	7.97%	4.00%	(3.92%)	(3.12%)	(8.94%)	(3.46%)
Military & Other	17.23%	5.68%	(12.74%)	(9.90%)	2.46%	(6.31%)	(18.41%)	44.33%	2.82%	0.35%	(0.77%)	-	(0.77%)
Total	(5.81%)	(3.06%)	0.64%	(1.60%)	1.96%	(8.74%)	(2.24%)	6.81%	4.10%	(3.57%)	(2.06%)	(1.62%)	(1.93%)
2007 Percent of Total	10.83%	7.94%	7.18%	5.71%	7.42%	5.29%	4.34%	5.00%	3.01%	12.70%	69.42%	30.58%	100.00%
2007 to 2008													
Commercial	(8.31%)	(9.23%)	(8.14%)	(1.49%)	(5.25%)	(14.57%)	(12.65%)	(19.26%)	(68.45%)	(97.01%)	(9.42%)	(6.23%)	(7.84%)
General Aviation[1]	(21.84%)	(15.29%)	(32.39%)	0.46%	(2.38%)	6.27%	(12.81%)	(28.60%)	15.00%	1.99%	(7.04%)	(16.81%)	(7.59%)
Military & Other	(28.64%)	(22.73%)	30.43%	(29.62%)	1.68%	(2.39%)	(74.26%)	0.80%	(0.30%)	10.57%	(5.36%)	-	(5.36%)
Total	(11.85%)	(10.60%)	(14.08%)	(1.18%)	(3.16%)	(3.17%)	(13.82%)	(27.76%)	2.81%	(0.01%)	(7.94%)	(6.99%)	(7.65%)
2008 Percent of Total	10.34%	7.69%	6.68%	6.11%	7.78%	5.54%	4.05%	3.91%	3.35%	13.75%	69.20%	30.80%	100.00%
2008 to 2009													
Commercial	(16.47%)	(14.86%)	(14.44%)	(12.06%)	(17.65%)	(14.51%)	(22.85%)	(1.02%)	(68.67%)	(100.00%)	(15.43%)	(4.23%)	(9.77%)
General Aviation[1]	(14.50%)	(0.16%)	(11.38%)	(20.07%)	(29.14%)	(27.94%)	(15.50%)	(4.71%)	(18.97%)	(9.44%)	(14.09%)	(48.61%)	(15.83%)
Military & Other	(25.05%)	39.04%	38.45%	(20.12%)	(10.94%)	(20.45%)	100.00%	(98.08%)	(14.29%)	(23.58%)	(17.42%)	-	(17.42%)
Total	(16.36%)	(11.67%)	(13.27%)	(15.63%)	(22.64%)	(21.78%)	(15.53%)	(6.27%)	(19.70%)	(9.63%)	(14.82%)	(7.08%)	(12.44%)
2009 Percent of Total	9.88%	7.76%	6.61%	5.88%	6.88%	4.95%	3.91%	4.19%	3.07%	14.19%	67.31%	32.69%	100.00%
2009 to 2010													
Commercial	(1.95%)	(3.38%)	(0.67%)	(2.43%)	(5.18%)	(1.79%)	3.39%	(35.54%)	259.24%	-	(2.27%)	1.47%	(0.27%)
General Aviation[1]	(4.22%)	8.53%	(5.00%)	(2.74%)	9.84%	2.99%	(15.48%)	0.34%	2.04%	8.91%	2.94%	19.93%	3.46%
Military & Other	11.08%	33.46%	(19.78%)	(42.67%)	(44.65%)	(4.56%)	(21.60%)	3264.71%	12.49%	47.74%	(7.50%)	-	(7.50%)
Total	(2.04%)	(0.44%)	(1.88%)	(3.06%)	(3.07%)	(0.87%)	(14.13%)	(0.45%)	7.59%	9.22%	0.26%	2.12%	0.87%
2010 Percent of Total	9.59%	7.65%	6.43%	5.65%	6.61%	4.87%	3.33%	4.13%	3.27%	15.37%	66.91%	33.09%	100.00%
2010 to 2011													
Commercial	7.98%	(4.88%)	(4.80%)	0.35%	(1.26%)	(0.08%)	5.19%	23.82%	13.26%	-	0.76%	0.83%	0.80%
General Aviation[1]	(12.13%)	3.21%	(8.35%)	(13.41%)	17.88%	(3.17%)	6.38%	5.27%	5.38%	(0.68%)	1.08%	92.28%	4.34%
Military & Other	19.88%	6.34%	(6.32%)	19.51%	23.32%	(14.85%)	(18.64%)	10.84%	5.85%	(21.50%)	(1.36%)	-	(1.36%)
Total	4.64%	(2.74%)	(5.53%)	(5.17%)	10.22%	(5.70%)	6.01%	6.03%	5.83%	(0.45%)	0.83%	4.63%	2.09%
2011 Percent of Total	9.83%	7.29%	5.95%	5.25%	7.13%	4.49%	3.46%	4.29%	3.39%	14.98%	66.08%	33.92%	100.00%

Table F-2 Percentage Change in Aircraft Operations by Classification for New England's Airports, 2000 to 2015

Airport	Bradley International	T.F. Green	Manchester-Boston Regional	Portland International Jetport	Burlington	Bangor	Tweed-New Haven	Worcester Regional	Portsmouth International	Hanscom Field[2]	Subtotal	Logan[3]	Total
2011 to 2012													
Commercial	(8.22%)	(12.05%)	(11.68%)	(5.80%)	(7.20%)	(8.35%)	16.90%	(18.74%)	(70.76%)	-	(9.39%)	(4.11%)	(6.51%)
General Aviation[1]	(5.42%)	13.81%	0.06%	(2.75%)	(0.49%)	(7.35%)	2.52%	(3.17%)	11.57%	2.49%	1.62%	(0.41%)	1.49%
Military & Other	2.64%	17.62%	22.77%	9.57%	20.19%	(12.99%)	34.19%	16.72%	(2.95%)	(47.62%)	(2.33%)	-	(2.33%)
Total	(7.42%)	(4.82%)	(8.95%)	(4.51%)	(1.44%)	(9.21%)	4.07%	(3.57%)	4.53%	1.97%	(2.92%)	(3.83%)	(3.23%)
2012 Percent of Total	9.41%	7.17%	5.60%	5.18%	7.27%	4.22%	3.72%	4.28%	3.67%	15.79%	66.29%	33.71%	100.00%
2012 to 2013													
Commercial	(1.87%)	(3.90%)	(3.98%)	(6.17%)	(0.93%)	(0.80%)	4.01%	(3.23%)	11.55%	(60.16%)	(3.07%)	2.42%	0.00%
General Aviation[1]	(2.55%)	(0.21%)	(8.57%)	(4.04%)	(4.58%)	(14.02%)	(17.20%)	(22.90%)	(4.09%)	(6.75%)	(8.60%)	(5.09%)	(8.37%)
Military & Other	(31.35%)	0.23%	14.07%	(19.35%)	(1.51%)	(3.98%)	1.68%	(19.86%)	(4.35%)	(28.32%)	(6.98%)	-	(6.98%)
Total	(3.09%)	(2.66%)	(4.63%)	(5.49%)	(3.01%)	(7.01%)	(14.86%)	(22.13%)	(3.94%)	(7.05%)	(6.48%)	1.82%	(3.68%)
2013 Percent of Total	9.46%	7.25%	5.54%	5.09%	7.32%	4.07%	3.28%	3.46%	3.66%	15.23%	64.37%	35.63%	100.00%
2013 to 2014													
Commercial	1.08%	(8.25%)	(11.24%)	(4.95%)	(2.82%)	(1.90%)	17.12%	49.31%	1378.21%	1.19%	(0.57%)	0.81%	0.23%
General Aviation[1]	(2.90%)	19.25%	7.53%	(17.41%)	1.10%	0.08%	(8.76%)	(11.40%)	(15.58%)	(13.19%)	(7.78%)	(1.00%)	(7.32%)
Military & Other	4.18%	138.16%	(25.82%)	18.90%	(1.86%)	4.73%	25.06%	61.21%	0.63%	13.80%	4.60%	-	4.60%
Total	0.54%	1.87%	(7.74%)	(9.57%)	(0.60%)	0.62%	(5.15%)	(7.43%)	8.78%	(13.07%)	(4.42%)	0.68%	(2.60%)
2014 Percent of Total	9.77%	7.58%	5.25%	4.72%	7.47%	4.21%	3.20%	3.29%	4.08%	13.60%	63.17%	36.83%	100.00%
2014 to 2015													
Commercial	(3.33%)	(4.36%)	(1.59%)	2.97%	(3.37%)	(5.61%)	31.72%	1.94%	3.25%	(14.06%)	(1.69%)	2.19%	0.54%
General Aviation[1]	(2.37%)	(23.02%)	5.21%	8.35%	1.76%	6.04%	5.47%	22.56%	9.85%	(4.47%)	0.29%	6.62%	0.74%
Military & Other	0.56%	(58.49%)	(10.68%)	1.25%	(13.59%)	(7.63%)	29.49%	(7.01%)	(1.60%)	(1.66%)	(7.62%)	-	(7.62%)
Total	(3.08%)	(12.46%)	(0.13%)	4.86%	(1.48%)	(1.81%)	9.86%	20.18%	6.33%	(4.48%)	(0.92%)	2.51%	0.34%
2015 Percent of Total	9.44%	6.61%	5.23%	4.93%	7.33%	4.12%	3.50%	3.94%	4.33%	12.94%	62.37%	37.63%	100.00%

Source: Massport, Federal Aviation Administration (FAA) Tower Counts, and individual airport records.

1 Includes itinerant and local general aviation (GA) operations at the regional airports. There are no local (touch-and-go training) operations at Logan Airport.

2 Commercial operations at Hanscom Field include scheduled commercial operations only; other air taxi operations counted as GA.

3 Operations at Logan Airport include international operations.

Table F-3 Scheduled Passenger Operations by Market and Carrier for Bradley International Airport

			Departures										Departing Seats									
Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	2015	'14-'15 Change	'14-'15 Pct. Change	2000	2005	2010	2011	2012	2013	2014	2015	'14-'15 Change	'14-'15 Pct. Change
Jet Carriers																						
Alaska	Chicago O'Hare	ORD	30								-	-	4,050								-	-
America West	Columbus	CMH	149								-	-	18,441								-	-
America West	Las Vegas	LAS	210								-	-	27,469								-	-
America West	Phoenix	PHX	275	365							-	-	37,772	54,570							-	-
American	Charlotte	CLT							1,763	1,775	12	0.7%							257,645	244,756	-12,889	-5.0%
American	Chicago O'Hare	ORD	2,139	1,570							-	-	304,855	203,929							-	-
American	Dallas/Fort Worth	DFW	1,343	1,052	1,052	1,078	1,068	1,069	1,008	695	-313	-31.1%	185,922	136,897	160,983	172,457	170,811	171,017	157,952	103,576	-54,376	-34.4%
American	Los Angeles	LAX	214					122	243		-243	-100.0%	31,244					19,520	38,880		-38,880	-100.0%
American	Miami	MIA	366	365	413	516	366	396	476	400	-76	-16.0%	51,427	49,990	63,559	82,560	58,560	63,360	74,981	59,600	-15,381	-20.5%
American	Philadelphia	PHL							265	31	-234	-88.3%							29,004	3,069	-25,935	-89.4%
American	New York J F Kennedy	JFK									-	-									-	-
American	San Juan	SJU	366	365	365	365	91				-	-	69,348	84,425	55,856	58,400	14,560				-	-
American	St. Louis	STL									-	-									-	-
American	Washington National	DCA							103	18	-85	-82.5%							12,536	2,196	-10,340	-82.5%
Boston-Maine Airways	Fort Lauderdale/Hollywood	FLL		13							-	-		1,993							-	-
Continental	Cleveland	CLE	582	131							-	-	68,974	16,262							-	-
Continental	Houston Intercontinental	IAH	366	313							-	-	45,790	34,072							-	-
Continental	New York Newark	EWR	331								-	-	38,916								-	-
Delta	Atlanta	ATL	2,192	3,098	2,099	2,094	2,105	2,109	2,391	2,374	-17	-0.7%	392,835	479,098	300,185	310,149	317,331	319,290	355,968	354,751	-1,217	-0.3%
Delta	Boston	BOS	4								-	-	634								-	-
Delta	Cancun	CUN			35	35	17	13	17	35	18	105.9%			5,470	5,397	2,735	1,973	2,571	5,207	2,636	102.5%
Delta	Cincinnati	CVG	1,464	1,373						4	4	-	244,837	196,741						471	471	-
Delta	Cleveland	CLE								60	60	-								3,000	3,000	-
Delta	Detroit	DTW			1,003	658	506	753	1,053	1,388	335	31.8%			129,228	91,657	73,117	110,361	145,867	188,469	42,602	29.2%
Delta	Fort Lauderdale/Hollywood	FLL	732	673	237	210					-	-	87,108	133,927	33,674	29,280					-	-
Delta	Fort Myers	RSW			99	90					-	-			13,104	12,780					-	-
Delta	Las Vegas	LAS			9						-	-			1,394						-	-
Delta	Los Angeles	LAX		100	83						-	-		19,928	13,257						-	-
Delta	Minneapolis	MSP			758	576	511	549	605	862	257	42.5%			99,431	79,418	75,291	82,545	87,377	115,026	27,649	31.6%
Delta	New York J F Kennedy	JFK	183								-	-	39,894								-	-
Delta	Orlando	MCO	1,838	1,095	261	608		57			-	-	218,705	217,905	99,129	88,041		8,514			-	-
Delta	Salt Lake City	SLC		27							-	-		3,986							-	-
Delta	Tampa	TPA		678	813	120					-	-		134,894	33,625	15,420					-	-
Delta	West Palm Beach	PBI	732	516	205	120					-	-	87,108	102,684	37,536	16,500					-	-
Frontier Airlines	Denver	DEN									-	-									-	-
jetBlue	Washington National	DCA							402	730	328	81.6%							40,229	85,300	45,071	112.0%
jetBlue	Fort Lauderdale/Hollywood	FLL			101	599	627	612	590	590	-	0.0%			15,086	90,231	94,029	91,800	87,836	88,479	643	0.7%
jetBlue	Fort Myers	RSW						61	181	212	31	17.1%						9,150	27,150	31,800	4,650	17.1%
jetBlue	Orlando	MCO			101	730	723	730	747	730	-17	-2.3%			15,086	109,860	108,300	109,500	112,071	109,500	-2,571	-2.3%
jetBlue	San Juan	SJU					366	365	405	465	60	14.8%					54,900	54,793	60,729	69,686	8,957	14.7%
jetBlue	Tampa	TPA						61	365	365	-	0.0%						9,150	44,693	48,750	4,057	9.1%
jetBlue	West Palm Beach	PBI					366	365	365	365	-	0.0%					45,700	54,750	44,907	45,550	643	1.4%
Laker Airways (Bahamas)	Freeport	FPO	39								-	-	5,850								-	-
Midway Airlines	Raleigh/Durham	RDU	683								-	-	69,213								-	-
Midwest/Republic	Milwaukee	MKE	619								-	-	44,455								-	-
Northwest	Amsterdam	AMS									-	-									-	-
Northwest	Detroit	DTW	1,699	1,451							-	-	215,750	192,679							-	-
Northwest	Fort Myers	RSW									-	-									-	-
Northwest	Minneapolis	MSP	1,177	1,042							-	-	135,570	140,194							-	-
Northwest	Orlando	MCO									-	-									-	-
Northwest	Tampa	TPA									-	-									-	-
Northwest	West Palm Beach	PBI									-	-									-	-
Southwest	Atlanta	ATL						174	1,086	172	-914	-84.2%						20,391	131,627	24,482	-107,145	-81.4%
Southwest	Baltimore	BWI	2,841	3,094	2,700	2,708	2,658	2,610	2,448	2,435	-13	-0.5%	389,158	423,878	367,534	367,414	362,995	372,650	353,791	353,038	-753	-0.2%
Southwest	Chicago Midway	MDW	723	953	923	979	964	967	961	974	13	1.4%	99,090	130,541	126,412	133,267	133,533	146,270	142,513	147,672	5,159	3.6%
Southwest	Denver	DEN			306	365	366	365	374	374	0	-0.1%			41,922	50,005	50,982	54,860	58,570	61,917	3,347	5.7%
Southwest	Fort Lauderdale/Hollywood	FLL			70	365	366	348	369	387	18	4.8%			9,551	50,005	50,272	49,521	53,381	57,309	3,928	7.4%
Southwest	Fort Myers	RSW					147	203	216	212	-4	-1.9%					20,413	28,917	30,949	30,586	-363	-1.2%
Southwest	Las Vegas	LAS	52	365	361	365	270	245	245	306	61	24.9%	7,163	50,005	49,398	50,005	40,466	34,876	35,035	44,037	9,002	25.7%
Southwest	Nashville	BNA	672	365	361	304					-	-	92,064	50,005	49,398	41,648					-	-
Southwest	Orlando	MCO	375	1,108	1,016	1,003	997	944	975	1,003	28	2.9%	51,336	151,816	139,212	137,411	137,843	136,115	140,866	151,806	10,940	7.8%
Southwest	Philadelphia	PHL		1,590							-	-		217,850							-	-
Southwest	Tampa	TPA		695	570	656	623	629	656	651	-5	-0.8%		95,156	78,129	89,852	85,873	90,219	93,662	93,905	243	0.3%
Southwest	West Palm Beach	PBI				61				4	4	-				8,357				633	633	-
Sunworld International	Philadelphia	PHL									-	-									-	-
Trans World Airlines	Portland (ME)	PWM	305								-	-	43,310								-	-
Trans World Airlines	St. Louis	STL	1,460								-	-	206,109								-	-
United	Chicago O'Hare	ORD	2,034	1,812	1,296	1,077	697	593	800	554	-246	-30.8%	299,522	259,437	198,709	159,738	104,725	86,911	112,864	72,529	-40,335	-35.7%
United	Denver	DEN	366								-	-	46,901								-	-

Table F-3 Scheduled Passenger Operations by Market and Carrier for Bradley International Airport

			Departures										Departing Seats									
Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	2015	'14-'15 Change	'14-'15 Pct. Change	2000	2005	2010	2011	2012	2013	2014	2015	'14-'15 Change	'14-'15 Pct. Change
United	New York Newark	EWR						18			-	-						2,126			-	-
United	San Francisco	SFO	366								-	-	45,384								-	-
United	Washington Dulles	IAD	1,455	726	1,192	812	514	180	222	82	-140	-63.1%	173,869	81,631	155,750	108,500	66,780	25,418	32,132	11,182	-20,950	-65.2%
US Airways	Baltimore	BWI	488								-	-	41,760								-	-
US Airways	Charlotte	CLT	1,464	2,188	1,588	1,664	1,665	1,734			-	-	214,719	350,776	228,119	238,508	241,320	255,885			-	-
US Airways	Fort Lauderdale/Hollywood	FLL	366	123							-	-	39,232	15,161							-	-
US Airways	Orlando	MCO	1,098	30							-	-	117,696	3,842							-	-
US Airways	Philadelphia	PHL	2,148	2,102	361	317	340	365			-	-	310,118	301,242	49,914	44,595	46,989	49,083			-	-
US Airways	Phoenix	PHX									-	-									-	-
US Airways	Pittsburgh	PIT	1,800	27							-	-	278,575	3,189							-	-
US Airways	Washington Dulles	IAD	732								-	-	86,376								-	-
US Airways	Washington National	DCA	1,329	1,064	361	365	335	208			-	-	171,891	141,068	51,434	52,210	46,511	25,610			-	-
US Airways	West Palm Beach	PBI	366								-	-	39,232								-	-
USA 3000 Airlines	Cancun	CUN		26							-	-		4,336							-	-
USA 3000 Airlines	Punta Cana	PUJ		13							-	-		2,128							-	-
Subtotal			38,171	30,507	18,695	18,841	16,686	16,845	19,331	18,252	-1,079	-5.6%	5,179,671	4,486,236	2,622,086	2,693,666	2,404,036	2,484,577	2,765,786	2,608,282	-157,504	-5.7%
Regional/Commuter Carriers																						
Air Canada Express	Montreal Dorval	YUL	1,385	1,038	1,021	986	976	952	996	1,008	12	1.2%	19,392	19,475	19,399	18,739	18,549	17,144	17,925	18,141	216	1.2%
Air Canada Express	Toronto	YYZ	1,589	1,342	1,287	1,308	1,294	1,295	1,313	1,395	82	6.2%	61,991	38,242	36,960	38,342	33,044	28,103	25,102	25,118	16	0.1%
America West Express	Columbus	CMH	450								-	-	22,493								-	-
American Connection	St. Louis	STL		947							-	-		44,356							-	-
American Eagle	Charlotte	CLT							366	290	-76	-20.9%							28,940	22,265	-6,675	-23.1%
American Eagle	Chicago O'Hare	ORD			1,501	1,630	1,613	1,630	1,622	1,604	-18	-1.1%			79,594	95,985	80,413	90,663	115,856	115,366	-490	-0.4%
American Eagle	New York J F Kennedy	JFK	1,460								-	-	48,166								-	-
American Eagle	Philadelphia	PHL							2,234	2,502	268	12.0%							136,683	146,222	9,539	7.0%
American Eagle	Pittsburgh	PIT							939	782	-157	-16.7%							67,549	39,086	-28,463	-42.1%
American Eagle	Raleigh/Durham	RDU		1,364	257						-	-		54,521	10,774						-	-
American Eagle	St. Louis	STL									-	-									-	-
American Eagle	Washington National	DCA							2,119	2,125	6	0.3%							141,783	130,975	-10,808	-7.6%
Continental Connection	Albany	ALB		51							-	-		961							-	-
Continental Connection	Binghamton	BGM									-	-									-	-
Continental Connection	Boston	BOS									-	-									-	-
Continental Connection	Buffalo	BUF	89								-	-	1,683								-	-
Continental Connection	Burlington	BTV	4								-	-	84								-	-
Continental Connection	New York J F Kennedy	JFK									-	-									-	-
Continental Connection	New York Newark	EWR			608						-	-			22,485						-	-
Continental Connection	Philadelphia	PHL									-	-									-	-
Continental Connection	Rochester	ROC	93								-	-	1,767								-	-
Continental Connection	Syracuse	SYR	97								-	-	1,851								-	-
Continental Express	Cleveland	CLE	803	1,102	1,208						-	-	39,357	54,951	60,400						-	-
Continental Express	New York Newark	EWR	1,747	1,351	465						-	-	82,365	67,455	23,264						-	-
Delta Connection	Atlanta	ATL				48	9	4	4	4	-	0.0%				3,396	647	279	288	326	38	13.2%
Delta Connection	Cincinnati	CVG			1,218	1,251	902	895	839	475	-364	-43.4%			61,642	66,559	45,181	44,757	43,557	25,537	-18,020	-41.4%
Delta Connection	Cleveland	CLE							170	183	13	7.6%							11,898	12,450	552	4.6%
Delta Connection	Columbus	CMH		994							-	-		49,196							-	-
Delta Connection	Detroit	DTW			1,004	1,323	1,429	1,195	659	300	-359	-54.5%			54,265	82,915	100,525	80,351	45,421	20,224	-25,197	-55.5%
Delta Connection	Fort Lauderdale/Hollywood	FLL									-	-									-	-
Delta Connection	Fort Myers	RSW		612							-	-		42,840							-	-
Delta Connection	Indianapolis	IND									-	-									-	-
Delta Connection	Minneapolis	MSP			481	814	858	812	738	338	-400	-54.2%			36,567	61,731	64,643	61,035	55,233	25,252	-29,981	-54.3%
Delta Connection	Myrtle Beach	MYR	61								-	-	3,057								-	-
Delta Connection	New York J F Kennedy	JFK			365	304	183				-	-			18,250	15,200	9,216				-	-
Delta Connection	Orlando	MCO							43	35	-8	-18.6%							3,156	2,354	-802	-25.4%
Delta Connection	Raleigh/Durham	RDU			100	569	454	270	257	261	4	1.6%			6,136	28,436	22,686	13,500	12,850	17,611	4,761	37.1%
Delta Connection	Tampa	TPA									-	-									-	-
Delta Connection	Washington National	DCA			166	929	360				-	-			11,324	51,524	18,074				-	-
Delta Connection	West Palm Beach	PBI									-	-									-	-
Frontier Express	Milwaukee	MKE			140	417					-	-			6,313	18,746					-	-
Independence Air	Washington Dulles	IAD		1,966							-	-		98,307							-	-
Midway Airlines	Raleigh/Durham	RDU	1,348								-	-	67,393								-	-
Midwest Connect	Milwaukee	MKE	4	965							-	-	142	30,871							-	-
Northwest Airlink	Detroit	DTW									-	-									-	-
Northwest Airlink	Indianapolis	IND		638							-	-		31,907							-	-
Northwest Airlink	Memphis	MEM									-	-									-	-
Northwest Airlink	Minneapolis	MSP		31							-	-		1,550							-	-
Shuttle America	Albany	ALB	66								-	-	3,286								-	-
Shuttle America	Bedford	BED	233								-	-	11,671								-	-
Shuttle America	Buffalo	BUF	337								-	-	16,857								-	-
Shuttle America	Islip	ISP	27								-	-	1,329								-	-

Table F-3 Scheduled Passenger Operations by Market and Carrier for Bradley International Airport

Carrier	Market	Code	Departures 2000	2005	2010	2011	2012	2013	2014	2015	'14-'15 Change	'14-'15 Pct. Change	Departing Seats 2000	2005	2010	2011	2012	2013	2014	2015	'14-'15 Change	'14-'15 Pct. Change
Shuttle America	Wilmington	ILG	159								-	-	7,936								-	-
Swissair	New York J F Kennedy	JFK	31								-	-	1,023								-	-
Trans World Airlines	New York J F Kennedy	JFK	1,098								-	-	31,842								-	-
United Express	Chicago O'Hare	ORD		691	548	685	1,038	1,045	877	904	27	3.1%		48,370	36,797	43,701	63,807	59,896	47,419	60,980	13,561	28.6%
United Express	Cleveland	CLE				1,200	1,125	1,127	235		-235	-100.0%				59,979	55,744	56,436	11,750		-11,750	-100.0%
United Express	Houston	IAH							96	365	269	280.2%							7,521	26,998	19,477	259.0%
United Express	New York Newark	EWR				1,159	1,347	1,269	853	1,335	482	56.5%				46,231	56,787	61,339	38,317	65,086	26,769	69.9%
United Express	Washington Dulles	IAD		1,519	494	889	928	1,280	1,224	1,243	19	1.6%		84,484	30,270	54,707	59,507	72,861	68,684	77,783	9,099	13.2%
US Airways Express	Baltimore	BWI	1,185								-	-	43,850								-	-
US Airways Express	Buffalo	BUF	1,032	839							-	-	38,200	28,607							-	-
US Airways Express	Charlotte	CLT		4	537	452	462	364			-	-		221	45,043	37,510	39,235	28,392			-	-
US Airways Express	New York La Guardia	LGA			139	1,057	364				-	-			5,159	39,098	13,468				-	-
US Airways Express	New York Newark	EWR									-	-									-	-
US Airways Express	Philadelphia	PHL		439	2,404	2,430	2,356	2,260			-	-		27,685	183,838	163,675	151,526	133,663			-	-
US Airways Express	Pittsburgh	PIT		1,646	939	939	941	939			-	-		84,598	46,929	46,929	47,057	77,901			-	-
US Airways Express	Rochester	ROC	937	574	478						-	-	34,658	19,555	16,242						-	-
US Airways Express	Syracuse	SYR	732	478							-	-	27,084	9,077							-	-
US Airways Express	Washington National	DCA		551	1,334	1,411	1,574	1,825			-	-		34,454	89,629	89,940	109,321	115,989			-	-
Subtotal			14,968	19,143	16,694	19,799	18,212	17,164	15,584	15,149	-435	-2.8%	567,477	871,682	901,282	1,063,342	989,430	942,310	879,932	831,774	-48,158	-5.5%
Total			53,139	49,651	35,389	38,640	34,898	34,009	34,915	33,402	-1,513	-4.3%	5,747,148	5,357,918	3,523,368	3,757,008	3,393,466	3,426,886	3,645,718	3,440,056	-205,662	-5.6%

Source: OAG Schedules.

Notes:

All Northwest Airlines operations included in Delta Air Lines from 2009 onwards (following 2008 merger)

All Continental Airlines operations included in United Airlines from 2011 onwards (following 2010 merger)

All AirTran Airways operations included in Southwest Airlines from 2012 onwards (following 2011 merger)

All US Airways operations included in American Airlines from 2014 onwards (following 2013 merger)

Table F-4 Scheduled Passenger Operations by Market and Carrier for T.F. Green Airport

			Departures										Departing Seats									
Carrier	**Market**	**Code**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**'14-'15 Change**	**'14-'15 Pct. Change**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**'14-'15 Change**	**'14-'15 Pct. Change**
Jet Carriers																						
American	Charlotte	CLT							1,275	1,176	-99	-7.8%							196,644	170,310	-26,334	-13.4%
American	Chicago O'Hare	ORD	1,464	1,113							-	-	203,104	143,522							-	-
American	Dallas/Fort Worth	DFW		365							-	-		47,085							-	-
American	Philadelphia	PHL							347	366	19	5.5%							34,381	36,514	2,133	6.2%
American	Washington National	DCA							77	52									9,566	6,483	-3,083	-32.2%
Continental	Cleveland	CLE	569	13							-	-	69,771	1,630							-	-
Continental	Houston Intercontinental	IAH	366								-	-	45,946								-	-
Continental	New York Newark	EWR	738	282							-	-	96,448	34,808							-	-
Condor	Frankfurt	FRA								22										5,940		
Delta	Atlanta	ATL	1,464	1,976	510	1,043	990	978	993	997	4	0.4%	207,888	290,915	72,461	150,526	147,729	145,241	148,012	148,078	66	0.0%
Delta	Cincinnati	CVG	732	695							-	-	103,944	89,235							-	-
Delta	Detroit	DTW			414	58		218	476	707	231	48.5%			50,065	7,139		30,414	62,046	87,078	25,032	40.3%
Delta	Fort Lauderdale/Hollywood	FLL									-	-									-	-
Delta	Minneapolis	MSP			74						-	-			9,211						-	-
Delta	Orlando	MCO	732								-	-	87,108								-	-
jetBlue	Fort Lauderdale/Hollywood	FLL					31	365	365	365	-	0.0%					4,650	54,750	54,750	54,750	-	0.0%
jetBlue	Orlando	MCO					62	713	713	713	0	-0.1%					9,300	103,786	106,886	106,886	0	0.0%
Laker Airways (Bahamas)	Freeport	FPO									-	-									-	-
Northwest	Detroit	DTW	1,682	1,550							-	-	200,509	202,255							-	-
Northwest	Minneapolis	MSP		539							-	-		68,977							-	-
Sata Internacional	Ponta Delgada	PDL									-	-									-	-
Southwest	Baltimore	BWI	3,913	4,180	3,260	3,043	3,128	3,004	2,820	2,793	-27	-1.0%	535,911	572,699	442,637	415,554	433,081	429,658	411,154	407,651	-3,503	-0.9%
Southwest	Chicago Midway	MDW	1,072	1,349	1,135	1,095	1,094	992	975	988	13	1.3%	146,844	184,813	153,121	149,877	150,303	154,633	156,543	158,640	2,097	1.3%
Southwest	Denver	DEN					366	304	9		-9	-100.0%					51,110	44,281	1,246		-1,246	-100.0%
Southwest	Fort Lauderdale/Hollywood	FLL	9		594	590	500	479	474	477	3	0.6%	1,194		81,378	80,791	68,347	70,413	68,401	70,778	2,377	3.5%
Southwest	Fort Myers	RSW					86	40	44	48	4	9.4%					11,743	5,520	6,292	7,305	1,013	16.1%
Southwest	Houston	HOU	152								-	-	20,824								-	-
Southwest	Islip	ISP	608								-	-	83,237								-	-
Southwest	Kansas City	MCI	366	365							-	-	50,142	50,005							-	-
Southwest	Las Vegas	LAS		31	365	365	362				-	-		4,247	50,005	50,005	49,932				-	-
Southwest	Nashville	BNA	706	721	296	123					-	-	96,702	98,816	39,578	16,067					-	-
Southwest	Orlando	MCO	955	1,821	1,799	1,659	1,585	1,423	1,419	1,464	45	3.2%	130,855	249,418	245,156	225,244	216,998	210,082	204,947	215,253	10,306	5.0%
Southwest	Philadelphia	PHL		1,773	1,402	1,298					-	-		238,366	192,054	177,001					-	-
Southwest	Phoenix	PHX	366	726	361	365					-	-	50,142	99,403	49,398	50,005					-	-
Southwest	Tampa	TPA	745	1,086	813	808	763	753	748	735	-13	-1.7%	102,065	148,821	111,231	109,572	104,140	107,959	107,481	108,451	970	0.9%
Southwest	West Palm Beach	PBI						31	35	31	-4	-11.4%						4,433	5,046	4,433	-613	-12.1%
Spirit Airlines	Detroit	DTW		120							-	-		18,000							-	-
Spirit Airlines	Fort Lauderdale/Hollywood	FLL		568							-	-		84,117							-	-
Spirit Airlines	Fort Myers	RSW		365							-	-		54,750							-	-
TACV	Praia	RAI								39	39	-								7,739	7,739	-
United	Chicago O'Hare	ORD	1,477	1,460	644	626	388	334	320	144	-176	-55.0%	239,076	200,677	82,802	78,487	48,697	46,258	42,658	17,570	-25,088	-58.8%
US Airways	Baltimore	BWI	2,462								-	-	263,921								-	-
US Airways	Charlotte	CLT	977	1,858	1,643	1,599	1,726	1,608			-	-	128,984	274,039	233,886	226,854	238,503	225,454			-	-
US Airways	Fort Lauderdale/Hollywood	FLL		17							-	-		2,186							-	-
US Airways	Orlando	MCO	52	43							-	-	5,605	5,831							-	-
US Airways	Philadelphia	PHL	1,830	2,182	1,299	1,012	399	313			-	-	253,015	312,890	130,008	101,987	39,529	30,973			-	-
US Airways	Pittsburgh	PIT	1,339	31							-	-	185,109	4,446							-	-
US Airways	Washington National	DCA	1,333	1,270	365	313	182	124			-	-	167,278	170,009	49,501	44,006	24,350	14,997			-	-
Subtotal			26,108	26,499	14,974	13,998	11,661	11,677	11,090	11,116	26	0.2%	3,475,622	3,651,961	1,992,492	1,883,114	1,598,412	1,678,851	1,616,053	1,613,859	-2,194	-0.1%

Table F-4 Scheduled Passenger Operations by Market and Carrier for T.F. Green Airport

			Departures										Departing Seats									
Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	2015	'14-'15 Change	'14-'15 Pct. Change	2000	2005	2010	2011	2012	2013	2014	2015	'14-'15 Change	'14-'15 Pct. Change
Regional/Commuter Carriers																						
Air Canada Express	Toronto	YYZ	989	734	625	591	593	84			-	-	37,482	13,783	11,880	11,232	11,262	1,517			-	-
American Eagle	Charlotte	CLT							175	341	166	94.9%							13,971	26,810	12,839	91.9%
American Eagle	Chicago O'Hare	ORD									-	-									-	-
American Eagle	Detroit	DTW					12				-	-					808				-	-
American Eagle	New York J F Kennedy	JFK	1,291								-	-	42,589								-	-
American Eagle	New York La Guardia	LGA	2,756								-	-	90,957								-	-
American Eagle	Raleigh/Durham	RDU		343							-	-		13,081							-	-
American Eagle	Philadelphia	PHL							2,213	2,163	-50	-2.3%							150,139	142,721	-7,418	-4.9%
American Eagle	Washington National	DCA							1,609	1,755	146	9.1%							111,183	111,865	682	0.6%
Cape Air	Block Island	BID							538	418	-120	-22.3%							4,846	3,765	-1,081	-22.3%
Cape Air	Hyannis	HYA									-	-									-	-
Cape Air	Martha's Vineyard	MVY	1,762	1,015	747	672	659	501	285	192	-93	-32.6%	15,861	9,132	6,722	6,048	5,930	4,513	2,561	1,725	-836	-32.6%
Cape Air	Nantucket	ACK	2,453	1,199	681	668	576	501	271	244	-27	-10.0%	22,073	10,787	6,128	6,012	5,181	4,510	2,438	2,196	-242	-9.9%
Continental Connection	Albany	ALB		51							-	-		961							-	-
Continental Connection	Boston	BOS									-	-									-	-
Continental Connection	New York Newark	EWR			427						-	-			31,630						-	-
Continental Connection	Plattsburgh	PLB									-	-									-	-
Continental Connection	Washington Dulles	IAD									-	-									-	-
Continental Express	Cleveland	CLE	699	1,238	1,217						-	-	34,936	61,900	60,836						-	-
Continental Express	New York Newark	EWR	1,482	1,455	1,028						-	-	86,552	71,185	51,407						-	-
Delta Connection	Atlanta	ATL		31	724	9	43	70	51	43	-8	-15.7%		1,550	52,959	662	3,279	4,522	3,380	3,001	-379	-11.2%
Delta Connection	Cincinnati	CVG		373	43						-	-		19,109	2,150						-	-
Delta Connection	Detroit	DTW			1,324	1,995	2,054	1,748	871	289	-582	-66.8%			78,701	111,901	113,630	90,191	45,809	18,671	-27,138	-59.2%
Delta Connection	Minneapolis	MSP			347	392	266	240	170		-170	-100.0%			26,192	29,553	20,189	17,380	12,878		-12,878	-100.0%
Delta Connection	New York J F Kennedy	JFK									-	-									-	-
Delta Connection	New York La Guardia	LGA	610								-	-	19,520								-	-
Delta Connection	Raleigh/Durham	RDU				131					-	-				6,557					-	-
Delta Connection	Washington National	DCA				685	225				-	-				34,243	11,271				-	-
Independence Air	Washington Dulles	IAD		1,509							-	-		75,429							-	-
Midway Airlines	Raleigh/Durham	RDU									-	-									-	-
Northwest Airlink	Detroit	DTW									-	-									-	-
Northwest Airlink	Minneapolis	MSP		31							-	-		1,550							-	-
Swissair	New York J F Kennedy	JFK	31								-	-	1,023								-	-
United Express	Chicago O'Hare	ORD		262	455	375	309	306	325	605	280	86.2%		18,330	29,820	24,079	19,900	19,896	19,443	34,473	15,030	77.3%
United Express	Cleveland	CLE				1,079	886	875	102		-102	-100.0%				53,943	42,991	43,757	5,100		-5,100	-100.0%
United Express	New York Newark	EWR				1,439	1,346	1,213	994	1,356	362	36.4%				69,724	61,168	65,636	57,558	73,682	16,124	28.0%
United Express	Washington Dulles	IAD	1,468	1,716	1,569	1,421	1,157	1,035	1,031	837	-194	-18.8%	52,832	85,821	99,719	89,593	73,470	65,632	67,077	52,139	-14,938	-22.3%
US Airways Express	Albany	ALB	679								-	-	12,898								-	-
US Airways Express	Boston	BOS	48								-	-	909								-	-
US Airways Express	Charlotte	CLT		18	126	147	65	166			-	-		879	10,047	12,035	5,423	12,857			-	-
US Airways Express	Hyannis	HYA									-	-									-	-
US Airways Express	Nantucket	ACK									-	-									-	-
US Airways Express	New York La Guardia	LGA	2,298	1,669	1,222	957	286				-	-	84,116	55,077	45,225	33,141	10,582				-	-
US Airways Express	New York Newark	EWR	1,569								-	-	31,176								-	-
US Airways Express	Philadelphia	PHL	366	716	1,526	1,713	2,206	2,347			-	-	13,542	45,199	107,790	122,386	152,816	154,401			-	-
US Airways Express	Pittsburgh	PIT		1,360							-	-		72,808							-	-
US Airways Express	Plattsburgh	PLB	26								-	-	497								-	-
US Airways Express	Washington National	DCA		482	1,373	1,304	1,479	1,492			-	-		30,996	92,151	95,527	110,451	107,775			-	-
Subtotal			18,527	14,200	13,436	13,577	12,161	10,577	8,635	8,243	-392	-4.5%	546,963	587,576	713,356	706,634	648,351	592,587	496,383	471,048	-25,335	-5.1%
Total			44,635	40,699	28,409	27,575	23,822	22,255	19,725	19,359	-366	-1.9%	4,022,585	4,239,537	2,705,848	2,589,748	2,246,763	2,271,438	2,112,436	2,084,907	-27,529	-1.3%

Source: OAG Schedules.

Notes:

All Northwest Airlines operations included in Delta Air Lines from 2009 onwards (following 2008 merger)

All Continental Airlines operations included in United Airlines from 2011 onwards (following 2010 merger)

All AirTran Airways operations included in Southwest Airlines from 2012 onwards (following 2011 merger)

All US Airways operations included in American Airlines from 2014 onwards (following 2013 merger)

Table F-5 Scheduled Passenger Operations by Market and Carrier for Manchester Airport

			Departures										Departing Seats									
Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	2015	'14-'15 Change	'14-'15 Pct. Change	2000	2005	2010	2011	2012	2013	2014	2015	'14-'15 Change	'14-'15 Pct. Change
Jet Carriers																						
Boston-Maine Airways	Myrtle Beach	MYR									-	-									-	-
Boston-Maine Airways	Portsmouth	PSM									-	-									-	-
Boston-Maine Airways	Sanford	SFB									-	-									-	-
Continental	Cleveland	CLE	130								-	-	16,151								-	-
Continental	New York Newark	EWR	462	286							-	-	62,358	30,953							-	-
Delta	Atlanta	ATL	244	668	275	565	514	463	459	365	-94	-20.5%	34,648	94,856	39,050	81,600	76,629	69,307	68,468	53,545	-14,923	-21.8%
Delta	Cincinnati	CVG		664							-	-		86,583							-	-
Delta	Detroit	DTW			796					122	122	-			89,289					14,414	14,414	-
Delta	New York - LGA	LGA								4	4	-								596	596	-
Northwest	Detroit	DTW	1,609	1,399							-	-	194,058	180,879							-	-
Northwest	Minneapolis	MSP		365							-	-		46,933							-	-
Southwest	Baltimore	BWI	2,828	3,850	2,891	2,761	2,775	2,726	2,494	2,476	-18	-0.7%	387,397	527,405	393,093	376,945	385,044	387,879	364,979	363,524	-1,455	-0.4%
Southwest	Chicago Midway	MDW	706	1,355	1,144	1,244	1,168	1,010	984	948	-36	-3.6%	96,702	185,481	155,466	169,440	161,822	158,820	157,501	148,825	-8,676	-5.5%
Southwest	Denver	DEN				92	366	304			-	-				12,604	50,379	43,211			-	-
Southwest	Fort Lauderdale/Hollywood	FLL			9	9	152	90		4	4	-			1,194	1,194	21,190	12,793		633	633	-
Southwest	Kansas City	MCI	366								-	-	50,142								-	-
Southwest	Las Vegas	LAS		365	365	365	122	61	9	9	-	0.0%		50,005	50,005	50,005	16,766	8,723	1,246	1,246	-	0.0%
Southwest	Nashville	BNA	397	730							-	-	54,389	99,879							-	-
Southwest	Orlando	MCO	410	1,468	1,125	977	906	831	752	743	-9	-1.2%	56,111	201,175	154,145	133,829	125,620	123,873	109,202	113,888	4,686	4.3%
Southwest	Philadelphia	PHL		1,786	1,411	1,325					-	-		244,356	192,456	180,871					-	-
Southwest	Phoenix	PHX			322	273					-	-			44,114	37,401					-	-
Southwest	Tampa	TPA		1,099	782	629	579	466	470	479	9	1.9%		150,165	107,173	86,212	79,639	68,120	67,509	70,529	3,020	4.5%
United	Chicago O'Hare	ORD	1,403	1,339							-	-	221,523	179,151							-	-
United	Portland (ME)	PWM	57								-	-	7,241								-	-
US Airways	Baltimore	BWI	1,782								-	-	191,078								-	-
US Airways	Charlotte	CLT		1,308	365	51					-	-		178,836	52,560	7,406					-	-
US Airways	Orlando	MCO	52								-	-	5,605								-	-
US Airways	Philadelphia	PHL	1,821	2,021	365	313	187	351			-	-	222,331	274,215	33,132	30,973	18,499	34,791			-	-
US Airways	Pittsburgh	PIT	1,085								-	-	139,837								-	-
US Airways	Washington National	DCA	675	575							-	-	82,085	77,461							-	-
Subtotal			14,026	19,279	9,850	8,604	6,769	6,302	5,168	5,150	-18	-0.3%	1,821,657	2,608,335	1,311,677	1,168,481	935,588	907,518	768,905	767,200	-1,705	-0.2%
Regional/Commuter Carriers																						
Air Canada Express	Montreal Dorval	YUL									-	-									-	-
Air Canada Express	Toronto	YYZ	339	930	707	403					-	-	5,616	17,439	13,441	7,652					-	-
American Eagle	Charlotte	CLT							496	730	234	47.3%							37,761	54,688	16,927	44.8%
American Eagle	New York La Guardia	LGA	1,833								-	-	60,480								-	-
American Eagle	Philadelphia	PHL							2,295	2,237	-58	-2.5%							149,598	152,206	2,608	1.7%
American Eagle	Washington National	DCA							1,198	1,152	-46	-3.9%							77,065	74,008	-3,057	-4.0%
Boston-Maine Airways	Bangor	BGR									-	-									-	-
Boston-Maine Airways	Martha's Vineyard	MVY									-	-									-	-
Boston-Maine Airways	Nantucket	ACK									-	-									-	-
Boston-Maine Airways	New London/Groton	GON									-	-									-	-
Boston-Maine Airways	Portsmouth	PSM									-	-									-	-
Boston-Maine Airways	Saint John	YSJ									-	-									-	-
Continental Connection	Albany	ALB	80	313							-	-	1,515	5,944							-	-
Continental Connection	New York J F Kennedy	JFK									-	-									-	-
Continental Connection	New York Newark	EWR			141						-	-			9,483						-	-
Continental Connection	Plattsburgh	PLB									-	-									-	-
Continental Connection	Rochester	ROC	44								-	-	841								-	-
Continental Connection	Syracuse	SYR	22								-	-	421								-	-
Continental Connection	Westchester County	HPN									-	-									-	-
Continental Express	Cleveland	CLE	593	1,186	1,178						-	-	29,614	58,991	58,921						-	-
Continental Express	New York Newark	EWR	1,028	1,165	1,267						-	-	64,944	58,140	63,336						-	-
Delta Connection	Atlanta	ATL	488	485	90			51	59		-59	-100.0%	24,400	26,620	6,300			3,843	4,484		-4,484	-100.0%
Delta Connection	Bangor	BGR	244								-	-	12,200								-	-
Delta Connection	Cincinnati	CVG	1,673	735							-	-	83,657	38,426							-	-
Delta Connection	Detroit	DTW			499	1,858	1,609	1,510	1,296	912	-384	-29.6%			32,795	95,802	80,786	75,507	69,261	51,960	-17,301	-25.0%
Delta Connection	New York J F Kennedy	JFK									-	-									-	-
Delta Connection	New York La Guardia	LGA	727	486			586	1,165	1,140	970	-170	-14.9%	36,357	24,300			31,216	66,132	63,202	55,968	-7,234	-11.4%
Delta Connection	Minneapolis	MSP																				
Independence Air	Washington Dulles	IAD		1,568							-	-		78,379							-	-

Table F-5 Scheduled Passenger Operations by Market and Carrier for Manchester Airport

			Departures										Departing Seats									
Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	2015	'14-'15 Change	'14-'15 Pct. Change	2000	2005	2010	2011	2012	2013	2014	2015	'14-'15 Change	'14-'15 Pct. Change
Northwest Airlink	Detroit	DTW									-	-									-	-
Northwest Airlink	Minneapolis	MSP		233							-	-		11,664							-	-
United Express	Chicago O'Hare	ORD		31	1,040	983	867	695	857	779	-78	-9.1%		2,170	67,675	62,096	45,929	39,114	49,854	42,976	-6,878	-13.8%
United Express	Cleveland	CLE				935	759	740	111		-111	-100.0%				46,736	36,046	36,986	5,564		-5,564	-100.0%
United Express	New York Newark	EWR				1,391	1,298	1,120	965	1,304	339	35.1%				67,250	60,049	54,604	44,824	60,052	15,228	34.0%
United Express	Washington Dulles	IAD		1,760	1,104	658	427	90			-	-		90,419	55,951	33,514	20,788	5,444			-	-
US Airways Express	Boston	BOS									-	-									-	-
US Airways Express	Charlotte	CLT		307	153	318	366	417			-	-		21,863	13,146	27,181	31,476	32,885			-	-
US Airways Express	New York La Guardia	LGA	2,583	2,499	1,381	1,269	594				-	-	96,936	86,492	49,420	43,737	21,962				-	-
US Airways Express	Philadelphia	PHL		562	2,116	2,068	2,092	2,004			-	-		30,239	140,277	135,156	134,567	126,552			-	-
US Airways Express	Pittsburgh	PIT		1,022							-	-		51,107							-	-
US Airways Express	Washington National	DCA		508	1,039	1,043	1,002	1,252			-	-		25,379	81,095	81,683	78,512	84,499			-	-
Subtotal			9,655	13,788	10,716	10,925	9,600	9,045	8,417	8,084	-333	-4.0%	416,980	627,572	591,840	600,808	541,331	525,567	501,613	491,858	-9,755	-1.9%
Total			23,681	33,067	20,566	19,529	16,369	15,347	13,585	13,234	-351	-2.6%	2,238,636	3,235,907	1,903,517	1,769,288	1,476,919	1,433,085	1,270,518	1,259,058	-11,459	-0.9%

Source: OAG Schedules.

Notes:

All Northwest Airlines operations included in Delta Air Lines from 2009 onwards (following 2008 merger)

All Continental Airlines operations included in United Airlines from 2011 onwards (following 2010 merger)

All AirTran Airways operations included in Southwest Airlines from 2012 onwards (following 2011 merger)

All US Airways operations included in American Airlines from 2014 onwards (following 2013 merger)

Table F-6 Scheduled Passenger Operations by Market and Carrier for Portland International Jetport

			Departures										Departing Seats									
Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	2015	'14-'15 Change	'14-'15 Pct. Change	2000	2005	2010	2011	2012	2013	2014	2015	'14-'15 Change	'14-'15 Pct. Change
Jet Carriers																						
American	Charlotte	CLT							374	365	-9	-2.4%							46,341	45,504	-837	-1.8%
American	Philadelphia	PHL							92		-92	-100.0%							9,108		-9,108	-100.0%
American	Washington National	DCA								30	30	-								3,720	3,720	-
AirTran	Atlanta	ATL			92	167					-	-			10,764	19,522					-	-
AirTran	Baltimore	BWI			944	927					-	-			112,951	109,024					-	-
AirTran	Orlando	MCO			52	52					-	-			6,503	6,355					-	-
Continental	Cleveland	CLE									-	-									-	-
Continental	New York Newark	EWR									-	-									-	-
Delta	Atlanta	ATL	732	486	424	793	751	737	693	714	21	3.0%	103,944	61,229	60,167	114,597	110,397	109,750	103,571	107,000	3,429	3.3%
Delta	Cincinnati	CVG	1,089	486							-	-	154,658	69,012							-	-
Delta	New York La Guardia	LGA					184	239	79	30	-49	-62.0%					24,256	35,374	11,750	3,300	-8,450	-71.9%
Independence Air	Washington Dulles	IAD		307							-	-		40,524							-	-
jetBlue	New York J F Kennedy	JFK			1,201	1,323	1,239	1,307	1,332	1,295	-37	-2.8%			128,936	135,379	124,571	130,671	133,200	130,314	-2,886	-2.2%
jetBlue	Orlando	MCO			212	181					-	-			21,214	21,344					-	-
Northwest	Detroit	DTW	523	427							-	-	52,105	42,700							-	-
Southwest	Baltimore	BWI					1,016	1,005	1,084	1,106	22	2.0%					119,112	136,588	152,939	158,358	5,419	3.5%
Southwest	Orlando	MCO					13		4	9	5	117.9%					1,521		633	1,246	613	96.9%
Southwest	Chicago Midway	MDW							9	4	-5	-50.8%							1,246	633	-613	-49.2%
Trans World Airlines	Hartford	BDL	305								-	-	43,310								-	-
United	Chicago O'Hare	ORD	728								-	-	88,996								-	-
United	Manchester	MHT	366								-	-	53,802								-	-
US Airways	Charlotte	CLT			395	352	366	365			-	-			48,688	47,130	49,044	45,260			-	-
US Airways	Philadelphia	PHL	1,312	154		217	18				-	-	163,051	19,404		21,525	1,895				-	-
US Airways	Pittsburgh	PIT	1,081								-	-	137,472								-	-
US Airways	Washington National	DCA		52							-	-		6,668							-	-
Subtotal			6,135	1,912	3,320	4,013	3,587	3,653	3,667	3,553	-114	-3.1%	797,338	239,537	389,224	474,876	430,796	457,644	458,788	450,075	-8,713	-1.9%
Regional/Commuter Carriers																						
Air Canada Express	Montreal Dorval	YUL	344								-	-	4,734								-	-
Air Canada Express	Toronto	YYZ			481	783	671	97			-	-			9,142	14,872	12,749	1,741			-	-
America West	New York Newark	EWR	52								-	-	2,457								-	-
American Eagle	Boston	BOS	3,804								-	-	125,518								-	-
American Eagle	Charlotte	CLT							26	143	117	450.0%							2,065	11,666	9,601	464.9%
American Eagle	Chicago O'Hare	ORD									-	-									-	-
American Eagle	New York La Guardia	LGA	2,033								-	-	67,084								-	-
American Eagle	Philadelphia	PHL							1,986	2,148	162	8.2%							125,325	141,789	16,464	13.1%
American Eagle	Washington National	DCA							1,426	1,613	187	13.1%							99,757	107,469	7,712	7.7%
Continental Conenction	Albany	ALB		291							-	-		5,537							-	-
Continental Conenction	Boston	BOS	204	241							-	-	3,871	4,576							-	-
Continental Conenction	New York Newark	EWR			1,426						-	-			105,503						-	-
Continental Conenction	Presque Isle	PQI									-	-									-	-
Continental Express	Cleveland	CLE	425	223	188						-	-	20,378	11,021	9,400						-	-
Continental Express	New York Newark	EWR	1,429	1,394	4						-	-	70,393	69,605	200						-	-
Delta Connection	Atlanta	ATL		700	350						-	-		48,440	25,532						-	-
Delta Connection	Boston	BOS		1,153							-	-		57,650							-	-
Delta Connection	Cincinnati	CVG		600							-	-		31,166							-	-
Delta Connection	Detroit	DTW			1,217	1,314	1,264	1,249	1,061	896	-165	-15.6%			62,320	65,686	64,758	62,436	60,448	59,315	-1,133	-1.9%
Delta Connection	New York J F Kennedy	JFK			270						-	-			13,500						-	-
Delta Connection	New York La Guardia	LGA	475	1,095	786	1,034	1,050	1,202	1,231	1,284	53	4.3%	15,191	54,750	41,440	57,437	67,453	80,898	80,103	76,325	-3,778	-4.7%
Delta Connection	Minneapolis	MSP																				
Independence Air	Washington Dulles	IAD		1,384							-	-		69,186							-	-
Lufthansa German Airlines	Washington Dulles	IAD	31								-	-	1,550								-	-
Northwest Airlink	Detroit	DTW	484	915							-	-	33,366	53,132							-	-
Northwest Airlink	Minneapolis	MSP		404							-	-		20,186							-	-
Starlink Aviation	Yarmouth	YQI			521	521	217				-	-			9,386	9,386	3,909				-	-
Swissair	Boston	BOS	31								-	-	1,023								-	-
United Express	Chicago O'Hare	ORD		1,095	1,249	1,176	1,125	1,045	1,038	1,029	-9	-0.9%		67,590	82,273	72,457	59,896	65,872	63,099	64,054	955	1.5%
United Express	Cleveland	CLE				188	249	298			-	-				9,400	11,906	14,886			-	-
United Express	New York Newark	EWR				1,426	1,596	1,630	1,470	1,779	309	21.0%				103,511	81,454	102,156	92,953	108,900	15,947	17.2%
United Express	Washington Dulles	IAD	996	1,456	1,078	1,066	885	750	689	560	-129	-18.7%	49,779	83,730	64,767	62,493	43,839	39,624	37,949	35,213	-2,736	-7.2%
US Airways Express	Bangor	BGR	231								-	-	8,558								-	-
US Airways Express	Boston	BOS	2,229								-	-	42,359								-	-
US Airways Express	Charlotte	CLT		365	88	18	31	35			-	-		23,710	5,323	1,364	2,542	2,777			-	-
US Airways Express	New York La Guardia	LGA	1,218	1,665	1,647	1,526	598				-	-	43,901	77,909	78,477	68,755	26,013				-	-
US Airways Express	Philadelphia	PHL		1,913	1,947	1,987	2,153	2,131			-	-		100,307	133,521	129,133	139,908	137,137			-	-
US Airways Express	Pittsburgh	PIT		219							-	-		10,971							-	-
US Airways Express	Plattsburgh	PLB	48								-	-	909								-	-
US Airways Express	Presque Isle	PQI									-	-									-	-
US Airways Express	Washington National	DCA	1,089	1,149	1,043	1,043	1,260	1,408			-	-	33,976	75,568	83,302	87,190	102,160	100,248			-	-
US Airways Express	Westchester County	HPN	65								-	-	1,235								-	-
Subtotal			15,187	16,261	12,296	12,081	11,098	9,843	8,927	9,452	525	5.9%	526,282	865,033	724,086	681,682	616,586	607,775	561,699	604,731	43,032	7.7%
Total			21,322	18,174	15,615	16,094	14,684	13,496	12,594	13,005	411	3.3%	1,323,619	1,104,570	1,113,310	1,156,558	1,047,382	1,065,419	1,020,487	1,054,806	34,320	3.4%

Source: OAG Schedules.

Notes:

All Northwest Airlines operations included in Delta Air Lines from 2009 onwards (following 2008 merger)

All Continental Airlines operations included in United Airlines from 2011 onwards (following 2010 merger)

All AirTran Airways operations included in Southwest Airlines from 2012 onwards (following 2011 merger)

All US Airways operations included in American Airlines from 2014 onwards (following 2013 merger)

Table F-7 Scheduled Passenger Operations by Market and Carrier for Burlington Airport

Departures

Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	2015	'14-'15 Change	'14-'15 Pct. Change
Jet Carriers												
AirTran	Baltimore	BWI									-	-
Allegiant Air	Orlando/Sanford	SFB							94	104	10	10.6%
American	Philadelphia	PHL							116			
Continental	New York Newark	EWR									-	-
Delta	Atlanta	ATL						153	92	92	-	0.0%
jetBlue	New York J F Kennedy	JFK	244	1,126	1,434	1,405	1,363	1,365	1,244	1,156	-88	-7.1%
jetBlue	Orlando	MCO			330	339	326				-	-
Northwest	Detroit	DTW		174							-	-
United	Chicago O'Hare	ORD	815	365						113	113	-
United	Portland (ME)	PWM									-	-
US Airways	Philadelphia	PHL	1,098	365				26			-	-
US Airways	Pittsburgh	PIT	732								-	-
US Airways	Washington National	DCA		4							-	-
Subtotal			2,889	2,035	1,764	1,744	1,690	1,543	1,546	1,465	-81	-5.2%
Regional/Commuter Carriers												
America West	New York Newark	EWR	166								-	-
American Eagle	Boston	BOS	3,094								-	-
American Eagle	Charlotte	CLT								122	122	-
American Eagle	Chicago O'Hare	ORD									-	-
American Eagle	Philadelphia	PHL							1,823	1,921	98	5.4%
American Eagle	Washington National	DCA							1,276	1,339	63	4.9%
Continental Connection	Albany	ALB									-	-
Continental Connection	Boston	BOS	244	634							-	-
Continental Connection	Buffalo	BUF	4								-	-
Continental Connection	Hartford	BDL									-	-
Continental Connection	New York Newark	EWR			405						-	-
Continental Connection	Plattsburgh	PLB	213	367							-	-
Continental Connection	Plattsburgh International	PBG									-	-
Continental Connection	Poughkeepsie	POU	66								-	-
Continental Connection	Washington Dulles	IAD									-	-
Continental Connection	Westchester County	HPN									-	-
Continental Express	Cleveland	CLE	322	509	366						-	-
Continental Express	New York Newark	EWR	1,458	1,455	1,020						-	-
Continental Express	Westchester County	HPN									-	-
Delta Connection	Atlanta	ATL		62				61	273	273	-	0.0%
Delta Connection	Boston	BOS		1,002							-	-
Delta Connection	Cincinnati	CVG		1,060							-	-
Delta Connection	Detroit	DTW			1,227	1,309	1,282	1,223	1,201	1,004	-197	-16.4%
Delta Connection	New York J F Kennedy	JFK			1,336	1,338	221				-	-
Delta Connection	New York La Guardia	LGA	355				781	1,279	1,248	1,257	9	0.7%
Independence Air	Washington Dulles	IAD		1,903							-	-
Lufthansa German Airlines	Washington Dulles	IAD	31								-	-
Northwest Airlink	Detroit	DTW		1,159							-	-
Northwest Airlink	Minneapolis	MSP		61							-	-
Porter Airlines	Toronto Island Apt	YTZ				9	31	56	47	39	-8	-17.0%
Swissair	Boston	BOS	31								-	-
United Express	Chicago O'Hare	ORD		1,003	1,353	1,565	1,391	1,396	1,402	1,144	-258	-18.4%
United Express	Cleveland	CLE				348	331	409	73		-73	-100.0%
United Express	New York Newark	EWR				1,425	1,425	1,456	1,281	1,569	288	22.5%
United Express	Washington Dulles	IAD	1,477	1,456	1,130	1,112	1,000	910	892	738	-154	-17.3%
US Airways Express	Boston	BOS	2,404								-	-
US Airways Express	Charlotte	CLT									-	-
US Airways Express	New York La Guardia	LGA	2,074	2,175	1,680	1,487	650				-	-
US Airways Express	Philadelphia	PHL		1,980	1,903	1,956	1,873	1,803			-	-
US Airways Express	Pittsburgh	PIT									-	-
US Airways Express	Plattsburgh	PLB	2,427								-	-
US Airways Express	Poughkeepsie	POU	718								-	-
US Airways Express	Saranac Lake	SLK	44								-	-
US Airways Express	Washington National	DCA	988	990	1,043	1,043	1,072	1,347			-	-
US Airways Express	Wilkes-Barre Scranton	AVP	22								-	-
Subtotal			16,138	15,816	11,461	11,593	10,058	9,941	9,516	9,405	-111	-1.2%
Total			19,028	17,851	13,225	13,336	11,748	11,484	11,062	10,870	-192	-1.7%

Departing Seats

Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	2015	'14-'15 Change	'14-'15 Pct. Change
Jet Carriers												
AirTran	Baltimore	BWI									-	-
Allegiant Air	Orlando/Sanford	SFB							15,873	17,880	2,007	12.6%
American	Philadelphia	PHL							11,470			
Continental	New York Newark	EWR									-	-
Delta	Atlanta	ATL						21,394	13,708	13,708	-	0.0%
jetBlue	New York J F Kennedy	JFK	39,528	173,920	180,286	163,839	163,821	143,907	124,357	115,600	-8,757	-7.0%
jetBlue	Orlando	MCO			33,014	33,871	32,643				-	-
Northwest	Detroit	DTW		17,429							-	-
United	Chicago O'Hare	ORD	105,509	42,379						13,777	13,777	-
United	Portland (ME)	PWM									-	-
US Airways	Philadelphia	PHL	150,338	46,170				2,546			-	-
US Airways	Pittsburgh	PIT	103,568								-	-
US Airways	Washington National	DCA		558							-	-
Subtotal			398,943	280,456	213,300	197,710	196,464	167,847	165,408	160,965	-4,443	-2.7%
Regional/Commuter Carriers												
America West	New York Newark	EWR	7,889								-	-
American Eagle	Boston	BOS	102,111								-	-
American Eagle	Charlotte	CLT								9,516	9,516	-
American Eagle	Chicago O'Hare	ORD									-	-
American Eagle	Philadelphia	PHL							110,129	126,772	16,643	15.1%
American Eagle	Washington National	DCA							89,462	86,015	-3,448	-3.9%
Continental Connection	Albany	ALB									-	-
Continental Connection	Boston	BOS	4,628	12,054							-	-
Continental Connection	Buffalo	BUF	84								-	-
Continental Connection	Hartford	BDL									-	-
Continental Connection	New York Newark	EWR			30,002						-	-
Continental Connection	Plattsburgh	PLB	4,039	6,970							-	-
Continental Connection	Plattsburgh International	PBG									-	-
Continental Connection	Poughkeepsie	POU	1,262								-	-
Continental Connection	Washington Dulles	IAD									-	-
Continental Connection	Westchester County	HPN									-	-
Continental Express	Cleveland	CLE	16,064	25,351	18,286						-	-
Continental Express	New York Newark	EWR	70,203	72,707	51,000						-	-
Continental Express	Westchester County	HPN									-	-
Delta Connection	Atlanta	ATL		3,100				4,636	20,701	20,748	47	0.2%
Delta Connection	Boston	BOS		50,100							-	-
Delta Connection	Cincinnati	CVG		52,979							-	-
Delta Connection	Detroit	DTW			61,417	65,443	64,114	61,224	60,043	57,053	-2,990	-5.0%
Delta Connection	New York J F Kennedy	JFK			67,071	81,259	14,884				-	-
Delta Connection	New York La Guardia	LGA	11,351				50,144	83,899	82,592	76,339	-6,253	-7.6%
Independence Air	Washington Dulles	IAD		95,136							-	-
Lufthansa German Airlines	Washington Dulles	IAD	1,550								-	-
Northwest Airlink	Detroit	DTW		61,983							-	-
Northwest Airlink	Minneapolis	MSP		3,050							-	-
Porter Airlines	Toronto Island Apt	YTZ				620	2,150	3,910	3,308	2,886	-422	-12.8%
Swissair	Boston	BOS	1,023								-	-
United Express	Chicago O'Hare	ORD		59,930	84,431	88,435	81,204	84,669	85,350	63,845	-21,505	-25.2%
United Express	Cleveland	CLE				17,421	15,376	20,464	3,636		-3,636	-100.0%
United Express	New York Newark	EWR				94,675	80,261	85,373	82,670	96,340	13,670	16.5%
United Express	Washington Dulles	IAD	73,843	72,786	61,988	69,793	58,665	48,930	50,633	41,127	-9,506	-18.8%
US Airways Express	Boston	BOS	48,139								-	-
US Airways Express	Charlotte	CLT									-	-
US Airways Express	New York La Guardia	LGA	76,749	80,491	62,144	55,008	24,050				-	-
US Airways Express	Philadelphia	PHL		97,288	128,140	131,727	121,653	111,615			-	-
US Airways Express	Pittsburgh	PIT									-	-
US Airways Express	Plattsburgh	PLB	46,116								-	-
US Airways Express	Poughkeepsie	POU	13,639								-	-
US Airways Express	Saranac Lake	SLK	841								-	-
US Airways Express	Washington National	DCA	31,574	61,458	77,625	82,974	85,623	100,348			-	-
US Airways Express	Wilkes-Barre Scranton	AVP	415								-	-
Subtotal			511,521	755,382	642,104	687,357	598,123	605,069	588,524	580,640	-7,884	-1.3%
Total			910,464	1,035,838	855,404	885,067	794,588	772,916	753,932	741,605	-12,327	-1.6%

Source: OAG Schedules.

Notes:

Allegiant Air stopped reporting to the OAG in 2009, so Allegiant Air 2009-2015 statistics are from the T100 database.

All Northwest Airlines operations included in Delta Air Lines from 2009 onwards (following 2008 merger)

All Continental Airlines operations included in United Airlines from 2011 onwards (following 2010 merger)

All AirTran Airways operations included in Southwest Airlines from 2012 onwards (following 2011 merger)

All US Airways operations included in American Airlines from 2014 onwards (following 2013 merger)

Table F-8 Scheduled Passenger Operations by Market and Carrier for Bangor Airport

Departures

Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	2015	'14-'15 Change	'14-'15 Pct. Change
Jet Carriers												
Allegiant Air	Orlando/Sanford	SFB			181	150	156	165	153	180	27	17.6%
Allegiant Air	Punta Gorda	PGD							33	0	-33	-100.0%
Allegiant Air	St. Petersburg/Clearwater	PIE			107	93	112	115	119	134	15	12.6%
Delta	Detroit	DTW								175	175	-
Pan American Airways	Allentown/Bethlehem	ABE									-	-
Pan American Airways	Baltimore	BWI									-	-
Pan American Airways	Pittsburgh	PIT	285								-	-
Pan American Airways	Portsmouth	PSM	389								-	-
Pan American Airways	Sanford	SFB									-	-
Subtotal			674	0	288	243	268	280	305	489	184	60.3%
Regional/Commuter Carriers												
American Eagle	Boston	BOS	4,670	1,530							-	-
American Eagle	New York La Guardia	LGA	382	518							-	-
American Eagle	Philadelphia	PHL							1,496	1,452	-44	-2.9%
American Eagle	Washington National	DCA							791	771	-20	-2.5%
Boston-Maine Airways	Halifax	YHZ									-	-
Boston-Maine Airways	Manchester	MHT									-	-
Boston-Maine Airways	Portsmouth	PSM									-	-
Boston-Maine Airways	Saint John	YSJ									-	-
Continental Connection	Albany	ALB		189							-	-
Continental Express	New York Newark	EWR		481							-	-
Delta Connection	Atlanta	ATL									-	-
Delta Connection	Boston	BOS		1,416							-	-
Delta Connection	Cincinnati	CVG	1,342	1,394							-	-
Delta Connection	Detroit	DTW			975	871	703	706	711	279	-432	-60.8%
Delta Connection	New York J F Kennedy	JFK			180						-	-
Delta Connection	New York La Guardia	LGA			537	844	1,043	1,153	975	976	1	0.1%
Delta Connection	Minneapolis	MSP									-	-
Northwest Airlink	Boston	BOS	27								-	-
Northwest Airlink	Detroit	DTW		1,012							-	-
Northwest Airlink	Minneapolis	MSP		61							-	-
Pan American Airways	Portsmouth	PSM									-	-
Pan American Airways	Saint John	YSJ									-	-
United Express	Chicago O'Hare	ORD							245	215	-30	-12.2%
US Airways Express	Boston	BOS	1,942								-	-
US Airways Express	New York La Guardia	LGA	35	158	1,017	1,230	299				-	-
US Airways Express	Philadelphia	PHL	428	1,179	1,156	1,405	1,543	1,564			-	-
US Airways Express	Pittsburgh	PIT									-	-
US Airways Express	Portland (ME)	PWM	231								-	-
US Airways Express	Presque Isle	PQI	299								-	-
US Airways Express	Washington National	DCA			31	52	589	883			-	-
Subtotal			9,357	7,937	3,896	4,402	4,178	4,307	4,218	3,693	-525	-12.4%
Total			10,031	7,937	4,184	4,645	4,446	4,587	4,523	4,182	-341	-7.5%

Departing Seats

Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	2015	'14-'15 Change	'14-'15 Pct. Change
Jet Carriers												
Allegiant Air	Orlando/Sanford	SFB			27,150	22,500	23,912	27,335	26,536	31,156	4,620	17.4%
Allegiant Air	Punta Gorda	PGD							5,478	0	-5,478	-100.0%
Allegiant Air	St. Petersburg/Clearwater	PIE			16,050	13,950	16,944	19,090	20,501	23,531	3,030	14.8%
Delta	Detroit	DTW								19,334	19,334	-
Pan American Airways	Allentown/Bethlehem	ABE									-	-
Pan American Airways	Baltimore	BWI									-	-
Pan American Airways	Pittsburgh	PIT	42,729								-	-
Pan American Airways	Portsmouth	PSM	58,414								-	-
Pan American Airways	Sanford	SFB									-	-
Subtotal			101,143	0	43,200	36,450	40,856	46,425	52,515	74,021	21,506	41.0%
Regional/Commuter Carriers												
American Eagle	Boston	BOS	154,115	56,594							-	-
American Eagle	New York La Guardia	LGA	12,606	19,166							-	-
American Eagle	Philadelphia	PHL							94,849	91,163	-3,686	-3.9%
American Eagle	Washington National	DCA							41,033	40,260	-773	-1.9%
Boston-Maine Airways	Halifax	YHZ									-	-
Boston-Maine Airways	Manchester	MHT									-	-
Boston-Maine Airways	Portsmouth	PSM									-	-
Boston-Maine Airways	Saint John	YSJ									-	-
Continental Connection	Albany	ALB		3,583							-	-
Continental Express	New York Newark	EWR		22,698							-	-
Delta Connection	Atlanta	ATL									-	-
Delta Connection	Boston	BOS		70,800							-	-
Delta Connection	Cincinnati	CVG	67,100	82,439							-	-
Delta Connection	Detroit	DTW			50,540	54,640	46,260	46,371	47,269	19,614	-27,655	-58.5%
Delta Connection	New York J F Kennedy	JFK			9,000						-	-
Delta Connection	New York La Guardia	LGA			26,958	49,368	62,868	71,955	59,239	57,025	-2,214	-3.7%
Delta Connection	Minneapolis	MSP										
Northwest Airlink	Boston	BOS	797								-	-
Northwest Airlink	Detroit	DTW		55,222							-	-
Northwest Airlink	Minneapolis	MSP		3,050							-	-
Pan American Airways	Portsmouth	PSM									-	-
Pan American Airways	Saint John	YSJ									-	-
United Express	Chicago O'Hare	ORD							16,170	14,190	-1,980	-12.2%
US Airways Express	Boston	BOS	36,906								-	-
US Airways Express	New York La Guardia	LGA	1,295	7,914	44,051	53,371	14,950				-	-
US Airways Express	Philadelphia	PHL	15,836	58,943	68,510	89,548	99,457	101,167			-	-
US Airways Express	Pittsburgh	PIT									-	-
US Airways Express	Portland (ME)	PWM	8,558								-	-
US Airways Express	Presque Isle	PQI	6,224								-	-
US Airways Express	Washington National	DCA			1,529	2,607	29,464	47,981			-	-
Subtotal			303,436	380,408	200,587	249,535	253,000	267,474	258,560	222,252	-36,308	-14.0%
Total			404,579	380,408	243,787	285,985	293,856	313,899	311,075	296,273	-14,802	-4.8%

Source: OAG Schedules.

Notes:

Allegiant Air stopped reporting to the OAG in 2009, so Allegiant Air 2009-2015 statistics are from the T100 database.

All Northwest Airlines operations included in Delta Air Lines from 2009 onwards (following 2008 merger)

All Continental Airlines operations included in United Airlines from 2011 onwards (following 2010 merger)

All AirTran Airways operations included in Southwest Airlines from 2012 onwards (following 2011 merger)

All US Airways operations included in American Airlines from 2014 onwards (following 2013 merger)

Table F-9 Scheduled Passenger Operations by Market and Carrier for Tweed-New Haven Airport

Departures

Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	2015	'14-'15 Change	'14-'15 Pct. Change
Regional/Commuter Carriers												
American Eagle	Philadelphia	PHL							1,356	1,222	-134	-9.9%
Delta Connection	Cincinnati	CVG		1,025							-	-
Boston-Maine Airways	Baltimore	BWI									-	-
Boston-Maine Airways	Bedford	BED									-	-
Boston-Maine Airways	Elmira/Corning	ELM									-	-
Boston-Maine Airways	Portsmouth	PSM									-	-
US Airways Express	Philadelphia	PHL	1,773	1,904	1,608	1,535	1,381	1,399			-	-
US Airways Express	Washington National	DCA	937								-	-
											-	-
Total			2,710	2,929	1,608	1,535	1,381	1,399	1,356	1,222	-134	-9.9%

Departing Seats

Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	2015	'14-'15 Change	'14-'15 Pct. Change
Regional/Commuter Carriers												
American Eagle	Philadelphia	PHL							50,161	49,657	-504	-1.0%
Delta Connection	Cincinnati	CVG		51,236							-	-
Boston-Maine Airways	Baltimore	BWI									-	-
Boston-Maine Airways	Bedford	BED									-	-
Boston-Maine Airways	Elmira/Corning	ELM									-	-
Boston-Maine Airways	Portsmouth	PSM									-	-
US Airways Express	Philadelphia	PHL	65,612	76,208	59,491	56,806	52,972	51,768			-	-
US Airways Express	Washington National	DCA	34,658								-	-
Total			100,270	127,444	59,491	56,806	52,972	51,768	50,161	49,657	-504	-1.0%

Source: OAG Schedules.

Notes:

All Northwest Airlines operations included in Delta Air Lines from 2009 onwards (following 2008 merger)

All Continental Airlines operations included in United Airlines from 2011 onwards (following 2010 merger)

All AirTran Airways operations included in Southwest Airlines from 2012 onwards (following 2011 merger)

All US Airways operations included in American Airlines from 2014 onwards (following 2013 merger)

Table F-10 Scheduled Passenger Operations by Market and Carrier for Worcester Regional Airport

Carrier	Market	Code	Departures 2000	2005	2010	2011	2012	2013	2014	2015	'14-'15 Change	'14-'15 Pct. Change	Departing Seats 2000	2005	2010	2011	2012	2013	2014	2015	'14-'15 Change	'14-'15 Pct. Change
Jet Carriers																						
Allegiant Air	Sanford	SFB									-	-									-	-
Boston-Maine Airways	Allentown/Bethlehem	ABE									-	-									-	-
Boston-Maine Airways	Portsmouth	PSM									-	-									-	-
Boston-Maine Airways	Sanford	SFB									-	-									-	-
Direct Air	Myrtle Beach	MYR			73	96					-	-			9,782	14,120					-	-
Direct Air	Orlando/Sanford	SFB			144	148					-	-			21,937	24,339					-	-
Direct Air	Punta Gorda	PGD			94	105					-	-			14,541	17,287					-	-
Direct Air	West Palm Beach	PBI			13	51					-	-			1,872	7,444					-	-
jetBlue	Fort Lauderdale/Hollywood	FLL						61	365	365	-	0.0%						6,100	36,500	36,500	-	0.0%
jetBlue	Orlando	MCO						61	365	365	-	0.0%						6,100	36,500	36,500	-	0.0%
Subtotal			0	0	324	400	0	122	730	730	-	0.0%	0	0	48,132	63,190	0	12,200	73,000	73,000	-	0.0%
Regional/Commuter Carriers																						
American Eagle	Chicago O'Hare	ORD									-	-									-	-
American Eagle	New York J F Kennedy	JFK	552								-	-	18,216								-	-
Delta Connection	Atlanta	ATL	670								-	-	33,500								-	-
US Airways Express	Philadelphia	PHL	1,464								-	-	54,168								-	-
Subtotal			2,686	0	0	0	0	0	0	0	-	-	105,884	0	0	0	0	0	0		-	-
Total			2,686	0	324	400	0	122	730	730	-	0.0%	105,884	0	48,132	63,190	0	12,200	73,000	73,000	-	0.0%

Source: OAG Schedules.

Notes:

All Northwest Airlines operations included in Delta Air Lines from 2009 onwards (following 2008 merger)

All Continental Airlines operations included in United Airlines from 2011 onwards (following 2010 merger)

All AirTran Airways operations included in Southwest Airlines from 2012 onwards (following 2011 merger)

All US Airways operations included in American Airlines from 2014 onwards (following 2013 merger)

Table F-11 Scheduled Passenger Operations by Market and Carrier for Hanscom Field

			Departures										Departing Seats									
Carrier	**Market**	**Code**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**'13-'14 Change**	**'13-'14 Pct. Change**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**'14-'15 Change**	**'14-'15 Pct. Change**
Regional/Commuter Carriers																						
Boston-Maine Airways	Elmira/Corning	ELM									-	-									-	-
Boston-Maine Airways	Hyannis	HYA									-	-									-	-
Boston-Maine Airways	Manchester	MHT									-	-									-	-
Boston-Maine Airways	Martha's Vineyard	MVY									-	-									-	-
Boston-Maine Airways	Nantucket	ACK									-	-									-	-
Boston-Maine Airways	New Haven	HVN									-	-									-	-
Boston-Maine Airways	New London/Groton	GON		9							-	-		159							-	-
Boston-Maine Airways	Portsmouth	PSM		193							-	-		3,482							-	-
Boston-Maine Airways	Trenton	TTN		867							-	-		15,606							-	-
Pan American Airways	Atlantic City Pomona Field	ACY									-	-									-	-
Pan American Airways	Martha's Vineyard	MVY									-	-									-	-
Pan American Airways	New York Newark	EWR									-	-									-	-
Pan American Airways	Portsmouth	PSM									-	-									-	-
Pan American Airways	Westchester County	HPN									-	-									-	-
Shuttle America	Buffalo	BUF	1,119								-	-	55,950								-	-
Shuttle America	Hartford	BDL	173								-	-	8,636								-	-
Shuttle America	New York La Guardia	LGA	523								-	-	26,143								-	-
Shuttle America	Trenton	TTN	2,062								-	-	103,093								-	-
Streamline	Trenton	TTN				155					-	-				4,650					-	-
US Airways	Martha's Vineyard	MVY									-	-									-	-
US Airways	Nantucket	ACK									-	-									-	-
US Airways	New York La Guardia	LGA									-	-									-	-
US Airways	Philadelphia	PHL									-	-									-	-
US Airways	Trenton	TTN									-	-									-	-
US Airways	Westchester County	HPN									-	-									-	-
Total			3,876	1,069	0	155	0	0	0	0	-	-	193,821	19,247	0	4,650	0	0	0	0	-	-

Source: OAG Schedules.

Notes:

All Northwest Airlines operations included in Delta Air Lines from 2009 onwards (following 2008 merger)

All Continental Airlines operations included in United Airlines from 2011 onwards (following 2010 merger)

All AirTran Airways operations included in Southwest Airlines from 2012 onwards (following 2011 merger)

All US Airways operations included in American Airlines from 2014 onwards (following 2013 merger)

Table F-12 Scheduled Passenger Operations by Market and Carrier for Portsmouth International Airport

			Departures										Departing Seats									
Carrier	**Market**	**Code**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**'14-'15 Change**	**'14-'15 Pct. Change**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**'14-'15 Change**	**'14-'15 Pct. Change**
Jet Carriers																						
Allegiant Airways	Orlando/Sanford	SFB		35				16	83	95	12	14.5%		5,229				2,656	14,242	16,111	1,869	13.1%
Allegiant Airways	Punta Gorda	PGD							22	35	13	59.1%							3,652	5,909	2,257	61.8%
Allegiant Airways	Fort Lauderdale/Hollywood	FLL								27	27	-								4,779	4,779	-
Boston-Maine Airways	Fort Lauderdale/Hollywood	FLL		13							-	-		1,993							-	-
Boston-Maine Airways	Hartford	BDL		13							-	-		1,993							-	-
Boston-Maine Airways	Newburgh	SWF		48							-	-		7,179							-	-
Boston-Maine Airways	Sanford	SFB		57							-	-		8,593							-	-
Pan American Airways	Allentown/Bethlehem	ABE	93								-	-	13,950								-	-
Pan American Airways	Bangor	BGR	389								-	-	58,414								-	-
Pan American Airways	Gary	GYY	51								-	-	7,714								-	-
Pan American Airways	Manchester	MHT									-	-									-	-
Pan American Airways	New York Newark	EWR									-	-									-	-
Pan American Airways	Pittsburgh	PIT	261								-	-	39,171								-	-
Pan American Airways	Sanford	SFB	296								-	-	44,400								-	-
Pan American Airways	Santo Domingo	SDQ									-	-									-	-
Pan American Airways	St. Petersburg/Clearwater	PIE									-	-									-	-
Pan American Airways	Worcester	ORH									-	-									-	-
Skybus	Columbus	CMH									-	-									-	-
Skybus	Greensboro	GSO									-	-									-	-
Skybus	Punta Gorda	PGD									-	-									-	-
Skybus	Saint Augustine	UST									-	-									-	-
Subtotal			1,091	167	0	0	0	16	105	157	52	49.5%	163,650	24,986	0	0	0	2,656	17,894	26,799	8,905	49.8%
Regional/Commuter Carriers																						
Boston-Maine Airways	Baltimore	BWI									-	-									-	-
Boston-Maine Airways	Bangor	BGR									-	-									-	-
Boston-Maine Airways	Bedford	BED		171							-	-		3,083							-	-
Boston-Maine Airways	Hyannis	HYA									-	-									-	-
Boston-Maine Airways	Manchester	MHT									-	-									-	-
Boston-Maine Airways	Martha's Vineyard	MVY									-	-									-	-
Boston-Maine Airways	Nantucket	ACK									-	-									-	-
Boston-Maine Airways	New Haven	HVN									-	-									-	-
Boston-Maine Airways	New London/Groton	GON									-	-									-	-
Boston-Maine Airways	Saint John	YSJ									-	-									-	-
Boston-Maine Airways	Trenton	TTN		22							-	-		399							-	-
Boston-Maine Airways	Westchester County	HPN									-	-									-	-
Pan American Airways	Atlantic City Pomona Field	ACY									-	-									-	-
Pan American Airways	Baltimore	BWI									-	-									-	-
Pan American Airways	Bangor	BGR									-	-									-	-
Pan American Airways	Bedford	BED									-	-									-	-
Pan American Airways	Martha's Vineyard	MVY									-	-									-	-
Pan American Airways	Saint John	YSJ									-	-									-	-
Subtotal			0	193	0	0	0	0	0	0	-	-	0	3,482	0	0	0	0	0	0	-	-
Total			1,091	360	0	0	0	16	105	157	52	49.5%	163,650	28,467	0	0	0	2,656	17,894	26,799	8,905	49.8%

Source: OAG Schedules.

Notes:

Allegiant Air stopped reporting to the OAG in 2009, so Allegiant Air 2009-2015 statistics are from the T100 database.

All Northwest Airlines operations included in Delta Air Lines from 2009 onwards (following 2008 merger)

All Continental Airlines operations included in United Airlines from 2011 onwards (following 2010 merger)

All AirTran Airways operations included in Southwest Airlines from 2012 onwards (following 2011 merger)

All US Airways operations included in American Airlines from 2014 onwards (following 2013 merger)

G

Ground Access

This appendix provides information in support of Chapter 5, *Ground Access to and from Logan Airport*:

- Table G-1A Logan Express Bus Service Ridership (Annual)
- Table G-1B Logan Express Back Bay Service Ridership (Annual)
- Table G-2 Water Transportation Services Ridership (Annual)
- Table G-3 Massachusetts Bay Transportation Authority (MBTA) Airport Station Passengers
- Table G-4 Annual Taxi Dispatches (Tickets Sold)
- Table G-5 Logan Airport Employee Parking Supply
- Table G-6 Logan Airport Commercial Parking Supply
- Table G-7 2015 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment, and Vehicle Miles Traveled (VMT) Summary
- VISSIM Traffic Roadway Network
- March 2015 Logan Airport Parking Space Inventory, submitted to Massachusetts Department of Environmental Protection (also known as the *Parking Freeze Report*)
- September 2015 Logan Airport Parking Space Inventory, submitted to Massachusetts Department of Environmental Protection (also known as the *Parking Freeze Report*)

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Table G-1A Logan Express Bus Service Ridership

	Ridership			Percent Change		
Service Year	**Air Passengers**	**Employees**	**Total**	**Air Passengers**	**Employees**	**Total**
Framingham						
1992	207,847	7,573	215,420	4.3%	21.3%	4.8%
1993	229,064	12,307	241,371	10.2%	62.5%	12.0%
1994	250,342	17,352	267,694	9.3%	41.0%	10.9%
1995	274,754	21,129	295,883	9.8%	21.8%	10.5%
1996	325,665	22,932	348,597	18.5%	8.5%	17.8%
1997	316,306	29,871	346,175	(2.9)%	30.3%	(0.7)%
1998	337,007	33,971	370,978	6.5%	13.7%	7.2%
1999	345,715	31,946	380,661	3.5%	(6.0)%	2.6%
2000	371,560	34,508	406,068	6.6%	8.0%	6.7%
2001	354,521	38,740	393,261	(4.6)%	12.3%	(3.2)%
2002	342,746	42,441	385,187	(3.3)%	8.7%	(2.1)%
2003	310,024	55,979	366,003	(9.5)%	31.9%	(5.0)%
2004	323,931	54,763	378,694	4.5%	(2.2%)	3.5%
2005	318,125	57,569	375,694	(1.8%)	5.1%	(0.8%)
2006	349,022	60,764	409,789	9.7%	5.5%	9.1%
2007	311,299	57,252	368,551	(2.1%)[5]	(0.6%)[5]	(1.9%)[5]
2008	276,112	57,797	333,909	(11.3%)	1.0%	(9.4%)
2009	264,233	59,840	324,073	(4.3%)	3.5%	(2.9%)
2010	272,190	62,226	334,416	3.0%	4.0%	3.2%
2011[1]	272,301	68,228	340,529	0.0%	9.6%	1.8%
2012	279,603	82,951	362,554	2.7%	21.6%	6.5%
2013	295,654	84,008	379,662	5.7%	1.3%	4.7%
2014	303,646	87,488	391,134	2.7%	4.1%	3.0%
2015	**345,680**	**82,943**	**428,623**	**13.8%**	**(5.2%)**	**9.6%**

Table G-1A	Logan Express Bus Service Ridership (Continued)					
	Ridership			Percent Change		
Service Year	**Air Passengers**	**Employees**	**Total**	**Air Passengers**	**Employees**	**Total**
Braintree						
1992	186,217	9,694	195,911	10.6%	16.6%	10.8%
1993	205,209	22,768	227,977	10.2%	134.9%	16.4%
1994	247,636	37,489	285,125	20.7%	64.7%	25.1%
1995	264,579	70,723	335,302	6.8%	88.7%	17.6%
1996	335,232	103,519	438,751	26.7%	46.4%	30.1%
1997	300,006	135,340	435,346	(10.5)%	30.7%	(0.8)%
1998	300,005	156,105	456,110	0.0%	15.3%	4.8%
1999	328,818	125,286	454,105	9.6%	(19.7)%	(0.5)%
2000	355,932	149,687	505,619	8.2%	19.5%	11.3%
2001	345,249	156,240	501,489	(3.0)%	4.4%	(0.8)%
2002	323,115	190,360	513,475	(6.4)%	21.8%	2.4%
2003	301,013	216,765	517,778	(6.8)%	13.9%	0.8%
2004	318,100	208,566	526,666	5.7%	(3.8%)	1.7%
2005	307,659	189,531	497,190	(3.2%)	(9.1%)	(5.5%)
2006	333,413	202,983	536,396	8.4%	7.1%	7.9%
2007	300,715	196,955	497,670	(2.3%)5	3.9%[5]	0.1%[5]
2008	252,289	221,591	473,880	(16.1%)	12.5%	(4.8%)
2009	231,151	234,908	466,059	(8.4%)	6.0%	(1.7%)
2010	231,422	251,443	482,865	0.1%	7.0%	3.6%
2011[1]	233,521	285,515	519,036	0.9%	13.6%	7.5%
2012	247,346	314,542	561,888	5.9%	10.2%	8.3%
2013	268,154	320,329	588,483	8.4%	1.8%	4.7%
2014	296,975	313,334	610,309	10.7%	(2.2%)	3.7%
2015	**313,576**	**311,695**	**625,271**	**5.6%**	**(0.5%)**	**2.5%**

Table G-1A	Logan Express Bus Service Ridership (Continued)					
	Ridership			**Percent Change**		
Service Year	**Air Passengers**	**Employees**	**Total**	**Air Passengers**	**Employees**	**Total**
Woburn[2]						
1992[3]	3,052	91	3,143	NA	NA	-
1993	59,635	5,027	64,662	NA	NA	-
1994	119,567	9,082	128,649	100.5%	80.7%	99.0%
1995	150,147	13,376	163,523	25.6%	47.3%	27.1%
1996	190,566	17,322	207,888	26.9%	29.5%	27.1%
1997	199,715	20,018	219,733	4.8%	15.6%	5.7%
1998	208,286	22,876	231,162	4.3%	14.3%	5.2%
1999	191,454	23,495	214,949	(8.1)%	2.7%	(7.0)%
2000	195,744	27,522	223,266	2.2%	17.1%	3.9%
2001	177,375	38,318	215,530	(9.4)%	39.2%	(3.4)%
2002	161,145	73,277	234,422	(9.2)%	91.0%	8.7%
2003	164,980	103,963	268,943	(2.4)%	41.9%	14.7%
2004	172,110	111,326	283,436	4.3%	7.1%	5.4%
2005	163,227	110,961	274,188	(5.1%)	(0.3%)	(3.2%)
2006	167,341	121,672	289,013	2.5%	9.7%	5.4%
2007	149,149	123,066	272,215	(8.6%)[5]	10.9%[5]	(0.7%)[5]
2008	129,385	122,777	252,162	(13.3%)	(0.2%)	(7.4%)
2009	113,607	121,633	235,240	(12.2%)	(0.9%)	(6.7%)
2010	115,257	127,120	242,377	1.5%	4.5%	3.0%
2011[1]	118,232	151,029	269,261	2.6%	18.8%	11.1%
2012	126,549	188,747	315,296	7.0%	25.0%	17.1%
2013	140,407	192,289	332,696	11.0%	1.9%	5.5%
2014	156,045	194,341	350,386	11.1%	1.1%	5.3%
2015	**163,469**	**191,242**	**354,711**	**4.8%**	**(1.6%)**	**1.2%**
Peabody						
2001[4]	8,151	3,097	11,248	NA	NA	NA
2002	28,626	20,629	49,255	NA	NA	NA
2003	32,318	23,425	55,743	21.4%	13.6%	13.2%
2004	43,389	33,642	77,031	34.3%	43.6%	38.2%
2005	51,023	39,599	87,622	17.6%	17.7%	13.7%
2006	42,142	32,632	74,774	(17.4%)	(17.6%)	(14.7%)
2007	36,367	26,949	63,316	(28.7%)[5]	(31.9%)[5]	(27.7%)[5]
2008	30,887	30,596	61,483	(15.1%)	13.5%	(2.9%)
2009	27,856	32,220	60,076	(9.8%)	5.3%	(2.3%)
2010	25,543	26,231	51,744	(8.3%)	(18.6%)	(13.8%)
2011[1]	25,555	31,741	57,296	0.0%	21.0%	10.7%
2012	27,542	37,909	65,451	7.8%	19.4%	14.2%
2013	28,790	38,067	66,857	4.5%	0.4%	2.1%
2014	31,485	36,848	68,333	9.4%	(3.2%)	2.2%
2015	**37,478**	**36,125**	**73,603**	**19.0%**	**(2.0%)**	**7.7%**

Table G-1A Logan Express Bus Service Ridership (Continued)						
		Ridership			**Percent Change**	
Service Year	**Air Passengers**	**Employees**	**Total**	**Air Passengers**	**Employees**	**Total**
Total System Ridership						
1992	397,116	17,358	414,474	8.0%	19.2%	8.5%
1993	493,908	39,832	533,740	24.4%	129.5%	28.8%
1994	617,545	63,923	681,468	25.0%	60.5%	27.7%
1995	689,480	105,228	794,708	11.6%	64.6%	16.6%
1996	851,463	143,773	995,236	23.4%	36.6%	25.2%
1997	816,015	185,229	1,001,254	(4.2)%	28.8%	0.6%
1998	845,598	212,952	1,058,550	3.6%	15.0%	5.7%
1999	868,987	180,727	1,049,714	2.7%	(15.2)%	(0.8)%
2000	923,236	211,717	1,134,953	6.2%	17.1%	8.1%
2001	885,296	236,395	1,121,691	(4.1)%	11.7%	(1.2)%
2002	855,632	326,707	1,182,339	(3.4)%	38.2%	5.4%
2003	808,335	400,132	1,208,467	(5.5%)	22.5%	2.2%
2004	857,530	408,297	1,265,827	6.1%	2.0%	2.2%
2005	837,034	397,660	1,234,694	(2.4%)	(2.6%)	(2.4%)
2006	891,918	418,051	1,309,969	6.6%	5.1%	6.1%
2007	797,530	404,222	1,201,752	(4.7%)[5]	1.7%[5]	(2.7%)[5]
2008	688,673	432,761	1,121,434	(13.6%)	7.1%	(6.7%)
2009	636,847	448,601	1,085,448	(7.5%)	3.7%	(3.2%)
2010	644,412	467,020	1,111,432	1.2%	4.1%	2.4%
2011[1]	649,609	536,513	1,186,122	0.8%	14.9%	6.7%
2012	681,040	624,149	1,305,189	4.8%	16.3%	10.0%
2013	733,005	634,693	1,367,698	8.0%	2.0%	5.0%
2014	788,151	632,011	1,420,162	7.5%	(0.4%)	3.8%
2015	**860,203**	**622,005**	**1,482,208**	**9.1%**	**-1.6%**	**4.4%**

Notes: Jan. 23, 2008: I-90/Ted Williams Tunnel opens to all traffic. The last toll increase for Ted Williams Tunnel was Jan. 1, 2008.
NA Not applicable.
1 Changes to employee parking and bus fares were implemented in October 2011.
2 Woburn Express moved from Mishawum Station to the Anderson Regional Transportation Center (ARTC) in Woburn in May 2001.
3 Reflects a partial year of operation. Woburn Logan Express service was implemented in November 1992.
4 Reflects a partial year of operation. The Peabody Logan Express service commenced in September 2001.
5 Percent comparison between 2007 and 2005. The I-90 Ted Williams Tunnel closures in 2006 resulted in atypical ridership.

Table G-1B Logan Express Back Bay Service Ridership[1]		
	Ridership	**Percent Change**
Service Year		
2014	152,892	NA
2015	**290,796**	**NA**

1 Back Bay Logan Express service commenced in April 2014. Only total ridership available.

Table G-2 Water Transportation Services Ridership to and from Logan Airport

	Rowes Wharf/Fan Pier Water Shuttle	**Private Water Taxi (on-demand)[1]**	**Harbor Express (Long Wharf/Quincy/Hull)[2]**	**Boston-Logan Water Shuttle (Long Wharf)**	**Total**
1990	181,530	NS	NS	NS	181,530
1991	142,500	NS	NS	NS	142,500
1992	133,297	NS	NS	NS	133,297
1993	159,525	NS	NS	NS	159,525
1994	209,057	NS	NS	NS	209,057
1995	203,829	NS	NS	NS	203,829
1996	159,992	3,364	11,781	NS	175,137
1997	132,542	6,299	71,309	NS	210,150
1998	124,836	9,243	101,174	NS	235,253
1999	122,211	17,252	98,539	NS	238,002
2000	128,097	26,335	83,243	NS	237,675
2001	107,400	29,642	82,704	NS	219,746
2002	75,304	36,736	66,471	NS	178,511
2003	26,480[3]	35,724[4]	61,849	5,722[5]	129,775
2004	NS	54,540	58,788	3,202[6]	116,530
2005	NS	44,975	51,960	NS	96,935
2006	NS	63,639	70,998	NS	134,637
2007	NS	50,737	59,460	NS	110,197
2008	NS	48,630	48,003	NS	96,633
2009	NS	50,734	37,861	NS	88,595
2010	NS	54,382	34,794	NS	89,176
2011	NS	58,879	33,403	NS	92,282
2012	NS	60,840	30,337	NS	91,177
2013	NS	70,378	21,925	NS	92,303
2014	NS	67,479	19,340	NS	86,819
2015	**NS**	**70,798**	**7,748**	**NS**	**78,546**

Note: Figures from 2003 – 2007 have been revised from previous documents.
NS Operation not in service.
1 Operates April-October only.
2 Service to Quincy was discontinued in 2013 and now operates between Long Wharft/Hingham/Hull.
3 Rowes Wharf Water Shuttle operated from January to June only in 2003.
4 Operated from May to October only in 2003.
5 Long Wharf Boston-Logan Water Shuttle operated from August to December in 2003.
6 Joint operation with City Water Taxi began on August 16, 2003.

Table G-3 Massachusetts Bay Transportation Authority (MBTA) Airport Station Passengers

Year	Entrances	Exits	Total Turnstile Count[1]	Percent Change
1990	NA	NA	2,854,317	-
1991	NA	NA	2,515,293	(11.9)%
1992	NA	NA	2,626,572	4.2%
1993	NA	NA	2,604,980	(0.8)%
1994	NA	NA	3,108,734	19.3%
1995	NA	NA	3,040,868	(2.2)%
1996	NA	NA	2,974,850	(2.2)%
1997[2]	NA	NA	2,774,268	(6.7)%
1998	NA	NA	2,850,367	2.7%
1999	NA	NA	2,974,045	4.3%
2000	NA	NA	3,019,086	1.5%
2001	NA	NA	2,896,638	(4.1)%
2002	NA	NA	2,670,594	(7.8)%
2003[3]	1,300,272	1,275,627	2,575,899	(3.6)%
2004	1,373,861	1,366,511	2,740,372	6.4%
2005	NA	NA	NA	NA
2006	NA	NA	NA	NA
2007[4]	1,412,055	--	2,524,079	--
2008[5]	2,212,111	--	3,647,394	56.7%
2009[5]	2,329,370	--	3,750,549	5.3%
2010[5]	2,270,241	--	3,629,193	(2.5%)
2011	2,277,311	NA	NA	0.3%
2012	2,442,085	NA	NA	7.2%
2013	2,597,306	NA	NA	6.3%
2014	2,378,965	NA	NA	(8.4%)[6]
2015	**2,122,597**	**NA**	NA	**(10.8%)[6]**

Source: MBTA.

Note: Turnstile counts include both Logan Airport bound (turnstile exits) and non-Logan Airport bound (turnstile entrances) passengers.

NA Data not available

1 As stated in the *Logan Airport 1999 ESPR*, Massport believes that ridership estimates through 2005 from the old Airport Station were actually understated because many travelers that were destined for the Airport with baggage had been observed to avoid the turnstiles and exit the old Airport Station via the wide gate (designed for handicapped access) that did not have the capability to count passengers.

2 Airport Station was closed on six weekends during September and October 1997 due to construction.

3 Airport Station was closed on eight weekend days during 2003.

4 Automated fare collection and new fare gates implemented beginning January 2007. Station access to Bremen Street Park opened June 2007. Exits are undercounted.

5 Exits are undercounted, as some exits occur through exit doors rather than turnstiles.

6 Due to the closure of Government Center Station in 2014, it is possible that passengers who would normally take the Blue Line to the Green Line have switched to alternate modes for their trips.

Table G-4 Annual Taxi Dispatches (Tickets Sold)

Year	Total (yearly tickets sold)	Percent Change
1990	1,330,418	
1991	1,208,611	(9.2)%
1992	1,266,033	4.8%
1993	1,336,603	5.6%
1994	1,409,505	5.5%
1995	1,499,869	6.4%
1996	1,721,093	14.7%
1997	1,827,244	6.2%
1998	1,888,281	3.3%
1999	1,955,895	3.6%
2000	2,140,724	9.4%
2001	1,789,736	(16.4)%
2002	1,679,508	(6.2)%
2003	1,562,076	(7.0)%
2004	1,713,696	9.7%
2005	1,769,876	3.3%
2006	1,857,609	5.0%
2007	1,925,817	3.7%
2008	1,749,730	(9.1)%
2009	1,630,333	(6.8)%
2010	1,829,961	12.1%
2011	1,937,743	6.0%
2012	2,022,239	4.4%
2013	2,131,371	5.0%
2014	2,237,793	5.0%
2015	**2,302,059**	**2.9%**

Table G-5 Logan Airport Employee Parking Supply

	Number of Spaces			
Location	**March 2014**	**September 2014**	**March 2015**	**September 2015**
Terminal Area	857	868	**868**	**865**
North Service Area	883	883	**881**	**876**
Southwest Service Area	4	4	**14**	**16**
South Service Area	681	681	**674**	**665**
Airside (Fire/Rescue)	0	0	**0**	**0**
Total spaces in service	2,425	2,436	**2,437**	**2,422**
Total spaces out of service	248	237	**236**	**251**
Total employee spaces	2,673	2,673	**2,673**	**2,673**

Source: Logan Airport Parking Space Inventory submitted to Massachusetts Department of Environmental Protection (MassDEP), March and September 2014 and 2015.
Note: As of June 2013, the Logan Airport Parking Freeze sets a limit of 18,415 commercial spaces and 2,673 employee spaces at the Airport.

Table G-6 Logan Airport Commercial Parking Supply

	Number of Spaces			
Location	**March 2014**	**September 2014**	**March 2015**	**September 2015**
Terminal Area				
Central Garage and West Garage	10,267	10,267	**10,267**	**10,340**
Terminal B Garage	2,254	2,254	**2,254**	**2,201**
Terminal E Lot 1	275	275	**243**	**237**
Terminal E Lot 2	248	248	**248**	**249**
Terminal E Lot 3 (Gulf Lot)	219	219	**219**	**217**
Signature (General Aviation)	35	35	**35**	**35**
Logan Airport Hilton	235	235	**35**	**35**
North Service Area				
Economy Garage	2,809	2,809	**2,809**	**2,864**
Overflow Green Lot (Wood Island)	0	0	**235**	**242**
South Service Area				
Harborside Hyatt Conference Center and Hotel	270	270	**270**	**270**
Overflow Blue Lot (Harborside Dr.)	0	0	**315**	**339**
Southwest Service Area				
Overflow Red Lot (Tomahawk Dr.)	0	0	**282**	**282**
Total spaces in service	16,612	16,612	**17,212**	**17,311**
Total spaces out of service	1,803	1,803	**1,203**	**1,104**
Total commercial spaces	18,415	18,415	**18,415**	**18,415**

Source: Logan Airport Parking Space Inventory submitted to MassDEP, March and September 2014 and 2015.
Note: Logan Airport Parking Freeze sets a limit of 21,088 spaces on Airport. As of June 2013, the allocation is 18,415 commercial and 2,673 employee spaces.

Table G-7 2015 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary

Link Name	Link Distance (ft)	Link Speed (mph)	VOLUME				VMT			
			AM Peak	PM Peak	High 8-Hour	AWDT	AM Peak	PM Peak	High 8-Hour	AWDT
1	344	23	994	1235	8812	19556	64.77	80.48	574.21	1274.31
2	496	26	532	661	4716	10467	49.97	62.09	442.99	983.20
3	1347	20	488	606	4324	9596	124.50	154.61	1103.16	2448.18
4	1166	27	1001	1243	8869	19683	221.04	274.48	1958.44	4346.36
5	378	24	1488	1849	13193	29278	106.60	132.46	945.12	2097.41
6	441	29	473	588	4195	9311	39.52	49.13	350.48	777.91
7	896	23	1013	1258	8976	19920	171.98	213.57	1523.89	3381.88
8	644	27	957	1189	8484	18828	116.81	145.13	1035.57	2298.16
9	1214	23	361	448	3197	7094	82.98	102.98	734.90	1630.72
10	1303	23	671	833	5944	13190	165.63	205.62	1467.22	3255.82
11	421	19	579	719	5130	11385	46.17	57.34	409.09	907.89
12	236	26	44	55	392	871	1.96	2.46	17.50	38.88
13	1311	26	68	85	606	1346	16.88	21.10	150.43	334.11
14	750	23	1526	1896	13528	30023	216.77	269.32	1921.63	4264.73
15	441	24	1296	1610	11488	25494	108.21	134.43	959.22	2128.69
16	1724	22	24	30	214	475	7.84	9.80	69.87	155.10
17	644	18	623	774	5523	12256	75.93	94.34	673.16	1493.79
18	354	25	603	749	5344	11860	40.44	50.23	358.37	795.34
19	687	17	71	88	628	1393	9.23	11.44	81.65	181.12
20	94	14	506	629	4488	9960	9.02	11.22	80.03	177.61
21	877	6	30	37	264	586	4.99	6.15	43.87	97.37
22	79	28	29	36	257	570	0.43	0.54	3.83	8.49
23	81	28	24	30	214	475	0.37	0.46	3.26	7.24
24	79	5	25	31	221	491	0.38	0.47	3.33	7.39
25	87	9	32	40	285	633	0.53	0.66	4.68	10.40
26	209	5	32	40	285	633	1.27	1.59	11.30	25.11
27	187	13	25	31	221	491	0.89	1.10	7.83	17.39
28	124	5	57	71	507	1124	1.34	1.67	11.94	26.47
29	226	28	361	448	3197	7094	15.45	19.18	136.85	303.67
30	1070	5	438	544	3882	8614	88.72	110.19	786.35	1744.88
31	385	31	292	363	2590	5748	21.27	26.45	188.69	418.76
32	516	25	68	85	606	1346	6.65	8.31	59.23	131.56
34	181	21	326	405	2890	6413	11.15	13.86	98.88	219.43
35	248	25	394	490	3496	7759	18.49	23.00	164.10	364.20
36	89	20	333	414	2954	6556	5.61	6.97	49.73	110.37
37	102	25	61	76	542	1203	1.18	1.47	10.52	23.35
38	110	32	105	131	935	2074	2.19	2.73	19.46	43.18
39	219	31	25	31	221	491	1.04	1.28	9.16	20.35
40	232	11	33	41	293	649	1.45	1.80	12.87	28.51
41	177	27	6	8	57	127	0.20	0.27	1.91	4.26
42	205	30	9	11	78	174	0.35	0.43	3.02	6.74
43	597	25	27	34	243	538	3.06	3.85	27.50	60.88
44	587	32	66	82	585	1298	7.34	9.12	65.03	144.29
45	96	32	59	73	521	1156	1.07	1.33	9.48	21.03
46	112	14	5	6	43	95	0.11	0.13	0.92	2.02
47	859	28	12	15	107	238	1.95	2.44	17.40	38.70
48	94	16	261	324	2312	5130	4.63	5.75	41.02	91.01
49	420	8	273	339	2419	5368	21.74	26.99	192.63	427.46
50	353	33	25	31	221	491	1.67	2.07	14.76	32.79
51	717	8	296	368	2626	5827	40.18	49.96	356.50	791.06
52	403	29	225	280	1998	4434	17.18	21.38	152.55	338.53
53	321	26	5	6	43	95	0.30	0.36	2.61	5.77
54	612	10	230	286	2041	4529	26.65	33.14	236.51	524.82

Table G-7 2015 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

Link Name	Link Distance (ft)	Link Speed (mph)	VOLUME				VMT			
			AM Peak	PM Peak	High 8-Hour	AWDT	AM Peak	PM Peak	High 8-Hour	AWDT
55	194	8	472	586	4181	9279	17.31	21.50	153.38	340.39
56	101	5	0	0	0	0	0.00	0.00	0.00	0.00
57	97	27	119	148	1056	2344	2.19	2.73	19.46	43.21
58	103	5	0	0	0	0	0.00	0.00	0.00	0.00
59	105	5	0	0	0	0	0.00	0.00	0.00	0.00
60	331	8	599	744	5309	11781	37.49	46.57	332.32	737.43
61	224	5	188	234	1670	3705	7.96	9.91	70.69	156.83
62	218	23	289	359	2562	5685	11.96	14.85	106.01	235.24
63	242	5	0	0	0	0	0.00	0.00	0.00	0.00
64	232	5	43	54	385	855	1.89	2.38	16.95	37.64
65	593	8	701	871	6215	13792	78.77	97.87	698.37	1549.78
66	465	25	17	21	150	333	1.50	1.85	13.20	29.30
67	483	21	10	12	86	190	0.92	1.10	7.87	17.40
68	487	27	0	0	0	0	0.00	0.00	0.00	0.00
69	361	15	30	37	264	586	2.05	2.53	18.05	40.05
90	582	5	398	495	3532	7838	43.88	54.57	389.40	864.12
103	85	33	14	17	121	269	0.22	0.27	1.94	4.32
104	85	5	0	0	0	0	0.00	0.00	0.00	0.00
105	95	5	0	0	0	0	0.00	0.00	0.00	0.00
106	95	5	0	0	0	0	0.00	0.00	0.00	0.00
107	260	15	127	158	1127	2502	6.26	7.79	55.55	123.33
108	389	11	83	103	735	1631	6.11	7.59	54.14	120.13
109	114	14	29	36	257	570	0.63	0.78	5.55	12.31
110	169	16	29	36	257	570	0.93	1.15	8.21	18.21
111	261	5	0	0	0	0	0.00	0.00	0.00	0.00
112	237	28	17	21	150	333	0.76	0.94	6.74	14.97
113	565	19	29	36	257	570	3.11	3.86	27.52	61.04
114	609	5	20	25	178	396	2.31	2.88	20.52	45.66
115	451	20	262	326	2326	5162	22.38	27.85	198.68	440.92
116	399	5	30	37	264	586	2.27	2.80	19.95	44.28
117	283	5	44	55	392	871	2.36	2.95	21.02	46.71
118	295	20	275	341	2433	5400	15.36	19.04	135.86	301.54
119	240	21	202	251	1791	3975	9.18	11.41	81.43	180.72
120	365	26	60	75	535	1188	4.15	5.19	37.00	82.16
121	356	24	86	107	763	1694	5.80	7.22	51.47	114.27
122	486	23	81	100	714	1583	7.45	9.20	65.70	145.67
123	486	32	99	123	878	1948	9.10	11.31	80.74	179.15
124	280	26	50	62	442	982	2.65	3.29	23.42	52.04
125	280	19	70	87	621	1378	3.71	4.61	32.91	73.03
126	631	15	128	159	1134	2518	15.30	19.00	135.54	300.97
127	652	11	83	103	735	1631	10.25	12.72	90.78	201.44
128	257	28	29	36	257	570	1.41	1.75	12.50	27.73
129	257	17	30	37	264	586	1.46	1.80	12.84	28.51
130	422	27	0	0	0	0	0.00	0.00	0.00	0.00
131	493	18	5	6	43	95	0.47	0.56	4.01	8.86
132	361	22	146	181	1291	2866	9.98	12.37	88.24	195.90
133	236	24	74	92	656	1457	3.31	4.11	29.31	65.10
134	1521	27	200	249	1777	3943	57.60	71.71	511.75	1135.53
135	1542	24	69	86	614	1362	20.16	25.12	179.35	397.85
136	384	26	14	18	128	285	1.02	1.31	9.31	20.73
137	354	16	10	12	86	190	0.67	0.80	5.77	12.75

Table G-7 2015 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

Link Name	Link Distance (ft)	Link Speed (mph)	VOLUME				VMT			
			AM Peak	PM Peak	High 8-Hour	AWDT	AM Peak	PM Peak	High 8-Hour	AWDT
138	225	22	39	49	350	776	1.66	2.08	14.88	33.00
139	96	15	39	49	350	776	0.71	0.89	6.38	14.14
140	295	24	70	87	621	1378	3.91	4.86	34.69	76.97
142	257	16	158	196	1398	3104	7.68	9.53	67.95	150.86
144	518	8	171	212	1513	3357	16.76	20.78	148.30	329.05
145	195	18	60	74	528	1172	2.22	2.74	19.54	43.37
146	463	18	56	70	499	1108	4.91	6.14	43.74	97.12
147	230	18	213	264	1884	4180	9.29	11.51	82.17	182.30
148	794	18	42	52	371	823	6.31	7.82	55.76	123.70
149	661	19	88	109	778	1726	11.02	13.65	97.39	216.07
150	281	19	89	110	785	1742	4.74	5.85	41.78	92.72
151	360	19	40	50	357	792	2.73	3.41	24.32	53.96
152	88	33	3	4	29	63	0.05	0.07	0.49	1.06
153	66	30	47	59	421	934	0.59	0.74	5.26	11.66
154	173	32	52	64	457	1013	1.71	2.10	14.99	33.22
155	258	30	216	268	1912	4244	10.57	13.12	93.59	207.75
156	645	26	115	143	1020	2264	14.04	17.46	124.52	276.38
157	218	22	101	125	892	1979	4.17	5.16	36.81	81.67
158	185	23	243	302	2155	4782	8.52	10.59	75.60	167.75
159	354	19	343	426	3040	6746	23.01	28.58	203.94	452.57
160	470	28	44	55	392	871	3.91	4.89	34.86	77.46
161	94	14	159	197	1406	3119	2.84	3.52	25.13	55.74
162	50	14	2	2	14	32	0.02	0.02	0.13	0.30
163	66	14	157	195	1391	3088	1.98	2.45	17.50	38.85
164	367	33	66	82	585	1298	4.59	5.70	40.69	90.28
165	124	28	102	127	906	2011	2.39	2.97	21.22	47.10
166	84	28	87	108	771	1710	1.39	1.73	12.32	27.33
167	956	28	88	109	778	1726	15.93	19.74	140.86	312.51
168	380	15	41	51	364	808	2.95	3.67	26.18	58.11
169	293	14	129	160	1142	2534	7.17	8.89	63.44	140.76
170	205	33	16	20	143	317	0.62	0.78	5.54	12.29
171	158	5	0	0	0	0	0.00	0.00	0.00	0.00
172	180	5	0	0	0	0	0.00	0.00	0.00	0.00
173	48	5	0	0	0	0	0.00	0.00	0.00	0.00
174	502	13	241	299	2133	4735	22.90	28.41	202.67	449.90
175	640	14	296	368	2626	5827	35.88	44.61	318.31	706.33
176	319	22	1260	1565	11166	24781	76.02	94.42	673.67	1495.10
177	286	29	1260	1565	11166	24781	68.27	84.80	605.02	1342.73
178	353	22	1019	1266	9033	20047	68.21	84.75	604.68	1341.98
179	348	31	757	940	6707	14885	49.85	61.90	441.63	980.12
180	366	30	808	1004	7164	15898	56.01	69.59	496.58	1101.98
181	453	14	76	95	678	1504	6.52	8.15	58.16	129.01
182	119	14	76	95	678	1504	1.71	2.13	15.22	33.76
183	50	14	64	80	571	1267	0.61	0.76	5.40	11.99
184	54	14	49	61	435	966	0.50	0.62	4.41	9.80
185	62	14	52	64	457	1013	0.61	0.75	5.35	11.86
186	39	14	108	134	956	2122	0.80	1.00	7.10	15.76
187	208	5	0	0	0	0	0.00	0.00	0.00	0.00
188	212	5	0	0	0	0	0.00	0.00	0.00	0.00
189	218	5	0	0	0	0	0.00	0.00	0.00	0.00
190	193	32	13	16	114	253	0.47	0.58	4.16	9.24

Table G-7 2015 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

Link Name	Link Distance (ft)	Link Speed (mph)	VOLUME				VMT			
			AM Peak	PM Peak	High 8-Hour	AWDT	AM Peak	PM Peak	High 8-Hour	AWDT
191	169	5	0	0	0	0	0.00	0.00	0.00	0.00
192	540	5	56	70	499	1108	5.73	7.16	51.07	113.41
193	138	14	295	367	2619	5811	7.70	9.58	68.36	151.67
194	932	16	291	362	2583	5732	51.35	63.88	455.79	1011.45
195	79	13	15	19	136	301	0.23	0.29	2.04	4.52
196	49	13	270	336	2397	5320	2.49	3.10	22.09	49.02
197	83	14	270	336	2397	5320	4.27	5.31	37.90	84.12
198	692	14	322	400	2854	6334	42.20	52.43	374.06	830.18
199	70	28	296	368	2626	5827	3.94	4.90	34.95	77.56
200	158	5	0	0	0	0	0.00	0.00	0.00	0.00
201	160	9	49	61	435	966	1.48	1.84	13.15	29.21
202	335	22	50	62	442	982	3.17	3.93	28.03	62.28
203	30	5	0	0	0	0	0.00	0.00	0.00	0.00
204	2022	8	106	132	942	2090	40.59	50.54	360.70	800.27
205	71	25	370	460	3282	7284	5.00	6.21	44.33	98.38
206	142	25	243	302	2155	4782	6.55	8.14	58.07	128.86
207	859	33	229	285	2034	4513	37.24	46.35	330.80	733.98
208	284	33	187	232	1655	3674	10.06	12.48	89.02	197.61
209	80	30	683	849	6058	13444	10.40	12.92	92.21	204.63
210	71	30	808	1004	7164	15898	10.93	13.58	96.87	214.97
211	390	30	870	1081	7713	17117	64.23	79.81	569.47	1263.79
212	117	30	407	506	3610	8012	9.04	11.24	80.16	177.90
213	1344	24	1297	1611	11495	25510	330.26	410.21	2927.00	6495.67
214	449	31	987	1226	8748	19413	83.89	104.20	743.52	1649.97
215	1110	31	75	93	664	1473	15.76	19.54	139.54	309.55
216	905	31	396	492	3510	7791	67.91	84.37	601.92	1336.05
217	1050	31	263	327	2333	5178	52.30	65.02	463.91	1029.63
218	581	28	627	779	5558	12335	68.96	85.68	611.29	1356.66
219	1063	32	329	409	2918	6476	66.26	82.37	587.69	1304.29
220	415	32	328	408	2911	6461	25.77	32.06	228.74	507.69
221	698	32	0	0	0	0	0.00	0.00	0.00	0.00
222	1920	23	17	21	150	333	6.18	7.64	54.56	121.12
223	1564	29	957	1189	8484	18828	283.44	352.16	2512.80	5576.49
224	377	26	529	657	4688	10403	37.81	46.96	335.06	743.53
225	551	26	172	214	1527	3389	17.95	22.33	159.34	353.63
226	788	32	78	97	692	1536	11.64	14.48	103.27	229.23
227	1303	32	307	381	2718	6033	75.74	93.99	670.54	1488.36
228	580	29	993	1233	8798	19524	109.14	135.52	966.96	2145.83
229	1653	30	379	471	3361	7458	118.64	147.44	1052.14	2334.67
230	2058	29	613	761	5430	12050	238.94	296.62	2116.51	4696.85
231	1300	18	774	962	6864	15233	190.51	236.79	1689.51	3749.46
232	736	21	690	857	6115	13570	96.15	119.42	852.09	1890.91
233	488	28	630	783	5587	12399	58.23	72.37	516.40	1146.03
234	449	11	423	525	3746	8313	35.96	44.64	318.50	706.80
235	310	24	326	405	2890	6413	19.14	23.77	169.65	376.46
236	310	5	97	120	856	1900	5.70	7.06	50.34	111.73
237	105	5	263	327	2333	5178	5.24	6.52	46.49	103.19
238	697	31	92	114	813	1805	12.14	15.04	107.26	238.13
239	186	25	56	69	492	1093	1.97	2.43	17.29	38.42
240	145	29	155	192	1370	3040	4.27	5.29	37.71	83.68
241	578	29	210	261	1862	4133	23.01	28.59	204.00	452.81

Table G-7 2015 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

Link Name	Link Distance (ft)	Link Speed (mph)	VOLUME				VMT			
			AM Peak	PM Peak	High 8-Hour	AWDT	AM Peak	PM Peak	High 8-Hour	AWDT
242	125	32	91	113	806	1789	2.15	2.67	19.05	42.29
243	564	32	91	113	806	1789	9.72	12.07	86.08	191.06
244	88	32	91	113	806	1789	1.51	1.87	13.36	29.65
245	48	5	0	0	0	0	0.00	0.00	0.00	0.00
246	175	13	202	251	1791	3975	6.69	8.32	59.35	131.73
247	65	23	3	4	29	63	0.04	0.05	0.36	0.78
248	39	13	296	368	2626	5827	2.17	2.70	19.28	42.79
249	128	13	205	255	1819	4038	4.96	6.17	44.02	97.72
250	484	13	215	267	1905	4228	19.73	24.50	174.80	387.95
251	388	5	0	0	0	0	0.00	0.00	0.00	0.00
252	308	16	306	380	2711	6017	17.88	22.20	158.38	351.52
253	54	12	10	12	86	190	0.10	0.12	0.88	1.94
254	51	5	0	0	0	0	0.00	0.00	0.00	0.00
255	290	31	3	4	29	63	0.17	0.22	1.60	3.47
256	377	31	37	46	328	728	2.64	3.29	23.43	52.01
257	215	31	23	28	200	443	0.94	1.14	8.15	18.05
258	321	29	7	9	64	143	0.43	0.55	3.89	8.69
259	203	29	2	3	21	48	0.08	0.12	0.81	1.84
260	362	29	2	3	21	48	0.14	0.21	1.44	3.29
261	219	31	20	25	178	396	0.83	1.04	7.39	16.45
262	218	13	6	7	50	111	0.25	0.29	2.06	4.57
263	177	33	24	30	214	475	0.80	1.00	7.16	15.90
264	157	5	0	0	0	0	0.00	0.00	0.00	0.00
265	2458	26	103	128	913	2027	47.95	59.58	425.01	943.58
266	752	26	147	183	1306	2898	20.94	26.06	186.00	412.72
267	1323	26	215	267	1905	4228	53.86	66.88	477.19	1059.10
268	1252	29	409	508	3625	8044	96.95	120.42	859.29	1906.79
269	302	18	19	23	164	364	1.09	1.32	9.40	20.85
270	1005	25	683	849	6058	13444	130.00	161.59	1153.03	2558.83
271	954	14	506	629	4488	9960	91.40	113.62	810.68	1799.10
272	656	18	465	578	4124	9152	57.78	71.82	512.43	1137.19
273	485	5	518	644	4595	10198	47.59	59.17	422.16	936.93
274	1244	19	159	198	1413	3135	37.46	46.65	332.91	738.62
275	419	9	0	0	0	0	0.00	0.00	0.00	0.00
276	649	19	147	182	1299	2882	18.06	22.36	159.61	354.13
277	2473	26	101	125	892	1979	47.31	58.56	417.86	927.07
278	573	30	197	245	1748	3880	21.39	26.60	189.76	421.20
279	458	18	263	327	2333	5178	22.80	28.35	202.26	448.91
280	295	24	159	198	1413	3135	8.89	11.07	79.00	175.27
281	440	14	157	195	1391	3088	13.07	16.23	115.80	257.08
282	76	14	101	126	899	1995	1.46	1.82	13.02	28.88
283	697	14	321	399	2847	6318	42.35	52.63	375.57	833.45
284	690	19	526	653	4659	10340	68.69	85.28	608.45	1350.38
285	91	19	511	635	4531	10055	8.80	10.94	78.05	173.21
286	464	19	836	1039	7413	16452	73.48	91.32	651.56	1446.03
287	229	19	806	1001	7142	15851	34.98	43.45	309.99	687.99
288	500	9	803	997	7114	15787	75.97	94.32	673.03	1493.56
289	738	21	1837	2282	16282	36135	256.78	318.98	2275.92	5051.00
290	190	25	1619	2011	14349	31844	58.18	72.27	515.66	1144.39
291	494	31	464	577	4117	9137	43.44	54.01	385.39	855.31
292	689	18	1156	1436	10246	22739	150.76	187.27	1336.20	2965.44

Table G-7 2015 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

Link Name	Link Distance (ft)	Link Speed (mph)	VOLUME				VMT			
			AM Peak	PM Peak	High 8-Hour	AWDT	AM Peak	PM Peak	High 8-Hour	AWDT
293	325	25	1298	1612	11502	25526	79.91	99.24	708.13	1571.54
294	396	18	233	289	2062	4576	17.49	21.69	154.78	343.49
295	1017	23	1064	1322	9433	20934	204.97	254.67	1817.18	4032.74
296	162	16	222	276	1969	4370	6.82	8.48	60.47	134.20
297	140	16	222	276	1969	4370	5.88	7.31	52.16	115.77
298	951	7	167	208	1484	3294	30.09	37.48	267.38	593.49
299	805	17	240	298	2126	4719	36.60	45.44	324.17	719.55
300	518	9	103	128	913	2027	10.11	12.56	89.62	198.96
301	749	7	132	164	1170	2597	18.73	23.27	166.01	368.48
302	652	7	231	287	2048	4545	28.52	35.44	252.89	561.22
303	547	6	136	169	1206	2676	14.08	17.50	124.86	277.04
304	406	10	35	43	307	681	2.69	3.31	23.60	52.35
305	442	5	24	30	214	475	2.01	2.51	17.92	39.78
306	207	5	59	73	521	1156	2.31	2.86	20.43	45.34
307	70	5	194	241	1720	3816	2.57	3.20	22.81	50.60
308	319	8	60	75	535	1188	3.63	4.53	32.33	71.79
309	281	6	87	108	771	1710	4.63	5.75	41.02	90.97
310	555	30	491	610	4352	9659	51.57	64.07	457.08	1014.47
311	208	26	491	610	4352	9659	19.34	24.03	171.44	380.51
312	125	26	1195	1485	10596	23515	28.29	35.16	250.85	556.70
313	332	8	704	875	6243	13855	44.31	55.07	392.92	872.01
314	440	8	1057	1313	9368	20791	88.12	109.47	781.02	1733.37
315	215	18	840	1044	7449	16531	34.21	42.52	303.38	673.26
316	543	14	118	146	1042	2312	12.14	15.02	107.20	237.86
317	180	8	249	309	2205	4893	8.49	10.53	75.18	166.82
318	221	9	249	309	2205	4893	10.41	12.92	92.18	204.54
319	2544	10	341	424	3025	6714	164.29	204.28	1457.41	3234.72
320	552	7	57	71	507	1124	5.96	7.42	52.97	117.44
321	628	5	339	421	3004	6666	40.34	50.10	357.48	793.26
322	181	8	423	525	3746	8313	14.50	18.00	128.44	285.02
323	58	8	366	455	3246	7205	4.04	5.02	35.83	79.53
324	387	9	5	6	43	95	0.37	0.44	3.15	6.97
325	406	9	371	461	3289	7300	28.51	35.42	252.70	560.88
326	89	5	83	103	735	1631	1.39	1.73	12.35	27.40
327	463	10	415	515	3675	8155	36.39	45.16	322.27	715.14
328	79	19	497	617	4402	9770	7.44	9.24	65.92	146.30
329	103	19	497	617	4402	9770	9.66	11.99	85.54	189.85
330	323	11	27	33	235	523	1.65	2.02	14.37	31.97
331	179	10	342	425	3032	6730	11.59	14.40	102.75	228.07
332	993	5	386	479	3418	7585	72.58	90.07	642.69	1426.21
333	384	5	0	0	0	0	0.00	0.00	0.00	0.00
334	366	6	349	433	3090	6856	24.17	29.99	213.99	474.80
335	583	31	564	700	4995	11084	62.27	77.29	551.51	1223.81
336	428	26	906	1125	8027	17814	73.49	91.25	651.07	1444.90
337	94	26	290	360	2569	5701	5.18	6.42	45.85	101.74
338	366	5	152	189	1349	2993	10.53	13.09	93.46	207.36
339	311	5	138	172	1227	2724	8.12	10.12	72.17	160.22
340	273	19	20	25	178	396	1.03	1.29	9.20	20.46
341	66	17	20	25	178	396	0.25	0.31	2.22	4.93
342	48	11	0	0	0	0	0.00	0.00	0.00	0.00
343	52	22	47	58	414	918	0.46	0.57	4.08	9.04

Table G-7 2015 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

Link Name	Link Distance (ft)	Link Speed (mph)	VOLUME				VMT			
			AM Peak	PM Peak	High 8-Hour	AWDT	AM Peak	PM Peak	High 8-Hour	AWDT
344	82	12	35	44	314	697	0.54	0.68	4.88	10.84
345	25	5	71	88	628	1393	0.34	0.42	2.97	6.60
346	121	5	70	87	621	1378	1.60	1.99	14.18	31.47
347	303	9	105	130	928	2059	6.02	7.46	53.24	118.12
348	146	6	494	614	4381	9723	13.67	17.00	121.27	269.15
349	67	6	188	234	1670	3705	2.38	2.96	21.11	46.84
350	446	5	186	231	1648	3658	15.70	19.50	139.13	308.81
351	335	5	32	40	285	633	2.03	2.54	18.11	40.22
352	430	5	266	331	2362	5241	21.64	26.93	192.20	426.47
353	360	5	43	53	378	839	2.93	3.61	25.74	57.13
354	50	14	105	130	928	2059	0.99	1.23	8.79	19.50
355	88	5	182	226	1613	3579	3.04	3.77	26.94	59.77
356	113	5	491	610	4352	9659	10.51	13.06	93.17	206.78
358	463	18	0	0	0	0	0.00	0.00	0.00	0.00
359	229	5	4	5	36	79	0.17	0.22	1.56	3.43
360	245	25	4	5	36	79	0.19	0.23	1.67	3.67
361	248	14	44	55	392	871	2.06	2.58	18.40	40.88
362	199	13	44	55	392	871	1.66	2.07	14.79	32.86
363	230	21	48	60	428	950	2.09	2.61	18.63	41.34
364	256	27	48	60	428	950	2.33	2.91	20.76	46.09
365	201	8	14	18	128	285	0.53	0.68	4.87	10.84
366	201	23	71	88	628	1393	2.71	3.35	23.93	53.08
367	337	31	658	818	5837	12953	42.01	52.22	372.62	826.89
368	868	8	404	502	3582	7949	66.45	82.57	589.15	1307.40
369	167	5	357	444	3168	7031	11.32	14.07	100.43	222.88
370	96	11	354	440	3139	6967	6.41	7.97	56.87	126.22
371	141	24	723	898	6407	14220	19.30	23.97	170.99	379.51
372	283	16	278	345	2462	5463	14.89	18.48	131.89	292.65
373	283	24	136	169	1206	2676	7.29	9.05	64.61	143.35
			Logan Airport VMT				**8,580**	**10,660**	**76,058**	**168,791**

AWDT = Average annual weekday daily traffic

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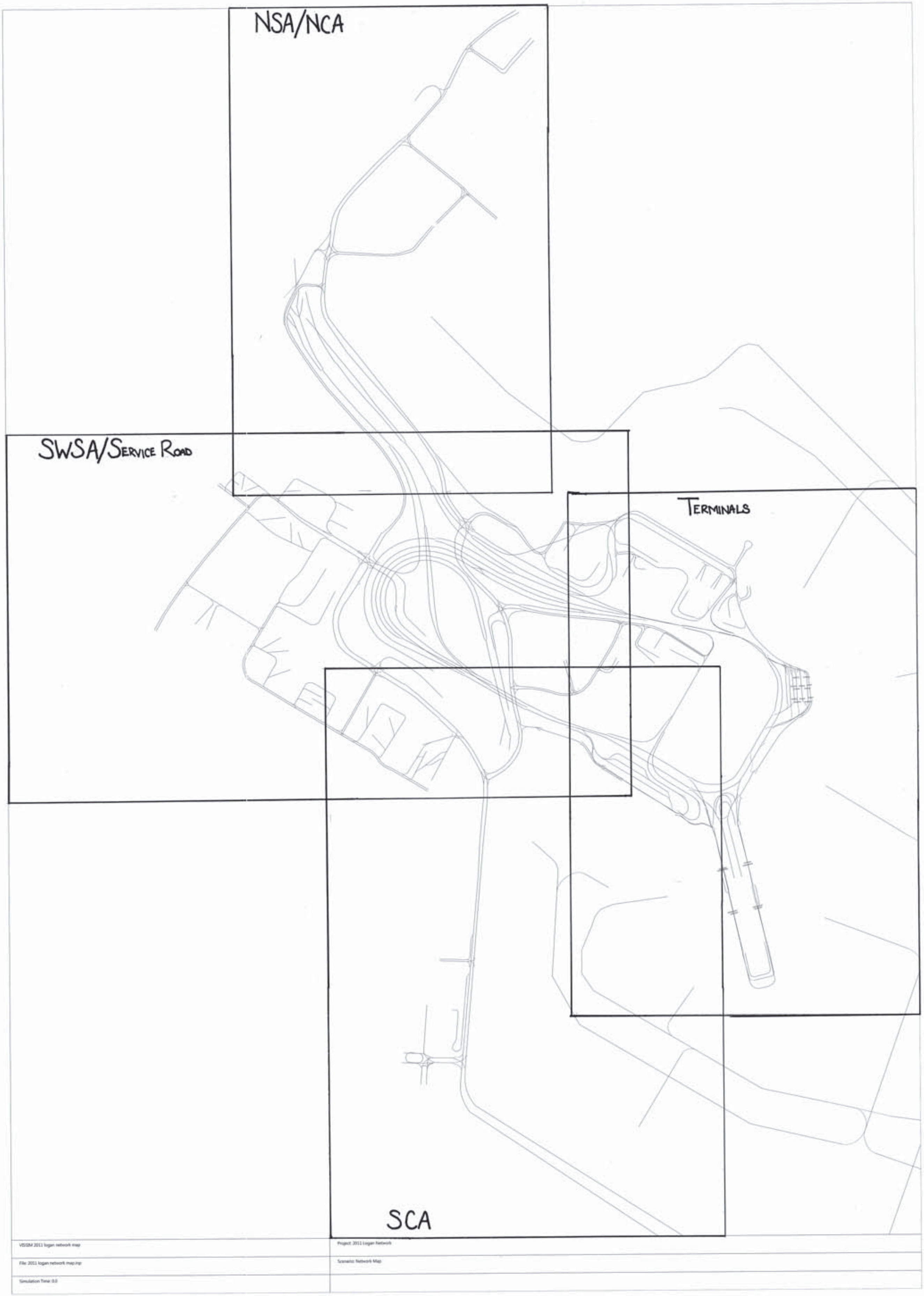
NSA/NCA
SWSA/Service Road
Terminals
SCA
VISSIM 2011 logan network map
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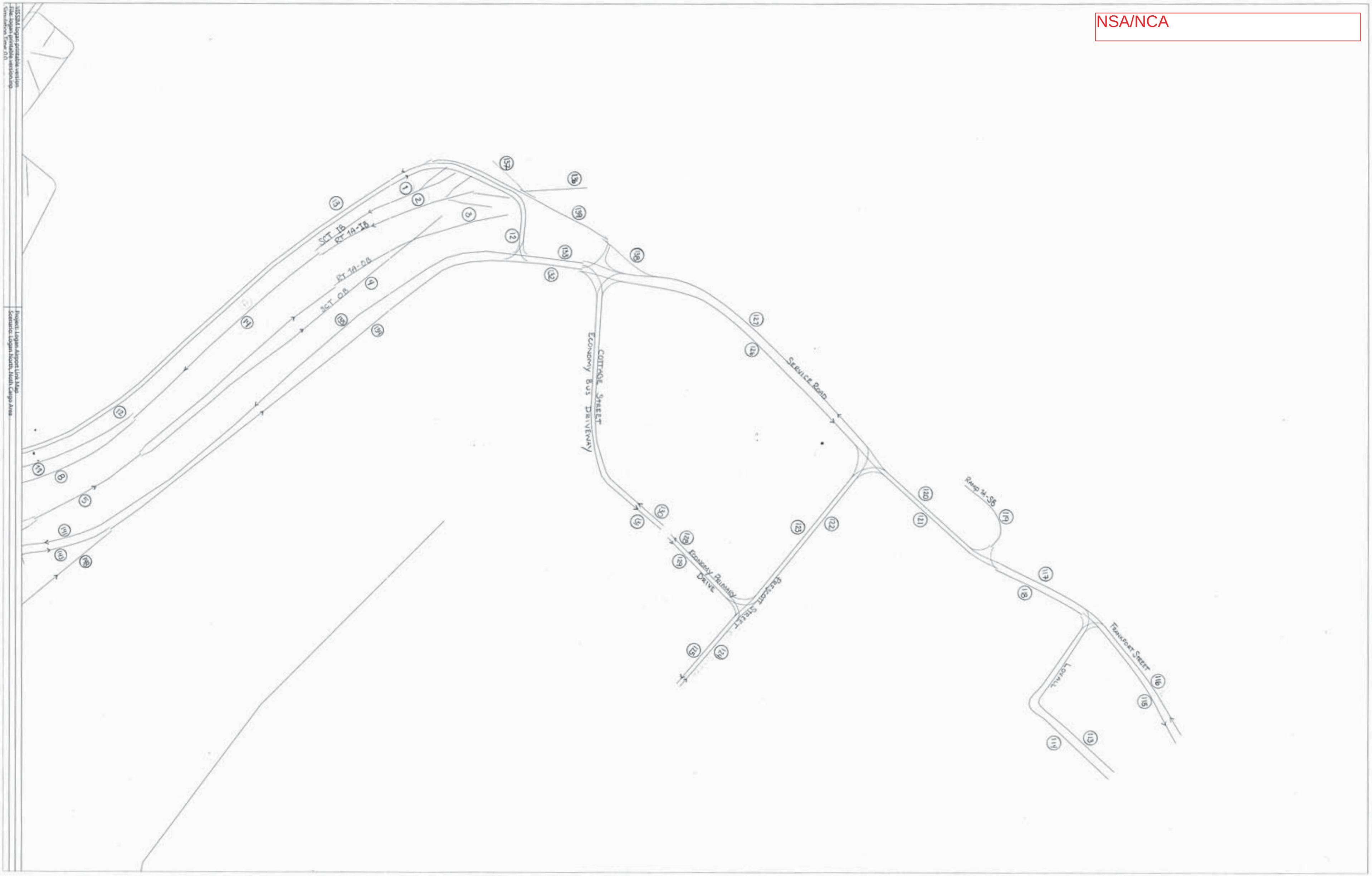
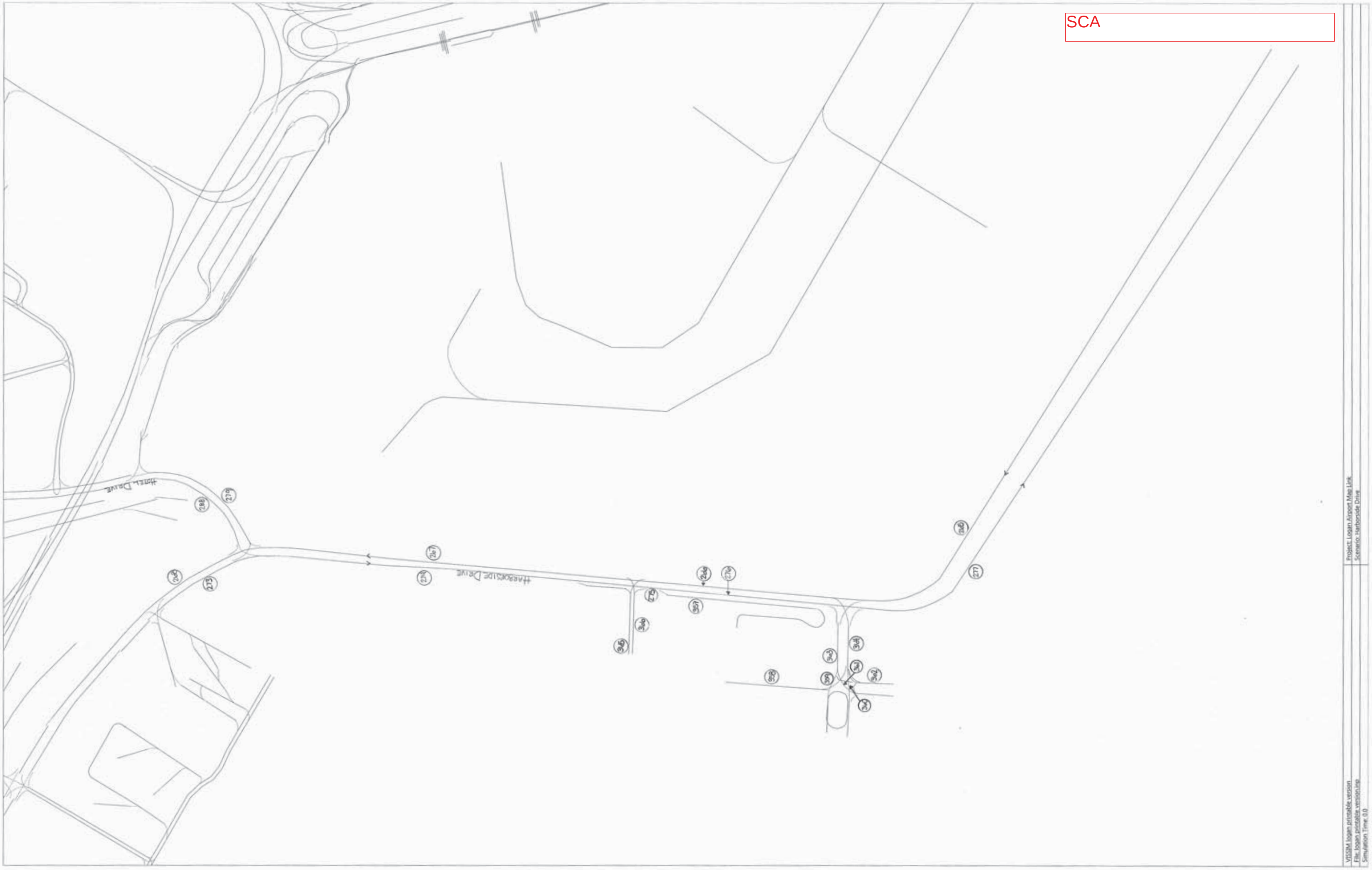
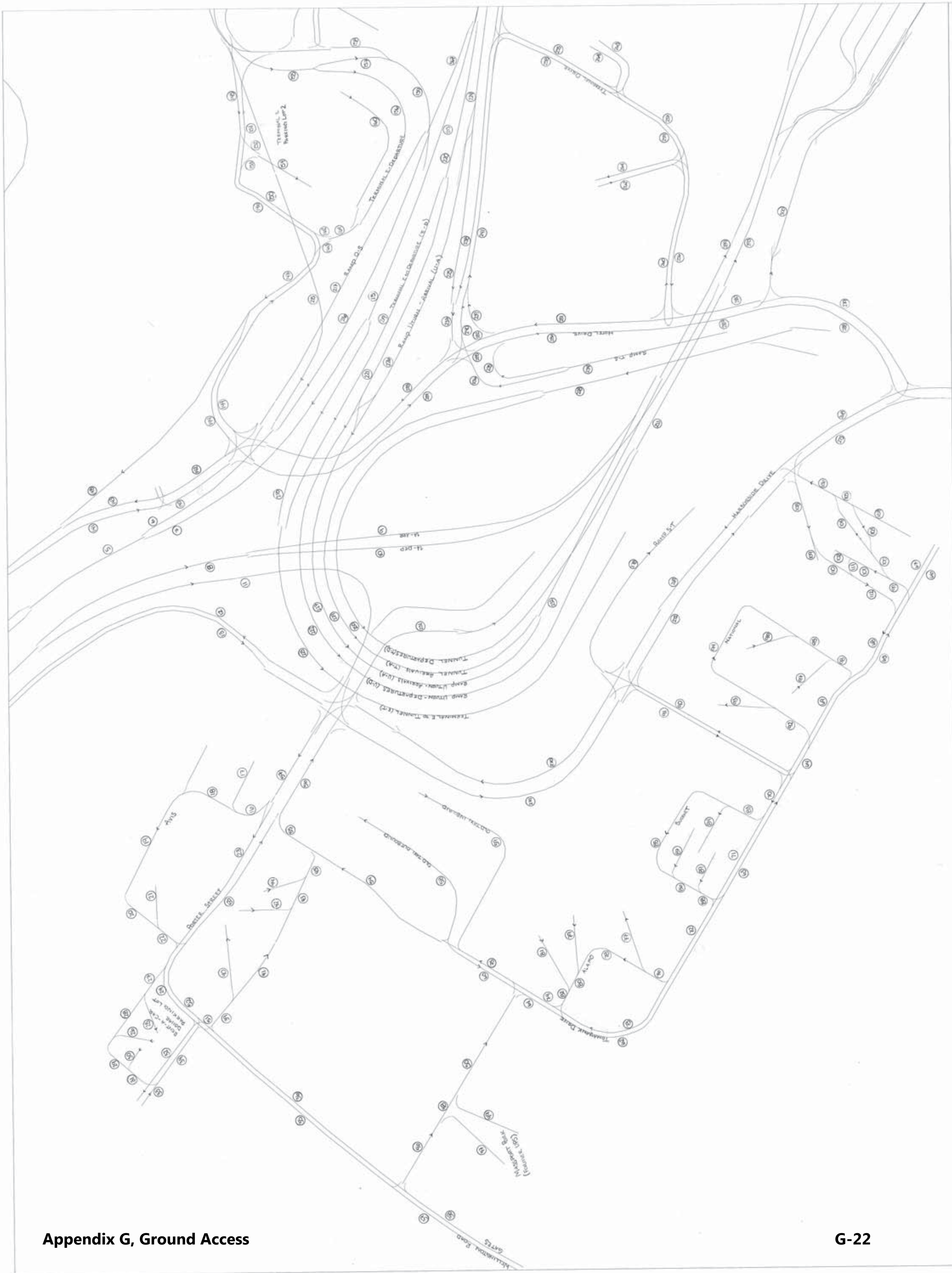
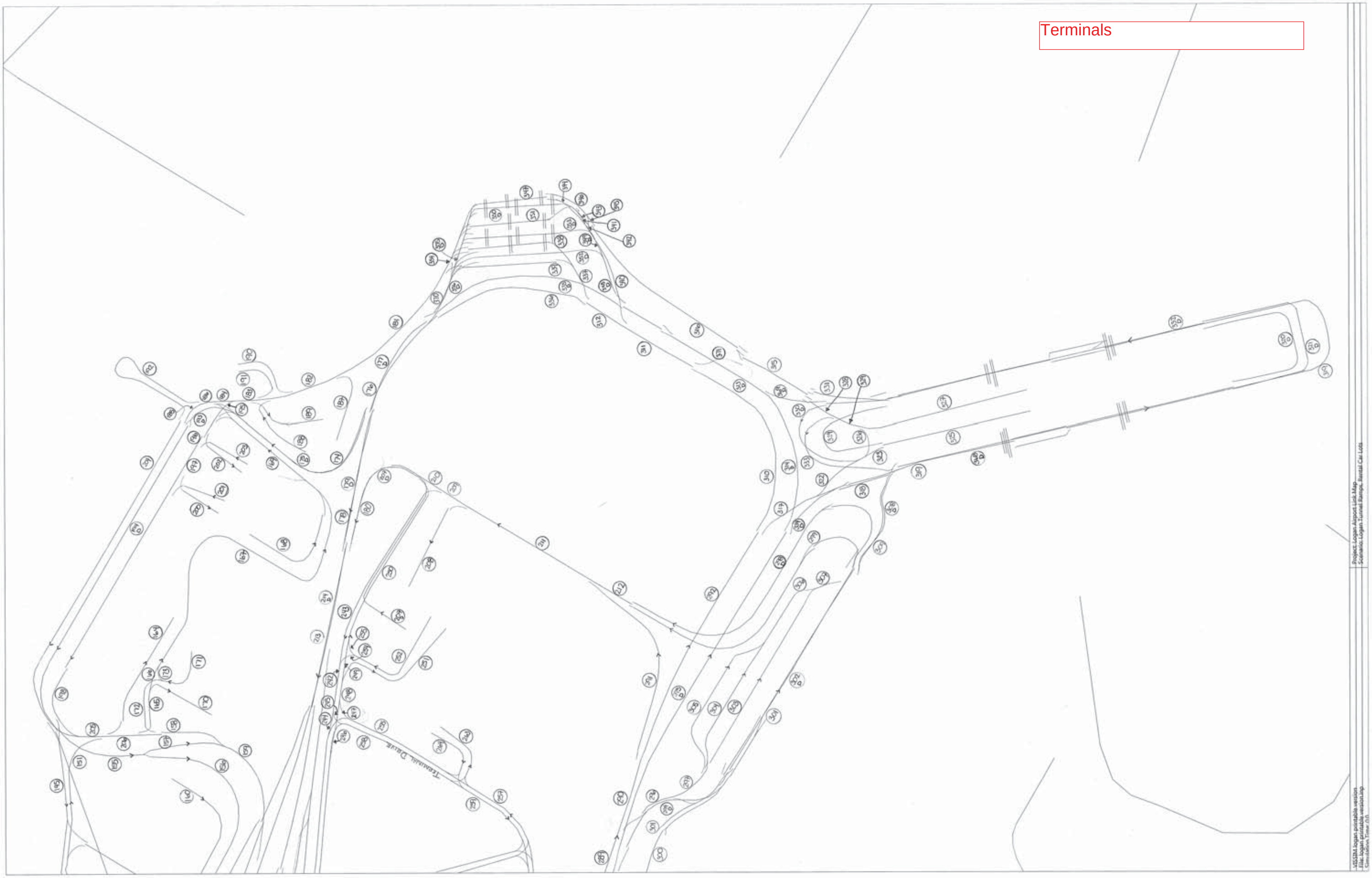
File: 2011 logan network map.inp
Scenario: Network Map
Simulation Time: 0.0


NSA/NCA
Service Road
Cottage Street
Economy Bus Driveway
Economy Parkway Drive
Prescott Street
Frankfort Street
Lovell
Ramp 1A-SB
RT 1A-IB
RT 1A-OB
SCT IB
SCT OB


SCA
Hotel Drive
Harborside Drive

SWSA/Service Roadways




Terminals

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Massachusetts Port Authority
One Harborside Drive, Suite 200-S
East Boston, MA 02128-2909
Telephone: 617-568-5000
www.massport.com

March 4, 2015

Christine Kirby, Director, Air & Climate Division
Department of Environmental Protection
Bureau of Air & Waste
One Winter Street
Boston, MA 02108

Re: March 1st, 2015, Logan Airport Parking Space Inventory

Dear Ms. Kirby:

In compliance with the reporting requirements of 310 CMR 7.30 (3)(d), enclosed are the following March 1st, 2015, Massachusetts Port Authority (Massport) submissions for Logan Airport:

- Commercial Parking Space Inventory
- Employee Parking Space Inventory
- Location Map

The attachments provide the quantity, physical distribution, and allocation of commercial and employee parking spaces on the airport, as defined by 310 CMR 7.30, as amended. These inventory tables represent information provided by the Aviation Department; the employee and commercial space counts are supported by comprehensive field checks and counts recently conducted in late February 2015. We continue to provide information on rental car spaces as a courtesy.

Massport's parking program remains in compliance with the Aviation and Transportation Security Act of 2001 (ATSA) and supplemental FAA security directives, and our top priority continues to be the safe and secure operation of our transportation and parking facilities.

The Commercial Parking Space Inventory totals 18,415 spaces; the Employee Parking Space Inventory totals 2,673 parking spaces; the total inventory of spaces at Logan Airport is 21,088. The allocations within each of the categories had changes because of the recent relocation of the taxi pool, the relocation of the bus/limo pool, and construction impacting a hotel lot.

Demand for commercial parking at Logan Airport continues to be strong. While the Aviation Department deploys operational innovations to accommodate passenger parking demand, a broader strategic planning effort is underway to plan for ground access needs at future passenger levels. As part of this effort, Massport is planning to consolidate all remaining (i.e., designated) parking spaces allowed under the freeze by adding to the West Garage structure located in the central terminal area.

The attached Logan Airport Parking Space Inventory reflects Massport's successful management of its parking program, within the requirements of 310 CMR 7.30, as amended. If you have any questions, please call me at 617-561-3425.

Sincerely,

Lourenço Dantas, AICP
Senior Transportation Planner
Strategic & Business Planning Department

cc: S. Dalzell, MPA
B. Desrosiers, MPA
I. Wallach, MPA
D. Conroy, EPA

Commercial Parking Space Inventory
Logan International Airport
March 1, 2015 Submission

Commercial Parking Spaces

Map ID#	Location of Commercial Parking Areas	Number of Spaces
Terminal Area and Economy Spaces		
C1	Central Garage	7,077
C2	West Garage	3,190
C3	Terminal B Garage	2,254
C5	Terminal E Lot 1	243
C6	Terminal E Lot 2	248
C7	Terminal E Lot 3 (fka "Gulf Station" Lot)	219
C8	Economy Garage	2,809
	subtotal	*16,040*
Overflow Commercial Spaces		
C11	Red Lot (Tomahawk Dr.)	282
C12	Blue Lot (Harborside Dr.)	315
C13	Green Lot (Wood Island)	235
	subtotal	*832*
Hotel Spaces		
C4a ~~& C4b~~	Logan Airport Hilton Hotel (one lot)	35
C10	Harborside Hyatt Conference Center	270
	subtotal	*305*
General Aviation Spaces		
C9	Signature (General Aviation Terminal)	35
	subtotal	*35*

Total In-Service Commercial Parking Spaces	**17,212**
Total Designated Commercial Parking Spaces	**1,203**
Total Commercial Parking Spaces	**18,415**
Total Employee Parking Spaces *(see table on next page)*	**2,673**
TOTAL PARKING FREEZE SPACES	**21,088**

Employee Parking Space Inventory
Logan International Airport
March 1, 2015 Submission

Employee Parking Spaces

Area	Map ID#	Location of Employee Parking Areas	Number of Spaces
Terminal Area	E81	West Garage	98
	E26	Airport Tower/Administration (parking in Central Garage)	524
	E20	Terminal C Pier A (Old Terminal D) (two lots)	122
	E18	Massport Facilities 1 (Heating Plant)	92
	E34	Hilton Hotel employee lot	28
	E86	Gulf Gas Station	4
North Service Area	E68a	LSG Sky Chefs (Bldg. 68), main lot	25
	E68b	LSG Sky Chefs (Bldg. 68), overflow lot	126
	E1	Flight Kitchen Building 1 (and nearby lot)	80
	E40	Lovell Street Lot (contractor trailer)	25
	E53	Green Bus Depot (Bus Maintenance Facility)	12
	E11a	North Cargo Building 11, TSA lot	93
	E11b	North Cargo Building 11, State Police lot	136
	E43	North Gate & EMS Trailer (EMS Station A7)	26
	E8	North Cargo Building 8	114
	E5	US Airways Administration/Hangar (Bldg. 5)	75
	N/A	Massport Facilities 2 (airside, Bldg. 3)	0
	E4	Massport Facilities 3 (landside, Bldg. 4)	69
	E13	UPS (Cargo Building 13)	44
	E94	United Aircraft Maintenance (Buildings 93 & 94)	56
SWSA	E59	Bus/Limo Pool Lot	3
	E60	Rental Car Center (Customer Service Center)	4
	E72	Taxi Pool Lot	7
South Service Area	E84	Bird Island Flats / Logan Office Center (LOC) Garage	425
	E63	South Cargo Building 63	16
	E62	South Cargo Building 62	43
	E58	South Cargo Building 58	23
	E57	South Cargo Building 57	44
	E56	South Cargo Building 56	39
	E78	Fire-Rescue HQ & Amelia Earhart Terminal/Hangar	84
	N/A	*ARFF Satellite Station* [1]	0

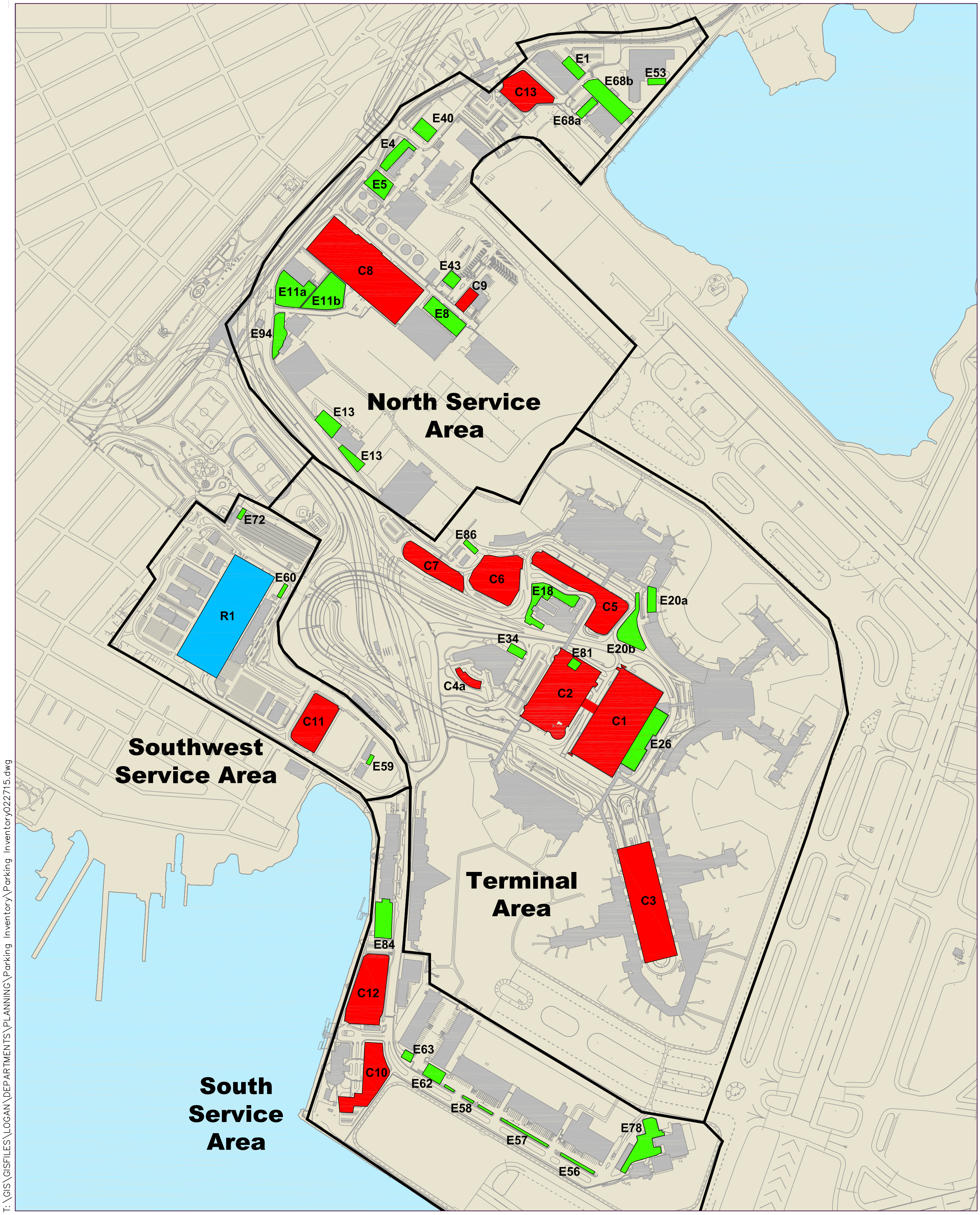
[1] This facility is located on the airfield and is not shown in the map. No employee parking spaces are provided.

Total In-Service Employee Parking Spaces	**2,437**
Total Designated Employee Parking Spaces	**236**
Total Employee Parking Spaces	**2,673**
Total Commercial Parking Spaces *(see table on previous page)*	**18,415**
TOTAL PARKING FREEZE SPACES	**21,088**

For Information Only:
Rental Car Spaces Inventory
Logan International Airport
March 1, 2015 Submission

Rental Car Company Parking Spaces

Map ID#		Number of Spaces
R1	Rental Car Center (RCC)	5,020
Total Rental Car Spaces		**5,020**



Logan Airport
Parking Space Inventory

Logan International Airport
East Boston, MA

Massachusetts Port Authority
March 1, 2015

Legend:

- Logan Parking Service Area Zones
- Commercial Parking Space Locations
- Employee Parking Space Locations
- Rental Car Parking Space Locations

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0 250 500 1000
in feet

Notes:

This plan is intended for informational purposes only and no use may be made of the same without the express written permission of the Massachusetts Port Authority ("Massport"). Massport does not certify the accuracy, information or title to the properties contained in this plan nor make any warranties of any kind, express or implied, in fact or by law, with respect to any boundaries, easements, restrictions, claims, overlaps or other encumbrances affecting such properties.

Massachusetts Port Authority
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East Boston, MA 02128-2909
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www.massport.com

September 1, 2015

Christine Kirby, Director, Air & Climate Division
Massachusetts Department of Environmental Protection
Bureau of Air & Waste
One Winter Street
Boston, MA 02108

Re: September 1st, 2015, Logan Airport Parking Space Inventory

Dear Ms. Kirby:

In compliance with the reporting requirements of 310 CMR 7.30 (3)(d), enclosed are the following September 1st, 2015, Massachusetts Port Authority (Massport) submissions for Logan Airport:

- Commercial Parking Space Inventory
- Employee Parking Space Inventory
- Location Map

The attachments provide the quantity, physical distribution, and allocation of commercial and employee parking spaces on the airport, as defined by 310 CMR 7.30, as amended. These inventory tables represent information provided by the Aviation Department and are supported by comprehensive field checks and counts conducted in late August 2015.

The Commercial Parking Space Inventory totals 18,415 spaces; the Employee Parking Space Inventory totals 2,673 parking spaces; the total inventory of spaces at Logan Airport is 21,088. For your information, we continue to provide information on rental car spaces.

As noted in our March letter, Massport is consolidating all remaining (i.e., designated) parking spaces allowed under the freeze by adding to the central terminal area's West Garage. We expect that the additional spaces will be open to the public by the end of the year.

The attached Logan Airport Parking Space Inventory reflects Massport's successful management of its parking program, within the requirements of 310 CMR 7.30, as amended. If you have any questions, please call me at 617-561-3425.

Sincerely,

Lourenço Dantas, AICP
Senior Transportation Planner
Strategic & Business Planning Department

cc: D. Conroy, EPA
S. Dalzell, MPA
B. Desrosiers, MPA
H. Morrison, MPA
I. Wallach, MPA

Commercial Parking Space Inventory
Logan International Airport
September 1, 2015 Submission

Commercial Parking Spaces

Map ID#	Location of Commercial Parking Areas	Number of Spaces
Terminal Area and Economy Spaces		
C1	Central Garage	7,213
C2	West Garage	3,127
C3	Terminal B Garage	2,201
C5	Terminal E Lot 1	237
C6	Terminal E Lot 2	249
C7	Terminal E Lot 3 (fka "Gulf Station" Lot)	217
C8	Economy Garage	2,864
	subtotal	*16,108*
Overflow Commercial Spaces		
C11	Red Lot (Tomahawk Dr.)	282
C12	Blue Lot (Harborside Dr.)	339
C13	Green Lot (Wood Island)	242
	subtotal	*863*
Hotel Spaces		
C4a ~~& C4b~~	Logan Airport Hilton Hotel (one lot)	35
C10	Harborside Hyatt Conference Center	270
	subtotal	*305*
General Aviation Spaces		
C9	Signature (General Aviation Terminal)	35
	subtotal	*35*

Total In-Service Commercial Parking Spaces	**17,311**
Total Designated Commercial Parking Spaces	**1,104**
Total Commercial Parking Spaces	**18,415**
Total Employee Parking Spaces *(see table on next page)*	**2,673**
TOTAL PARKING FREEZE SPACES	**21,088**

Employee Parking Space Inventory
Logan International Airport
September 1, 2015 Submission

Employee Parking Spaces

Area	Map ID#	Location of Employee Parking Areas	Number of Spaces
Terminal Area	E81	West Garage	98
	E26	Airport Tower/Administration (parking in Central Garage)	521
	E20	Terminal C Pier A (Old Terminal D) (two lots)	122
	E18	Massport Facilities 1 (Heating Plant)	92
	E34	Hilton Hotel employee lot	28
	E86	Gulf Gas Station	4
North Service Area	E68a	LSG Sky Chefs (Bldg. 68), main lot	25
	E68b	LSG Sky Chefs (Bldg. 68), overflow lot	126
	E1	Flight Kitchen Building 1 (and nearby lot)	80
	E40	Lovell Street Lot (contractor trailer)	25
	E53	Green Bus Depot (Bus Maintenance Facility)	12
	E11a	North Cargo Building 11, TSA lot	93
	E11b	North Cargo Building 11, State Police lot	136
	E43	North Gate & EMS Trailer (EMS Station A7)	21
	E8	North Cargo Building 8	114
	E5	US Airways Administration/Hangar (Bldg. 5)	75
	N/A	Massport Facilities 2 (airside, Bldg. 3)	0
	E4	Massport Facilities 3 (landside, Bldg. 4)	69
	E13	UPS (Cargo Building 13)	44
	E94	United Aircraft Maintenance (Buildings 93 & 94)	56
SWSA	E59	Bus/Limo Pool Lot	4
	E60	Rental Car Center (Customer Service Center)	4
	E72	Taxi Pool Lot	8
South Service Area	E84	Bird Island Flats / Logan Office Center (LOC) Garage	416
	E63	South Cargo Building 63	16
	E62	South Cargo Building 62	43
	E58	South Cargo Building 58	23
	E57	South Cargo Building 57	44
	E56	South Cargo Building 56	39
	E78	Fire-Rescue HQ & Amelia Earhart Terminal/Hangar	84
	N/A	*ARFF Satellite Station* [1]	0

[1] This facility is located on the airfield and is not shown in the map. No employee parking spaces are provided.

Total In-Service Employee Parking Spaces	**2,422**
Total Designated Employee Parking Spaces	**251**
Total Employee Parking Spaces	**2,673**
Total Commercial Parking Spaces *(see table on previous page)*	**18,415**
TOTAL PARKING FREEZE SPACES	**21,088**

For Information Only:
Rental Car Spaces Inventory
Logan International Airport
September 1, 2015 Submission

Rental Car Company Parking Spaces

Map ID#		Number of Spaces
R1	Rental Car Center (RCC)	5,020
Total Rental Car Spaces		**5,020**

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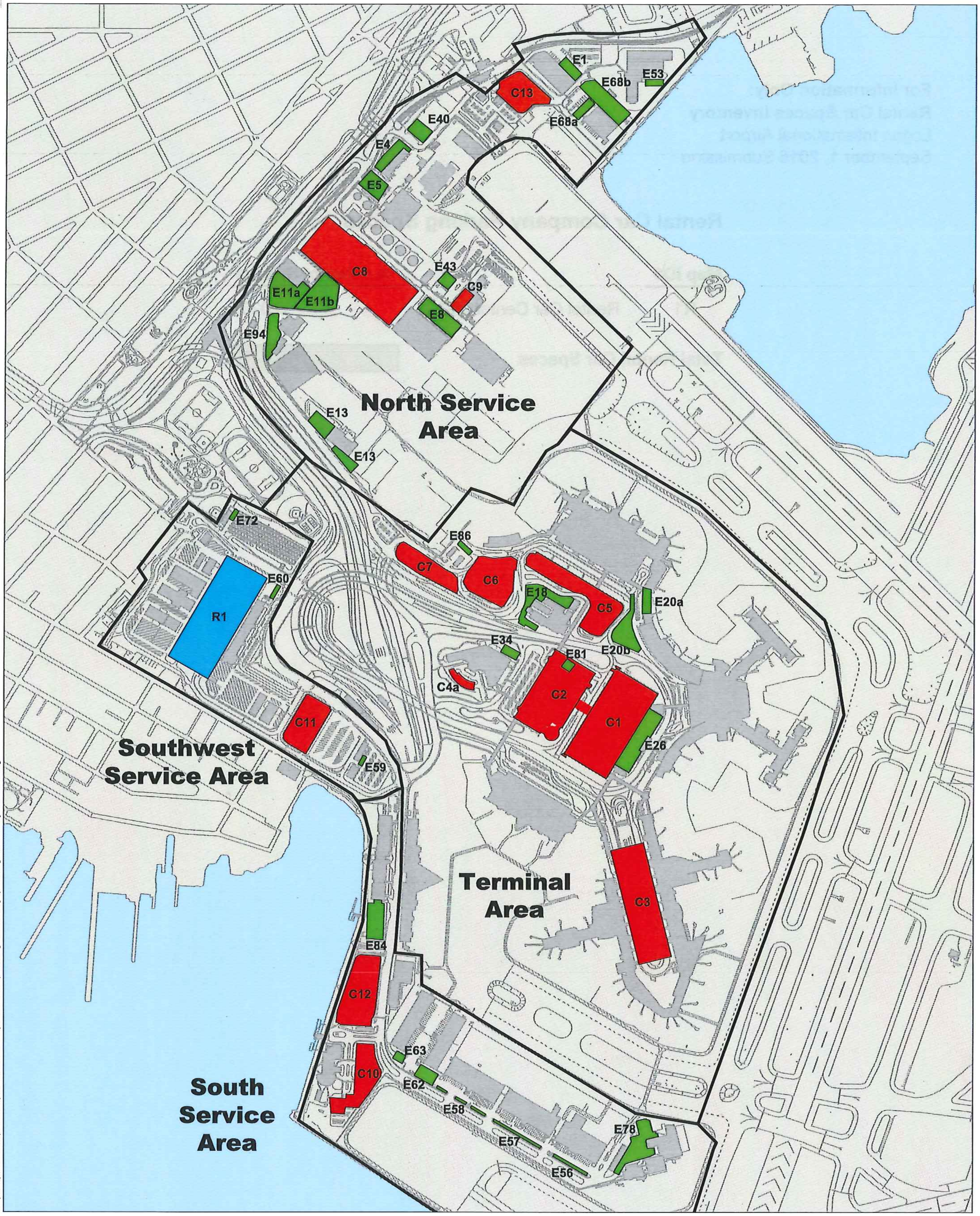

Logan Airport
Parking Space Inventory

Logan International Airport
East Boston, MA

massport
Massachusetts Port Authority
September 1, 2015

Legend:

- Logan Parking Service Area Zones
- Commercial Parking Space Locations
- Employee Parking Space Locations
- Rental Car Parking Space Locations

N

0 250 500 1000
In feet

Notes:

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H

Noise Abatement

This appendix provides detailed information, tables, and figures in support of Chapter 6, *Noise Abatement*. The contents of this appendix are summarized below.

  - Table H-24a	Runway 33L Gates – Passages Below 3,000 Feet for 2014
  - Table H-24b	Runway 33L Gates – Passages Below 3,000 Feet for 2015
  - Table H-25	Runway Usage by Runway End
- Logan Airport Census Block Group Noise Levels
  - Table H-26	Logan Census Block Group Noise Levels
- Dourado, E. and Russell, R. October 2016. “Airport Noise NIMBYism: An Empirical Investigation.” *Mercatus on Policy: Mercatus Center at George Mason University*.

masport

Massachusetts Port Authority
One Harborside Drive, Suite 200S
East Boston, MA 02128-2090
Telephone (617) 568-1003
www.massport.com

November 16, 2016

Richard Doucette
Airports Division
Federal Aviation Administration, New England Region
1200 District Avenue
Burlington, MA 01803

Dear Mr. Doucette:

Following up to our October 17th meeting where we discussed the FAA's new AEDT model for noise and air emissions, I am writing to you to request that FAA review the AEDT model results as applied to Boston Logan International Airport (Boston Logan) both related to noise and air quality. We also request that the FAA work with Massport and our consultants to develop Logan specific modification to the AEDT so that the model more accurately reflects the local noise and air quality environment.

As you are aware, Massport produces and circulates an annual environmental and planning report for Boston Logan to state officials and the interested public. FAA noise and air quality models form the basis of much of these reports. Massport also seeks to maintain with the FAA an updated Noise Exposure Map that supports our soundproofing efforts of eligible homes. As a result, Massport publishes annually Boston Logan specific noise and air quality data based on the latest FAA approved models (previously the INM and EDMS models). Overtime, Massport has worked closely with the FAA, and USDOT Volpe Center, to enhance the INM including, for example, Logan-specific modifications for "hill effects" and "over water propagation".

For the 2015 calendar year EDR, Massport's noise and air quality consultants utilized the FAA's new AEDT model (Version 2B Service Pack 2). Based on preliminary results, we have strong concerns on the general applicability of the noise module to accurately reflect Boston Logan's noise environment. To assist with the development of a Boston Logan specific modeling process, we have asked our consultant to put together a request (attached) to be sent to FAA AEE for review and approval of AEDT Non-standard modeling and methods. Finally, we also have a narrower concern on the AEDT's estimate of Particulate Matter (PM) which we would also like to discuss.

We look forward to working with you on reviewing and modifying the AEDT to better reflect Boston Logan's noise and air quality footprint.

Very truly yours,

Flavio Leo
Director, Aviation Planning & Strategy

CC: Mary Walsh (FAA), Gail Latrell (FAA), Stewart Dalzell (Massport)

HMMH
77 South Bedford Street
Burlington, Massachusetts 01803
781.229.0707
www.hmmh.com

TECHNICAL MEMORANDUM

To:	Flavio Leo Massport One Harborside Drive, Suite 2005 East Boston, MA 02128
From:	Robert Mentzer Jr., HMMH Bradley Dunkin, HMMH
Date:	November 16, 2016
Subject:	Logan International Airport Annual DNL Noise Contours - Requested Review and Approval of Aviation Environmental Design Tool Non-Standard Modeling
Reference:	HMMH Project Number 307260.002

hmmh

1. INTRODUCTION

Harris Miller Miller & Hanson Inc. (HMMH) is assisting the Massachusetts Port Authority (Massport) in the preparation of their annual DNL noise contours for the Massachusetts Environmental Policy Act (MEPA) review. Massport will also potentially use the updated DNL contour to submit to FAA for additional sound insulation funding. We plan to use the Aviation Environmental Design Tool (AEDT) Version 2c (released September 2016) for all future aircraft noise modeling. Consistent with Federal Aviation Administration (FAA) policies and procedures, any changes to the standard AEDT modeling procedures require prior written approval from the FAA Office of Environment and Energy Noise Division (AEE-100). This requirement applies to the use of custom adjustments to the model and use of non-standard data.

As part of the preparation of Massport's annual Environmental Data Review (EDR) for 2015, an AEDT study using the latest version available at the time (Version 2b, Service Pack 2) was conducted in order to assess consistency with an INM study of the same data, as well as INM results for previous years. The judgment was made that the results were not consistent, and that this was largely due to unique conditions at Logan Airport that have, in the past, been addressed by specific FAA-approved adjustments to the INM process. Massport seeks to work with the FAA to develop and implement approved methods to address these conditions in future AEDT studies.

Massport has historically strived to provide an accurate DNL contour to the public. This has resulted in several model methods and adjustments that are Logan-specific:

- 1996 – Overwater adjustment approved for INM model
- 1999 – Hill Effects adjustment approved for the INM model
- 2004 – All radar tracks used for modeling - RealContours & RealProfiles
    - Stagelength selected by Profile match
    - Custom Profile developed for each flight
- 2007 Incorporation of daily weather averages for modeling

Massport has consistently used the updated INM version in the year of or the year after its release. The Overwater and Hill Effects adjustments were also approved for use in the Logan Airside EIS (LAIP) completed in 2001.

On behalf of Massport, HMMH is evaluating the options and data available in AEDT and is in the process of developing recommended adjustments and non-standard data for AEDT. Massport is requesting AEE review and concurrence of this process to develop and implement adjustments and the use of non-standard data for AEDT for Logan International Airport.

2. OVERWATER ADJUSTMENT

2.1 Background

Logan Airport is surrounded on three sides by water. Massport has several permanent noise monitoring sites located near the edge of the Harbor that have consistently measured noise and reported levels higher than modeled with the standard INM. Massport commissioned additional noise measurement data and along with their consultants developed a method to increase the thrust of aircraft in the INM on takeoff roll to more accurately reflect the monitoring results.

2.2 Current Method

The current method involves the development of an adjustment grid to increase the noise levels from aircraft departing on the runways at Logan Airport. The adjustment generally results in a 6 dB increase from departing aircraft up to 100 feet above the runway. A point is inserted in the profile at 100 feet to return the aircraft to its normal model thrust and climb.

All jet departures for each year are run in the model with the adjustment and then without. The grid without the increase is subtracted from the grid with the increased thrust. This results in an adjustment grid which can be applied to the annual INM result. This results in increased noise levels on the west sides of Runway 15R-33L and portions of Runway 4L-22R that are not adjacent to water however most of this area is airport property.

2.3 Proposed Method

We are aware that ACRP 02-52, *Improving AEDT Noise Modeling of Ground Surfaces* is underway and is designed to provide a method for incorporating modeling of mixed surfaces within the AEDT. Until such time that this option is available in AEDT, we propose to use the GIS capabilities of the AEDT and modify noise levels over identified hard water surfaces. This method will also eliminate noise increases over areas of non-water surfaces as was done by the previous method. The existing Department of Defense NOISEMAP model has a method for modeling mixed surfaces once they have been identified using mapping however its civil aircraft database is very limited (Lear35, older 747, DC9 aircraft). The NOISEMAP model also uses the NMPLOT grid format which can easily be applied to the AEDT NMPLOT result grid.

HMMH has been evaluating this method and propose to incorporate a representative current fleet of aircraft into the Noisemap database to develop an adjustment grid for AEDT. Using the representative fleet, we will model a set of prototypical flight tracks for arrivals and departures in the model both with and without the mixed surfaces adjustment turned on. The grid without the adjustment will be subtracted from the grid with the adjustment and the result added to the AEDT NMPLOT result grid.

As this approach incorporates the effects of surface reflections directly rather than using increased thrust as a proxy, the results should have equal or better accuracy than the former method if implemented correctly.

Please let us know if you concur with this approach or suggest an alternate method.

3. HILL EFFECTS ADJUSTMENT

3.1 Background

This adjustment has been used since 1999 and was developed and approved by FAA for use in the INM (was used in LAIP EIS). Orient Heights just to the northwest of Runway 22R has a rapid increase in elevation and residents look down onto the runway and start of takeoffs from Runway 22R.

Massport conducted a measurement program for this area and an adjustment grid was developed. FAA and the Volpe Center reviewed and ultimately approved for INM at Logan Airport. This resulted in a grid adjustment that shifted the DNL contour up the hill and the adjustment area only applies to the area of the hill.

3.2 Current Method

After the annual DNL contour is completed, the Hill Effects grid is applied to the INM results. This grid increases the DNL values on the side of the hill facing the airport.

3.3 Proposed Method

ACRP 02-79, *AEDT Noise Model Improvements to Account for Terrain and Man-made Structures* is anticipated to begin in 2017. Massport plans to cooperate with the study if possible. Until such time that this study is completed and an option is added to the AEDT to account for this condition, we propose to use the existing Hill Effects adjustment grid. It is a NMPLOT adjustment grid and is easily applied to the AEDT NMplot result grid.

Since this adjustment is unchanged from the former approach, the results should be identical.

Please let us know if you concur with this approach or suggest an alternate method.

4. STAGELENGTH SELECTION

4.1 Background

Logan Airport has a diverse set of operations including domestic and international traffic. The INM modeling since 2004 has includes stagelength selection based on radar profile matching instead of city pair assignments.

4.2 Current Method

For INM, each radar ground track is imported into the study for modeling. The flight profile up to 3,000 feet is compared to the set of available standard profiles in the INM for that aircraft type. Using a least squares fit method; the best match stagelength is selected.

4.3 Proposed Method

For AEDT, following FAA guidance, each city pair would be used to select the stagelength. This generally results in a lower stagelength than the method historically used and does not take advantage of the available radar data. Since, for the Logan Airport modeling each radar ground track is imported into the AEDT database, we propose to use the data to select the stagelength. The flight profile up to 3,000 feet will be compared to the set of available standard profiles in the AEDT for that aircraft type. Using a least squares fit method the best match stagelength is selected. This results in a stagelength best match for each ground track.

This approach is a straightforward port of the former method, and thus should yield identical results.

Please let us know if you concur with this approach or suggest an alternate method.

5. CUSTOM PROFILES

5.1 Background

Since 2004, Logan Airport modeling has used a pre-processor to develop custom profiles for each track based on the radar data. This process uses the SAE 1845 equations and procedure step data available in the model. AEDT now provides a method for developing custom profiles without additional FAA approval.

5.2 Current Method

The current INM modeling for Logan Airport processes each radar track through a pre-processor. This pre-processor uses the radar data, procedure step data and the SAE 1845 equations to develop a custom profile to closely match the radar data profile. This allows the mode to account for ATC level segments and low departure climbs where necessary. If a custom profile cannot be constructed, the flight is modeled using the best match INM standard profile that is available.

5.3 Proposed Method

The AEDT model now has the ability to use altitude control codes (ACC) to allow the model to develop custom profiles. However, there is no guidance on how to use these options in the model. Massport would like to use this option to the extent possible especially since the local community is accustomed to this type of modeling and every radar track is being modeled. Does FAA have any guidance on how best to add the codes? Should they be added every x number of miles in distance or every 1000 feet in altitude? The ACC = 2 (Match) frequently results in errors which then discard the operation instead of defaulting to another method to allow the flight to continue. With hundreds or thousands of tracks, this results in an enormous amount of effort by the modeler to correct these errors in order to retain these tracks. Does the FAA have any suggestions to reduce this effort? We did encounter odd results with AEDT 2B Service Pack 2 but understand these have been corrected in AEDT 2C. Are there other known issues with the custom profile construction and use?

As there are currently many unknowns with this approach, the results are uncertain and Massport looks forward to collaboration with the FAA to ensure that a method can be developed that is robust, repeatable, and automated.

We will be using AEDT 2C to evaluate the application of this method to Logan Airport modeling and any assistance you can provide will be helpful.

6. NON-STANDARD WEATHER DATA

6.1 Background

Since 2007, the daily DNL modeling conducted for BOS has used daily weather averages. The current version of AEDT does not appear to have this capability except for when using High Fidelity weather. The FAA guidance also requires the use of the 30-year normal weather data built into the model or the modeler can request use of other data from the FAA.

6.2 Current Method

The prior INM modeling was run for each day and daily weather averages were used in the INM model to adjust aircraft performance and atmospheric absorption. These daily DNL results were then averaged to develop the annual average DNL.

6.3 Proposed Method

The AEDT only allows for one set of average weather data for the study. Even though, the model can be setup to use a detailed flight schedule which includes the date and time, the weather is fixed to this average unless detailed High Fidelity weather data is selected. We expect that the High Fidelity weather data will further reduce processing times and increase database size therefore we would prefer to just use the daily average.

FAA guidance requires the use of the 30 –year normal data built into the model. Since contours for BOS are developed for each specific year at a minimum we request the use of annual average weather data (acquired from the National Climatic Data Center (NCDC)) for the year being modeled. We also would appreciate any suggestions for using daily average values without having to use the High Fidelity weather data.

Approval of the use of annual weather will improve accuracy for an annual study by removing the effects of long-term weather trends. If a method for using daily weather can be developed, this will allow for equal accuracy to the former approach by modeling performance using existing conditions.

Fundamentals of Acoustics and Environmental Noise

This section introduces the fundamentals of acoustics and noise terminology as well as the effects of noise on human activity and community annoyance.

Introduction to Acoustics and Noise Terminology

Chapter 6, *Noise Abatement* of this *2015 Environmental Data Report (EDR)* relies largely on a measure of cumulative noise exposure over an entire calendar year, in terms of a metric called the Day-Night Average Sound Level (DNL). However, DNL does not always provide a sufficient description of noise for many purposes. Other measures are available to address essentially any issue of concern. This section introduces the following acoustic metrics, which are all related to DNL, but provide bases for evaluating a broad range of noise situations. These metrics include:

- Decibel (dB)
- A-Weighted Decibel (dBA)
- Sound Exposure Level (SEL)
- Equivalent Sound Level (Leq)
- Time Above (TA)
- Time Above, Night (TAN)
- DNL

The Decibel (dB)

All sounds come from a sound source – a musical instrument, a voice speaking, or an airplane that passes overhead. It takes energy to produce sound. The sound energy produced by any sound source is transmitted through the air in the form of sound waves – tiny, quick oscillations of pressure just above and just below atmospheric pressure. These oscillations, or sound pressures, impinge on the ear, creating the sound we hear.

Our ears are sensitive to a wide range of sound pressures. The loudest sounds that we hear without pain have about one million times more energy than the quietest sounds we hear. However, our ears are incapable of detecting small differences in these pressures. Thus, to match how we hear this sound energy, we compress the total range of sound pressures to a more meaningful range by introducing the concept of sound pressure level (SPL). SPL is a measure of the sound pressure of a given noise source relative to a standard reference value (typically the quietest sound that a young person with good hearing can detect). SPLs are measured in decibels (abbreviated dB). Decibels are logarithmic quantities – logarithms of the squared ratio of two pressures, the numerator being the pressure of the sound source of interest, and the denominator being the reference pressure (the quietest sound we can hear).

The logarithmic conversion of sound pressure to SPL means that the quietest sound we can hear (the reference pressure) has a SPL of about zero decibels, while the loudest sounds we hear without pain have SPLs of about 120 dB. Most sounds in our day-to-day environment have SPLs from 30 to 100 dB.

Because decibels are logarithmic quantities, they do not behave like regular numbers with which we are more familiar. For example, if two sound sources each produce 100 dB and they are operated together, they produce only 103 dB – not 200 dB as we might expect. Four equal sources operating simultaneously result in a total SPL of 106 dB. In fact, for every doubling of the number of equal sources, the SPL goes up another three decibels. A tenfold increase in the number of sources makes the SPL go up 10 dB. A hundredfold increase makes the level go up 20 dB, and it takes a thousand equal sources to increase the level 30 dB.

If one source is much louder than another source, the two sources together will produce the same SPL (and sound to our ears) as if the louder source were operating alone. For example, a 100 dB source plus an 80 dB source produces 100 dB when operating together. The louder source “masks” the quieter one, but if the quieter source gets louder, it will have an increasing effect on the total SPL. When the two sources are equal, as described above, they produce a level three decibels above the sound of either one by itself.

From these basic concepts, note that one hundred 80 dB sources will produce a combined level of 100 dB; if a single 100 dB source is added, the group will produce a total SPL of 103 dB. Clearly, the loudest source has the greatest effect on the total decibel level.

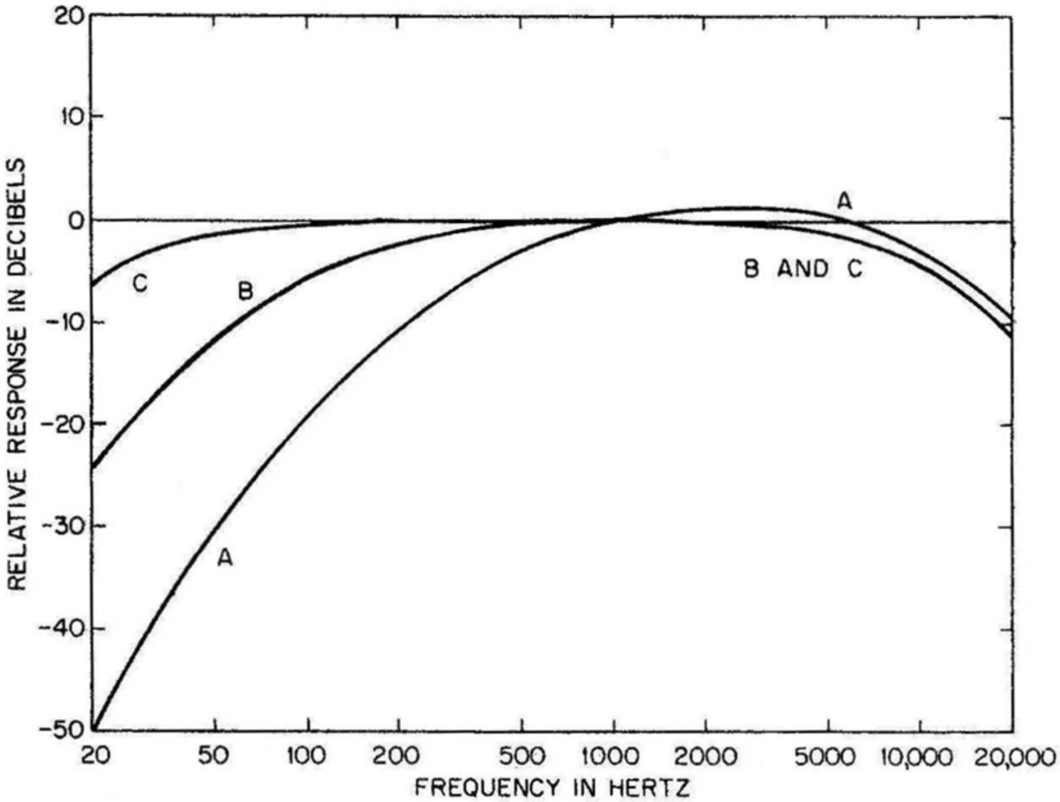
A-Weighted Decibel, dBA

Another important characteristic of sound is its frequency, or “pitch.” This is the rate of repetition of the sound pressure oscillations as they reach our ear. Formerly expressed in cycles per second, frequency is now expressed in units known as Hertz (Hz).

Most people hear from about 20 Hz to about 10,000 to 15,000 Hz. People respond to sound most readily when the predominant frequency is in the range of normal conversation, around 1,000 to 2,000 Hz. Acousticians have developed "filters" to match our ears' sensitivity and help us to judge the relative loudness of sounds made up of different frequencies. The so-called "A" filter does the best job of matching the sensitivity of our ears to most environmental noises. SPLs measured through this filter are referred to as A-weighted levels (dBA). A-weighting significantly de-emphasizes noise at low and very high frequencies (below about 500 Hz and above about 10,000 Hz) where we do not hear as well. Because this filter generally matches our ears' sensitivity, sounds having higher A-weighted sound levels are usually judged louder than those with lower A-weighted sound levels, a relationship which does not always hold true for unweighted levels. It is for these reasons that A-weighted sound levels are normally used to evaluate environmental noise.

Other weighting networks include the B and C filters. They correspond to different level ranges of the ear. The rarely used B-weighting attenuates low frequencies (those less than 500 Hz), but to a lesser degree than A-weighting. C weighting is nearly flat throughout the audible frequency range, hardly de-emphasizing low frequency noise. C-weighted levels can be preferable in evaluating sounds whose low-frequency components are responsible for secondary effects such as the shaking of a building, window rattle, or perceptible vibrations. Uses include the evaluation of blasting noise, artillery fire, and in some cases, aircraft noise inside buildings. **Figure H-1** compares these various weighting networks.

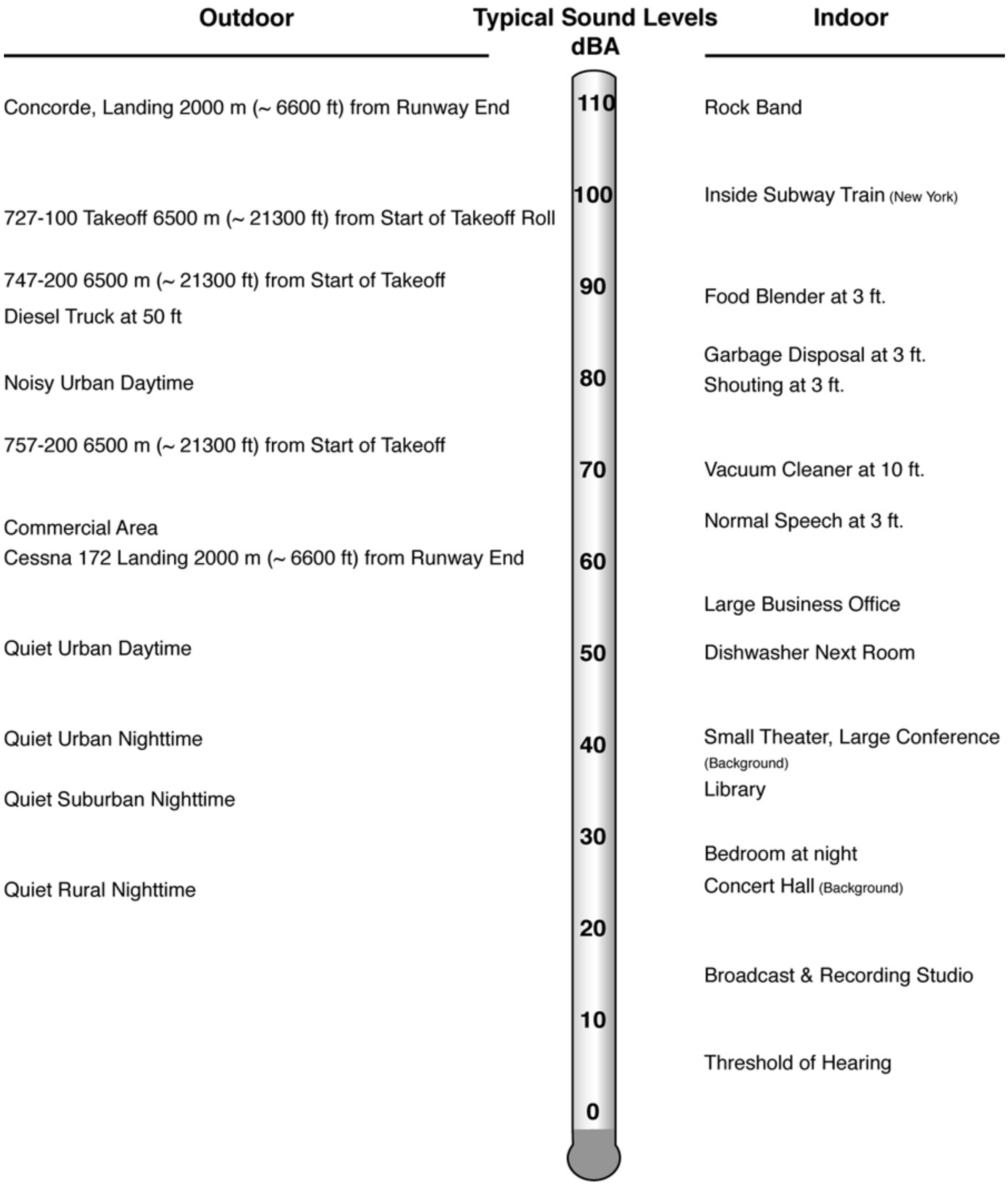
Figure H-1 Frequency-Response Characteristics of Various Weighting Networks



Source: Harris, Cyril M., editor; Handbook of Acoustical Measurements and Noise Control, (Chapter 5, "Acoustical Measurement Instruments"; Johnson, Daniel L.; Marsh, Alan H.; and Harris, Cyril M.); New York; McGraw-Hill, Inc.; 1991; p. 5.13.

Because of the correlation with our hearing, the A-weighted level has been adopted as the basic measure of environmental noise by the U.S. Environmental Protection Agency (EPA) and by nearly every other federal and state agency concerned with community noise. **Figure H-2** presents typical A-weighted sound levels of several common environmental sources.

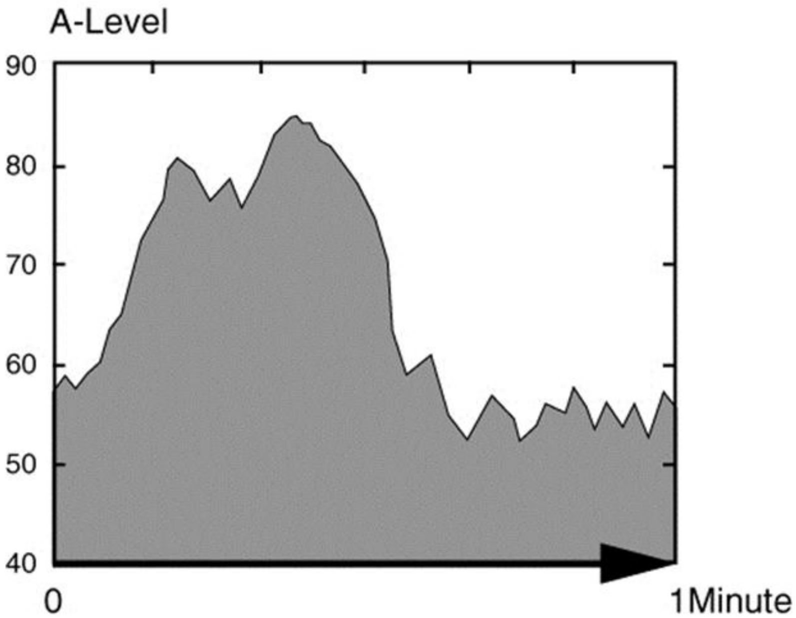
Figure H-2 Common Environmental Sound Levels, in dBA



Source: HMMH (Aircraft noise levels from FAA Advisory Circular 36-3H)

An additional dimension to environmental noise is that A-weighted levels vary with time. For example, the sound level increases as an aircraft approaches, then falls and blends into the background as the aircraft recedes into the distance (though even the background varies as birds chirp or the wind blows or a vehicle passes by). **Figure H-3** illustrates this concept.

Figure H-3 Variations in the A-Weighted Sound Level Over Time



Source: HMMH

Maximum A-Weighted Noise Level, L_{max}

The variation in noise level over time often makes it convenient to describe a particular noise "event" by its maximum sound level, abbreviated as L_{max}. In the figure above, it is approximately 85 dBA.

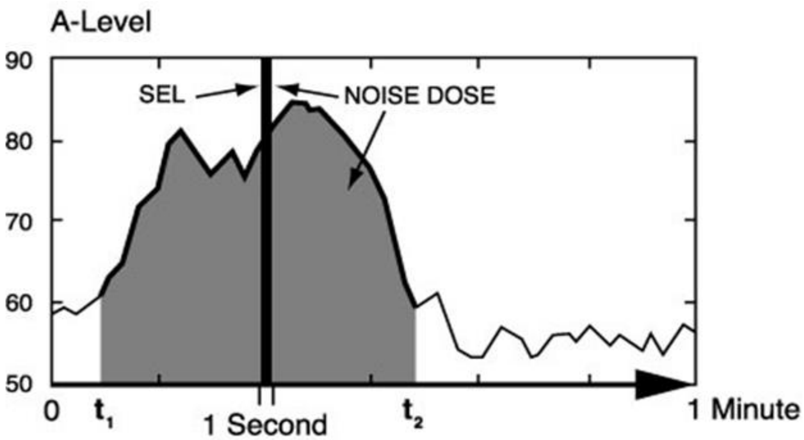
The maximum level describes only one dimension of an event; it provides no information on the cumulative noise exposure. In fact, two events with identical maxima may produce very different total exposures. One may be of very short duration, while the other may continue for an extended period and be judged much more annoying. The next measure corrects for this deficiency.

Sound Exposure Level (SEL)

The most frequently used measure of noise exposure for an individual aircraft noise event (and the measure that Part 150 specifies for this purpose) is the SEL. SEL is a measure of the total noise energy produced during an event, from the time when the A-weighted sound level first exceeds a threshold level (normally just above the background or ambient noise) to the time that the sound level drops back down below the threshold. To allow comparison of noise events with very different durations, SEL “normalizes” the duration in every case to one second; that is, it is expressed as the steady noise level with just a one-second duration that includes the same amount of noise energy as the actual longer duration, time-varying noise. In lay terms, SEL “squeezes” the entire noise event into one second.

Figure H-4 depicts this transformation. The shaded area represents the energy included in an SEL measurement for the noise event, where the threshold is set to 60 dBA. The dark shaded vertical bar, which is 90 dBA high and just one second long (wide), contains exactly the same sound energy as the full event.

Figure H-4 Sound Exposure Level (SEL)



Source: HMMH

Because the SEL is normalized to one second, it will always be larger than the L_{max} for an event longer than one second. In this case, the SEL is 90 dB; the L_{max} is approximately 85 dBA. For most aircraft overflights, the SEL is normally on the order of 7 to 12 dB higher than L_{max}. Because SEL considers duration, longer exposure to relatively slow, quiet aircraft, such as propeller models, can have the same or higher SEL than shorter exposure to faster, louder planes, such as corporate jets.

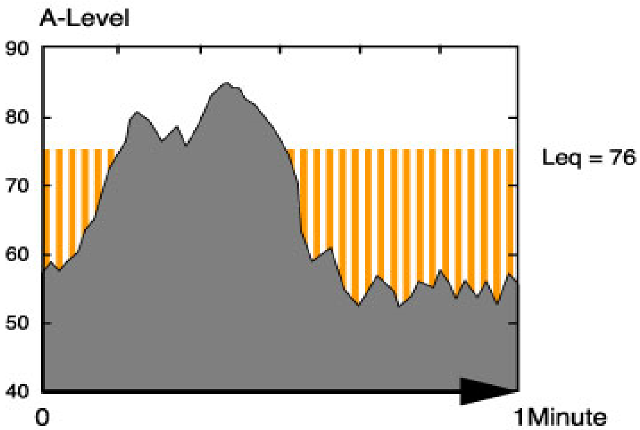
Equivalent Sound Level (L_{eq})

The L_{max} and SEL quantify the noise associated with individual events. The remaining metrics in this section describe longer-term cumulative noise exposure that can include many events.

The Equivalent Sound Level (L_{eq}) is a measure of exposure resulting from the accumulation of A-weighted sound levels over a particular period of interest (e.g., an hour, an eight-hour school day, nighttime, or a full 24-hour day). Because the length of the period can differ, the applicable period should always be identified or clearly understood when discussing the metric. Such durations are often identified through a subscript, for example $L_{eq(8)}$ or $L_{eq(24)}$.

L_{eq} is equivalent to the constant sound level over the period of interest that contains as much sound energy as the actual time-varying level. This is illustrated in **Figure H-5**. Both the solid and striped shaded areas have a one-minute L_{eq} value of 76 dB. It is important to recognize, however, that the two signals (the constant one and the time-varying one) would sound very different in real life. Also, be aware that the "average" sound level suggested by L_{eq} is not an arithmetic value, but a logarithmic, or "energy-averaged" sound level. Thus, loud events dominate L_{eq} measurements.

Figure H-5 Example of a One Minute Equivalent Sound Level (L_{eq})



Source: HMMH

In airport noise studies, L_{eq} is often presented for consecutive one-hour periods to illustrate how the exposure rises and falls throughout a 24-hour period, and how individual hours are affected by unusual activity, such as rush hour traffic or a few loud aircraft.

Time Above (TA)

TA is a metric that gives the duration, in minutes, for which aircraft-related noise exceeds a specified A-weighted sound level during a given period. The measure is referred to generally as TA. For this *2015 EDR*, three threshold sound levels are used in the analysis: 65, 75, and 85 dBA. These times are computed using the Federal Aviation Administration (FAA)-approved Integrated Noise Model (INM).

Time Above Night (TAN)

Identical to TA, except it is computed for only the 9-hour period between 10:00 PM and 7:00 AM. The TAN is also developed using three threshold sound levels 65, 75, and 85 dBA.

Day-Night Average Sound Level (DNL)

Virtually all studies of aircraft noise rely on a slightly more complicated measure of noise exposure that describes cumulative noise exposure during an average annual day: the DNL. The EPA identified DNL as the most appropriate means of evaluating airport noise based on the following considerations:[1]

1. The measure should be applicable to the evaluation of pervasive long-term noise in various defined areas and under various conditions over long periods.

2. The measure should correlate well with known effects of the noise environment and on individuals and the public.

3. The measure should be simple, practical, and accurate. In principal, it should be useful for planning as well as for enforcement or monitoring purposes.

1 Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety," U. S. EPA Report No. 550/9-74-004, March 1974

4. The required measurement equipment, with standard characteristics, should be commercially available.

5. The measure should be closely related to existing methods currently in use.

6. The single measure of noise at a given location should be predictable, within an acceptable tolerance, from knowledge of the physical events producing the noise.

7. The measure should lend itself to small, simple monitors, which can be left unattended in public areas for long periods.

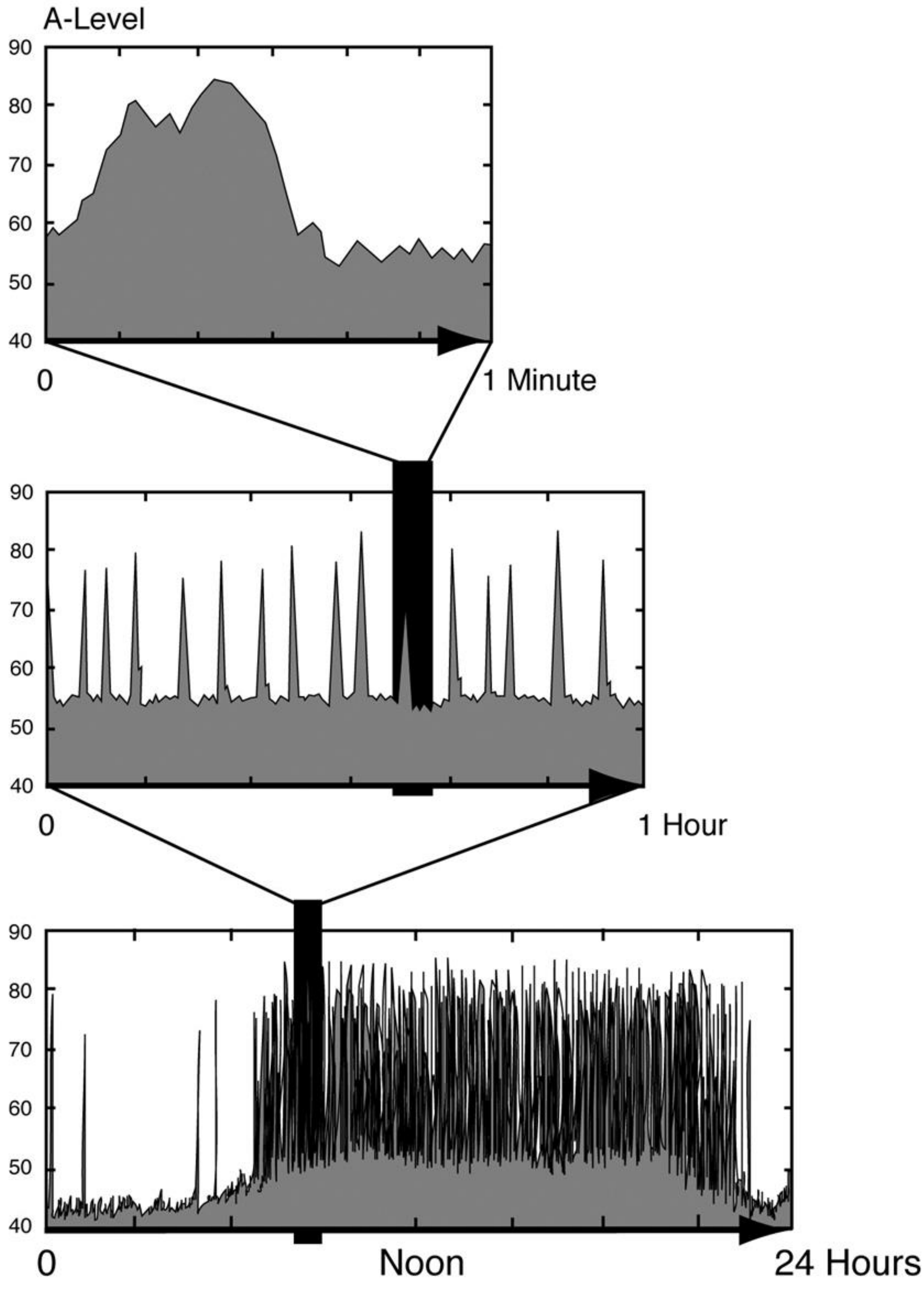
Most federal agencies dealing with noise have formally adopted DNL. The Federal Interagency Committee on Noise (FICON) reaffirmed the appropriateness of DNL in 1992. The FICON summary report stated; "There are no new descriptors or metrics of sufficient scientific standing to substitute for the present DNL cumulative noise exposure metric."

The DNL represents noise as it occurs over a 24-hour period, with one important exception: DNL treats nighttime noise differently from daytime noise. In determining DNL, it is assumed that the A-weighted levels occurring at night (defined as 10:00 PM to 7:00 AM) are 10 dB louder than they really are. This 10 dB penalty is applied to account for greater sensitivity to nighttime noise, and the fact that events at night are often perceived to be more intrusive because nighttime ambient noise is less than daytime ambient noise.

Figure H-4 illustrated the A-weighted sound level due to an aircraft fly-over as it changed with time. The top frame of **Figure H-6** repeats this figure. The shaded area reflects the noise dose that a listener receives during the one-minute period of the sample. The center frame of **Figure H-4** includes this one-minute sample within a full hour. The shaded area represents the noise during that hour with 16 noise events, each producing an SEL. Similarly, the bottom frame includes the one-hour interval within a full 24 hours. Here the shaded area represents the listener's noise dose over a complete day. Note that several overflights occur at a time when the background noise drops some 10 dB, to approximately 45 dBA.

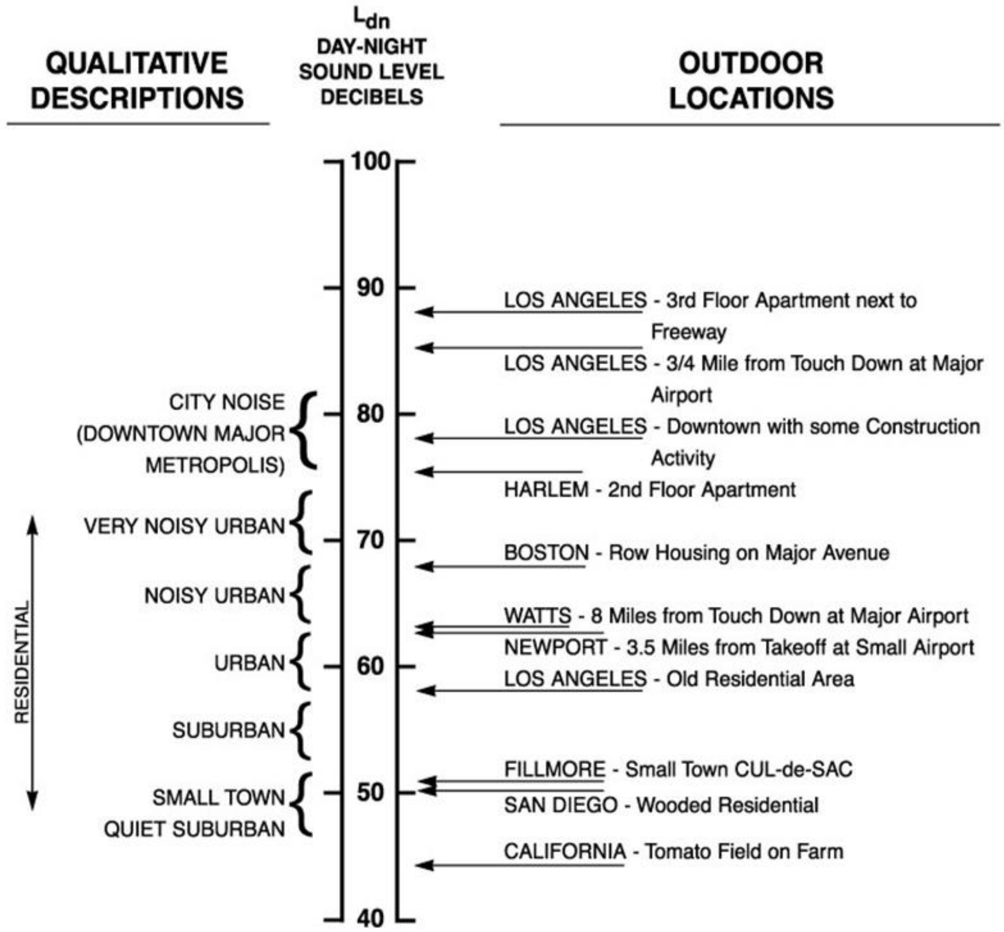
DNL can be measured or estimated. Measurements are practical only for obtaining DNL values for relatively limited numbers of points, and, in the absence of a permanently installed monitoring system, only for relatively short time periods. Most airport noise studies are based on computer-generated DNL estimates, determined by accounting for all of the SELs from individual events, which comprise the total noise dose at a given location. Computed DNL values are often depicted in terms of equal-exposure noise contours (much as topographic maps have contours of equal elevation). **Figure H-7** depicts typical DNL values for a variety of noise environments.

Figure H-6 Daily Noise Dose



Source: HMMH

Figure H-7 Examples of Day-Night Average Sound Levels (DNL)



Source: EPA, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, March 1974, p. 14.

As of May 2015, the FAA is beginning work on the next step in a multi-year Noise Research Program that will update the scientific evidence on the relationship between aircraft noise exposure and its effects on communities around airports. If changes are warranted, FAA will propose revised policy and related guidance and regulations, subject to interagency coordination, as well as public review and comment.

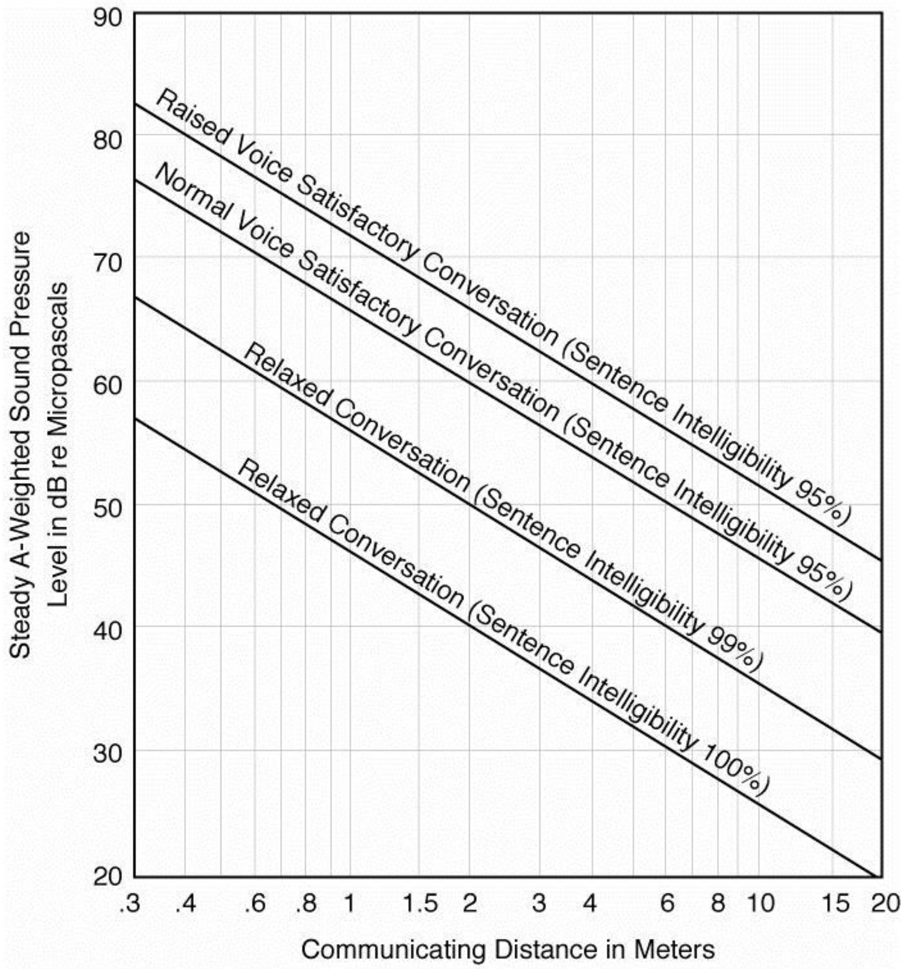
The Effects of Aircraft Noise on People

To residents around airports, aircraft noise can be an annoyance and a nuisance. It can interfere with conversation and listening to television, it can disrupt classroom activities in schools, and it can disrupt sleep. Relating these effects to specific noise metrics helps in the understanding of how and why people react to their environment.

Speech Interference

A primary effect of aircraft noise is its tendency to drown out or "mask" speech, making it difficult to carry on a normal conversation. The sound level of speech decreases as the distance between a talker and listener increases. As the background sound level increases, it becomes harder to hear speech. **Figure H-8** presents typical distances between talker and listener for satisfactory outdoor conversations, in the presence of different steady A-weighted background noise levels for raised, normal, and relaxed voice effort. As the background level increases, the talker must raise his/her voice, or the individuals must get closer together to continue talking.

Figure H-8 Outdoor Speech Intelligibility



Source: EPA, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, March 1974, p. D-5.

As indicated in the figure, "satisfactory conversation" does not always require hearing every word; 95 percent intelligibility is acceptable for many conversations. Listeners can infer a few unheard words when they occur in a familiar context. However, in relaxed conversation, we have higher expectations of hearing speech and generally require closer to 100 percent intelligibility. Any combination of talker-listener distances and background noise that falls below the bottom line in **Figure H-8** (thus assuring 100 percent intelligibility) represents an ideal environment for outdoor speech communication and is considered necessary for acceptable indoor conversation as well.

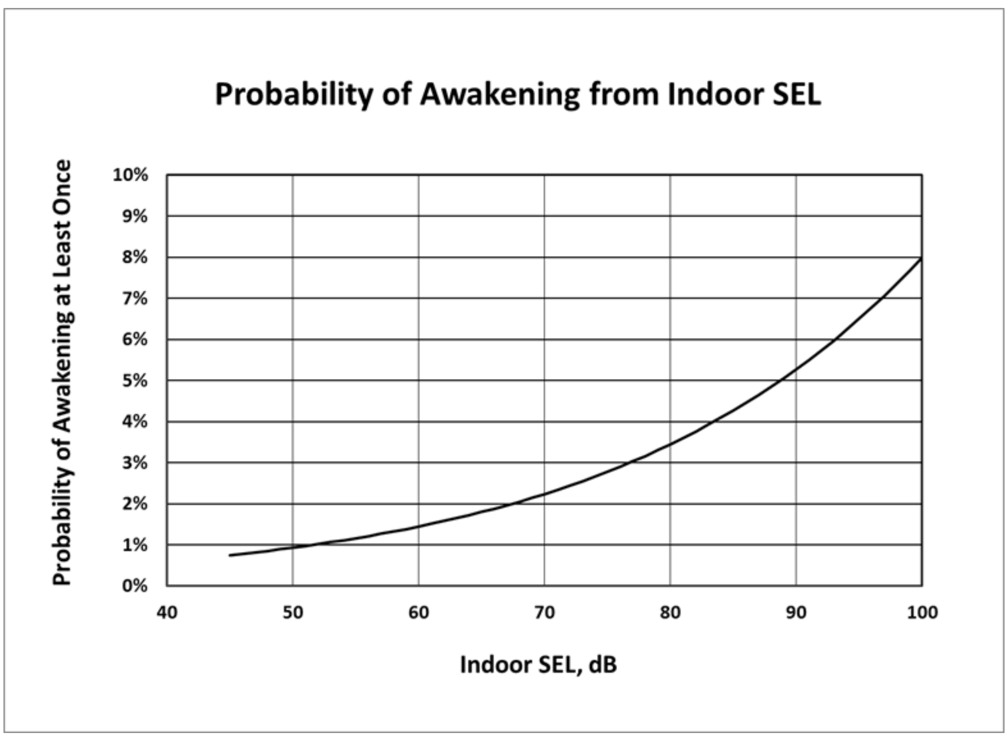
One implication of the relationships in **Figure H-8** is that for typical communication at distances of 3 or 4 feet (1 to 1.5 meters), acceptable outdoor conversations can be carried on in a normal voice as long as the background noise outdoors is less than about 65 dBA. If the noise exceeds this level, as might occur when an aircraft passes overhead, intelligibility would be lost unless vocal effort were increased or communication distance were decreased.

Indoors, typical distances, voice levels, and intelligibility expectations generally require a background level less than 45 dBA. With windows partly open, housing generally provides about 12 dBA of interior-to-exterior noise level reduction. Thus, if the outdoor sound level is 60 dBA or less, there is a reasonable chance that the resulting indoor sound level will afford acceptable conversation inside. With windows closed, 24 dB of attenuation is typical.

Sleep Interference

Research on sleep disruption from noise has led to widely varying observations. In part, this is because (1) sleep can be disturbed without awakening, (2) the deeper the sleep the more noise it takes to cause arousal, and (3) the tendency to awaken increases with age, and other factors. **Figure H-9** shows one such relationship from recent research conducted in the U.S. – the probability that a group of people will be awakened at least once when exposed to a given indoor SEL.

Figure H-9 Probability of Awakening at Least Once from Indoor Noise Event



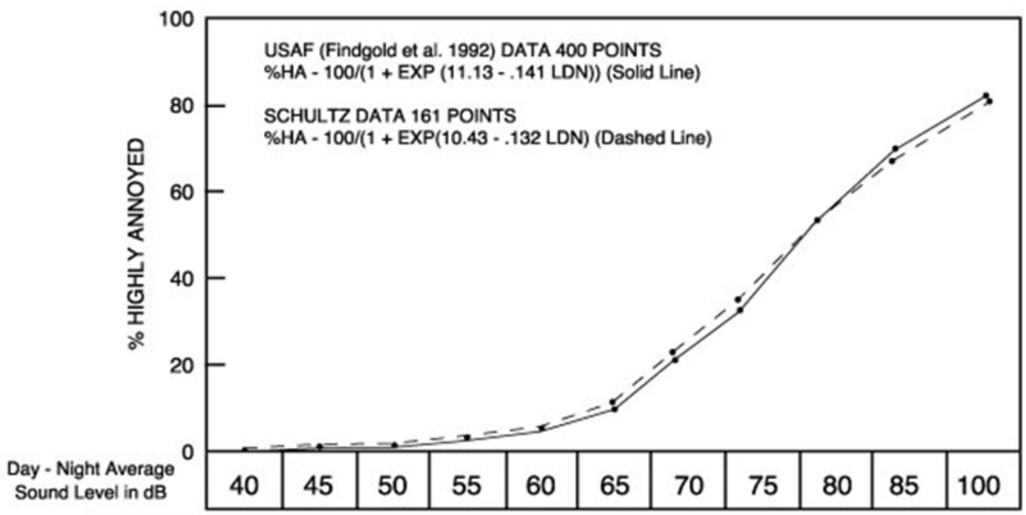
Source: ANSI S12.9-2008/Part 6, Quantities and Procedures for Description and Measurement of Environmental Sound — Part 6: Methods for Estimation of Awakenings Associated with Outdoor Noise Events Heard in Homes; Equation 1

For example, an indoor SEL of 80 dB results in approximately 3.5 percent of the exposed population being awakened. If windows are open in the bedroom on a warm evening and a house provides a typical outside-to-inside noise level reduction of around 15 dB, which suggests it takes an SEL of about 95 dB outdoors to awaken 3.5 percent of the population. The American National Standards Institute (ANSI) has extended this concept further and developed a standard (ANSI S12.9-2008/Part 6) for computing the percentage of the population that is likely to be awakened by multiple noise events occurring throughout the night. The Federal Interagency Committee on Aviation Noise (FICAN) subsequently endorsed the standard as the best available means of estimating behavioral awakenings from aircraft noise.

Community Annoyance

Social survey data make it clear that individual reactions to noise vary widely for a given noise level. Nevertheless, as a group, people's aggregate response is predictable and relates well to measures of cumulative noise exposure such as DNL. **Figure H-10** shows a widely recognized relationship between environmental noise and annoyance.

Figure H-10 Percentage of People Highly Annoyed



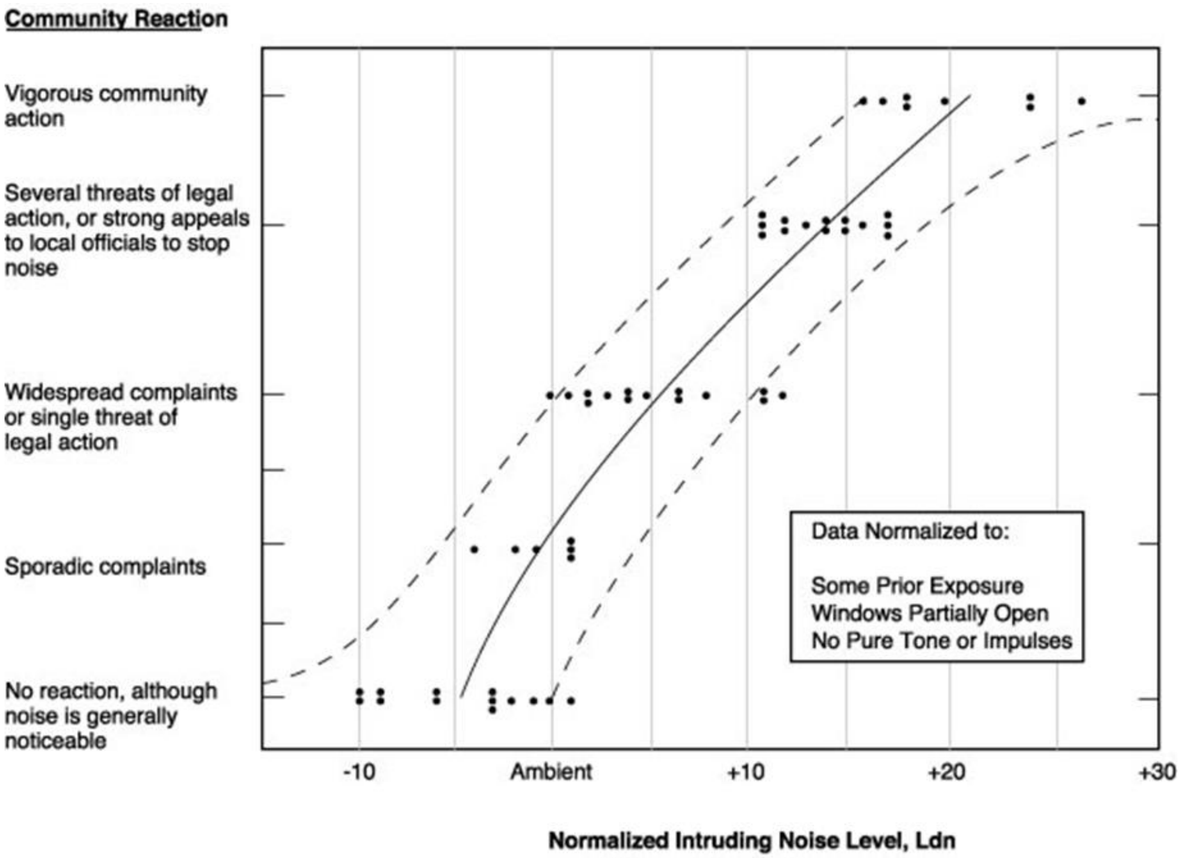
Calculated %HA Points											
USAF	0.41	0.831	1.66	3.31	6.48	12.29	22.1	36.47	53.74	70.16	82.64
SCHULTZ	0.576	1.11	2.12	4.03	7.52	13.59	23.32	37.05	53.25	68.78	81

Source: FICON. "Federal Agency Review of Selected Airport Noise Analysis Issues." August 1992. (From data provided by USAF Armstrong Laboratory). pp. 3-6.

Based on data from 18 surveys conducted worldwide, the curve indicates that at levels as low as DNL 55, approximately 5.0 percent of the people will still be highly annoyed, with the percentage increasing more rapidly as exposure increases above DNL 65.

Separate work by the EPA has shown that overall community reaction to a noise environment can also be related to DNL. This relationship is shown in **Figure H-11**. Levels have been normalized to the same set of exposure conditions to permit valid comparisons between ambient noise environments. Data summarized in **Figure H-11** suggest that little reaction would be expected for intrusive noise levels five decibels below the ambient, while widespread complaints can be expected as intruding noise exceeds background levels by about five decibels. Vigorous action is likely when the background is exceeded by 20 dB.

Figure H-11 Community Reaction as a Function of Outdoor DNL



Source: Wyle Laboratories, "Community Noise," prepared for the U.S. Environmental Protection Agency, Office of Noise Abatement and Control, Washington, D.C., December 1971, pg. 63

Regulatory Framework

Logan Airport Noise Abatement Rules and Regulations

Massport's primary mechanism for reducing noise impacts from Logan Airport's operations is the Noise Rules.[2] The Noise Rules were designed to reduce noise impacts by encouraging use of quieter aircraft by requiring decreased use of noisier aircraft and by limiting nighttime activity by louder Stage 2 types. Many secondary goals aimed at limiting noise in specific areas also were stated.

Specific provisions of the Noise Rules, which continue to serve these goals, include:

- Limiting cumulative noise exposure at Logan Airport (as measured by Massport's CNI) to a maximum of 156.5 Effective Perceived Noise Decibels (EPNdB);

2 The Logan International Airport Noise Abatement Rules and Regulations, effective July 1, 1986, are codified at 740 Code of Massachusetts Regulations (CMR) 24.01 et seq (also known as the Noise Rules).

- Maximizing use of Stage 3 aircraft;
- Restricting nighttime operations by Stage 2 aircraft;
- Placing limitations on times and locations of engine run-ups and use of auxiliary power units (APU); and
- Restricting use of certain runways by noisier aircraft and time of day.

These restrictions and limitations are subject to FAA implementation and safe operation of the airport and airspace.

Federal Aviation Regulation (FAR) Part 36

Logan Airport operates within a framework of federal aviation regulations that limits an airport operator's ability to control noise. For example, the FAA's FAR Part 36[3] sets noise limits for aircraft certification and the procedures by which aircraft noise emission levels must be measured to determine compliance. The regulation defines noise emission limits for turbojets, turboprops, and helicopters, classifying turbojets into categories referred to as stages based on noise levels at each of three locations: takeoff, landing, and to the side of the runway during takeoff (sideline). The stages are:

- Stage 1 aircraft are the oldest and usually have the loudest operations, having preceded the existence of any noise emission regulation. Rare examples include old, restored civil or military aircraft. There are no Stage 1 aircraft operating at Logan Airport
- Stage 2 aircraft are less old and less noisy than Stage 1; they were the first aircraft types required to meet a noise limit. A subsequent regulation, FAR Part 91 (described in the next section), prohibits the operation of a Stage 2 aircraft in the continental U.S. unless its takeoff weight is 75,000 pounds or less. The FAA Reauthorization bill of 2012 also mandated the phase out of Stage 2 aircraft with a takeoff weight less than 75,000 pounds by 2015. In 2014, for the first time, there were no Stage 2 operations at Logan Airport which is a reduction from 2013 when less than 0.1 operations per day occurred (approximately 107 operations)
- Stage 3 aircraft were certified for service before 2006 and have relatively quiet jets, although some are Stage 2 aircraft that have been re-engined, or have been fitted with hushkits, enabling them to meet Stage 3 noise limits.
- Stage 4 aircraft are the newest and quietest of the jets. These aircraft will be required to operate with noise levels at least 10 dB quieter than Stage 3 aircraft at three prescribed measurement points. Jet aircraft certificated after January 1, 2006 must meet the Stage 4 limits. Although not required, the majority of aircraft in the 2015 Logan Airport fleet would also meet the Stage 4 noise limits if they were recertificated.

3 14 CFR Part 36, "Noise Standards: Aircraft Type and Air Worthiness Certification."

FAR Part 150

First implemented in February 1981, FAR Part 150[4] defines procedures that an airport operator must follow if it chooses to conduct and implement an airport noise and land use compatibility plan. Part 150 Noise Compatibility studies require the use of DNL to evaluate the airport noise environment. FAR Part 150 identifies noise compatibility guidelines for different land uses depending on their sensitivity. Key values include a DNL of 75 dB, above which no residences, schools, hospitals, or churches are considered compatible, and a DNL of 65 dB, above which those land uses are considered compatible only if they are sound insulated.

Noise abatement or mitigation measures that an airport operator must consider in a Part 150 study include acquisition of incompatible land, construction of noise barriers, sound insulation of buildings, implementation of a preferential runway program, use of noise abatement flight tracks, implementation of airport use restrictions, and any other actions that would have a beneficial effect on the public.

While Massport has implemented variations of all of these and additional measures at Logan Airport, Massport has not filed an official Part 150 noise compatibility study with the FAA because all of Logan Airport's program elements, while regularly reviewed and updated, preceded the promulgation of Part 150 and are effectively grandfathered under the regulation.

FAR Parts 91 and 161

The Airport Noise and Capacity Act of 1990 (ANCA)[5] directed the U.S. Secretary of Transportation to undertake three key noise-related actions:

- Establish a schedule for a phase out of Part 36 Stage 2 aircraft by the year 2000;
- Establish a program for FAA review of all new airport noise and access restrictions limiting operations of Stage 2 aircraft; and
- Establish a program for FAA review and approval of any restriction that limits operations of Stage 3 aircraft, including public notice requirements.

The FAA addressed these requirements through amendment of an existing federal regulation, "Part 91,"[6] and establishment of a new regulation, "Part 161."[7] ANCA effectively ended Massport's pursuit of any additional operational restrictions outside of this program.

Amendment to Part 91

The FAA establishes and regulates operating noise limits for civil aircraft operation in Subpart I, "Operating Noise Limits," of 14 CFR Part 91, "General Operating and Flight Rules." The noise limits are based on aircraft noise certification criteria set forth in 14 CFR Part 36, "Noise Standards: Aircraft Type and Airworthiness Certification." For transport category "large" aircraft (with maximum takeoff weights of

4 14 CFR Part 150, "Airport Noise Compatibility Planning."
5 Pub. L. No. 101-508, 104 Stat. 1388, as recodified at 49 United States Code 47521- 47533.
6 14 CFR Part 91, "General Operating and Flight Rules."
7 14 CFR Part 161, "Notice and Approval of Airport Noise and Access Restrictions."

12,500 pounds or more) and for all turbojet-powered aircraft, Part 36 identifies four "stages" of aircraft with respect to their relative noisiness:

- Stage 1 aircraft, which have never been shown to meet any noise standards, because they have never been tested, or because they have been tested and failed to meet any established standards;
- Stage 2 aircraft, which meet original noise limits, set in 1969;
- Stage 3 aircraft, which meet more stringent limits, established in 1977; and
- Stage 4 aircraft, which meet the most stringent limits, established in 2005.

In 1976, the FAA ordered a phase out of all Stage 1 aircraft with a maximum gross takeoff weight (MGTOW) over 75,000 pounds, to be completed on January 1, 1985. After that date, Stage 1 civil aircraft over 75,000 pounds MGTOW were banned from operating in the U.S. (with limited exemptions related to commercial service at "small communities," which has since expired in 1988). ANCA required a similar phase out of Stage 2 aircraft over 75,000 pounds by December 31, 1999. The 75,000-pound weight limit exempted most "business" (or "corporate") jets and a very small number of the very smallest "air carrier" type jets until December 31, 2015 when a full ban will take effect.[8] Aircraft operators responded to the Stage 1 and 2 phase-outs by retiring their non-compliant aircraft or modifying some of their aircraft to meet the more stringent standards. The modifications undertaken include installation of quieter engines, noise-reducing physical modifications to the airframe and/or existing engines, and limitation of operating weights and procedures to meet the applicable Part 36 limits. Some former Stage 2 airline aircraft that were "recertificated" as Stage 3 with these modifications still operate at Logan Airport, but are generally declining due to the aircrafts' age and high operating costs (in particular due to the generally low fuel efficiency of these older aircraft).

As airlines add new aircraft, Stage 4 aircraft have been added to their fleets. The new Stage 4 noise standard applies to any new jet aircraft type designs over 12,500 pounds requiring FAA approval after January 1, 2006. The International Civil Aviation Organization (ICAO) has already adopted a similar regulation for international operators, but neither the FAA nor ICAO have indicated there will be restrictions on the remaining recertificated Stage 3 aircraft from carrier fleets.

FAA is in the process of adopting a higher standard of noise classification called Stage 5 which, if implemented, will be effective for new aircraft type certification after December 31, 2017 and December 31, 2020, depending on the weight of the aircraft.[9]

Part 161

FAA implemented the ANCA requirements related to notice, analysis, and approval of use restrictions affecting Stage 2 and 3 aircraft through the establishment of a new regulation, 14 CFR Part 161, "Notice and Approval of Airport Noise and Access Restrictions." In simple terms, Part 161 requires an airport operator that proposes to implement a restriction on Stage 2 or 3 aircraft operations to undertake, document, and publicize certain benefit-cost analyses, comparing the noise benefits of the restriction to

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8 The FAA Modernization and Reform Act of 2012 sets a January 1, 2016 ban of Stage 2 aircraft less than 75,000 lbs.

9 The Notice of Proposed Rulemaking (NPRM) was published on January 14, 2016.

its economic costs. Operators must obtain specific FAA approvals of the analysis, documentation, and notice processes, and – for Stage 3 restrictions – approval of the restriction itself.

Part 161 and ANCA define more demanding requirements and explicit guidance for Stage 3 restrictions. To implement a Stage 3 restriction, formal FAA approval is required. The FAA's role for Stage 2 restrictions is limited to commenting on compliance with Part 161 notice and analysis procedural requirements. Part 161 provides guidance regarding appropriate information to provide in support of these findings. While Part 161 does not require this information for a Stage 2 restriction, Part 161 states that it would be "useful." Moreover, the FAA has required airports to provide this same information for Stage 2 restrictions (and even for Stage 1 restrictions pursued under FAR Part 150), on the grounds that they are required for airports to comply with grant assurance 22(a), "Economic Nondiscrimination," which states that an airport operator "will make its airport available as an airport for public use on reasonable terms and without unjust discrimination to all types, kinds, and classes of aeronautical activities, including commercial aeronautical activities offering services to the public at the Airport."[10]

Although several (on the order of a dozen) airports have embarked on efforts to adopt both Stage 2 and 3 restrictions in the past two decades, the FAA has found that only one, Naples Municipal Airport, a GA airport in Naples, Florida, has fully complied with Part 161 analysis, notice, and documentation requirements for a ban on Stage 2 jet operations. FAA found the airport was in violation of prior FAA grant assurances. The airport operator successfully sued the FAA to overturn that ruling and has implemented the restriction.

ANCA and Part 161 specifically exempt Stage 3 use restrictions that were effective on or before October 1, 1990 and Stage 2 restrictions that were proposed before that date. The Logan Airport Noise Rules were promulgated in 1986; therefore, ANCA and Part 161 have no bearing on their continued implementation in their current form. Any future proposals to make the rules more stringent with regard to Stage 2 operations or to restrict Stage 3 operations in any way would almost certainly trigger Part 161 notice, analysis, and approval processes for Stage 3 restrictions. In 2006, Massport requested an opinion from the FAA regarding the pursuit of a Part 161 waiver or exemption to allow Massport to implement a curfew of nighttime operations of hush-kitted Stage 3 aircraft. FAA informed Massport that a waiver or exemption from the requirements of Part 161 is not authorized under, or consistent with, federal statutory and regulatory requirements. A copy of FAA's letter to Massport was provided in *Appendix H, Noise Abatement* in the *2005 EDR*.

Logan Airport RealContours™ Data Inputs

To relate portions of the foregoing discussion to the specific noise environment around Logan Airport, for this *2015 EDR*, the Massachusetts Port Authority (Massport) has produced a set of DNL noise contours, TA noise metrics, and population counts for 2015 using the pair of software packages RealProfiles™ and RealContours™. This software takes radar data from individual flights occurring throughout the year,

10 FAA Order 5190.6(b),"Airport Compliance Manual" Chapter 13, Section 14, paragraph (a). To be approved, restrictions must meet the following six statutory criteria: 1) The proposed restriction is reasonable, nonarbitrary, and nondiscriminatory. 2) The proposed restriction does not create an undue burden on interstate or foreign commerce. 3) The proposed restriction maintains safe and efficient use of the navigable airspace. 4) The proposed restriction does not conflict with any existing federal statute or regulation. 5) The applicant has provided adequate opportunity for public comment on the proposed restriction. 6) The proposed restriction does not create an undue burden on the national aviation system.

processes the information, and formats it into a form usable as input to the latest version of the FAA's INM, which serves as the computational "engine" for calculating noise. Version 7.0d was used for 2015, incorporating improvements in the updated version of the INM that became available at the end of 2013. The RealProfiles™ and RealContours™ system used the individual flight tracks taken directly from the Massport Noise and Operations Management System (NOMS) rather than relying on consolidated data summaries. For 2014, the INM noise model used 345,090 flights from the NOMS that retained suitable data. For 2015, the INM noise model used 370,014 flights from the NOMS that retained suitable data.

Overview

Standard INM input methodology involves development of operational inputs and calculation of the DNL for a prototypical average annual day.[11] This approach requires manually collecting, refining, and entering the enormous amount of data averaged over a full year of activity at an airport. Typically, the model inputs may include an aircraft fleet mix with several dozen representative aircraft types, on the order of 100 to 300 representative flight tracks (common for a facility the size of Logan Airport), and runway use and flight track use percentages for three or four categories of aircraft types with similar performance characteristics.

This normal approach to noise modeling meets accepted professional standards, and reduces the effort and cost that would be associated with manually entering the parameters for every actual operation. However, it represents a significant simplification of the extraordinary diversity of actual aircraft operations over a year. It also does not take full advantage of the investment that Massport has made in installing and maintaining a state-of-the-art radar system,[12] which automatically collects flight track data and flight identification data for all operations at the Airport and feeds the NOMS.

Instead, for this report, Massport has utilized an INM pre-processor, RealContours™, which takes maximum possible advantage of both the INM's capabilities and the investment that Massport has made in operations monitoring. RealContours™ automates the process of preparing the INM inputs directly from the actual flight operations, and permits airports to model the full diversity of activity as precisely as possible, at a cost equivalent to the more simplified manual approach. RealContours™ improves the precision of modeling by utilizing operations monitoring results in five key areas:

- Directly converts the flight track for every identified aircraft operation to an INM track, rather than assigning multiple operations to a limited number of prototypical tracks.
- Models each operation on the specific runway that it actually used, rather than applying a generalized distribution to broad ranges of aircraft types.
- Models each operation in the period that it occurred, which takes into account delays at the Airport during the year.
- Selects the specific airframe and engine combination to model, on an operation-by-operation basis, based on the registration data for each flight wherever possible; otherwise, the published compositions of the fleets of the specific airlines operating at Logan Airport are used.

11 FAA INM Version 7.0 User's Guide, April 2007, p. 12.

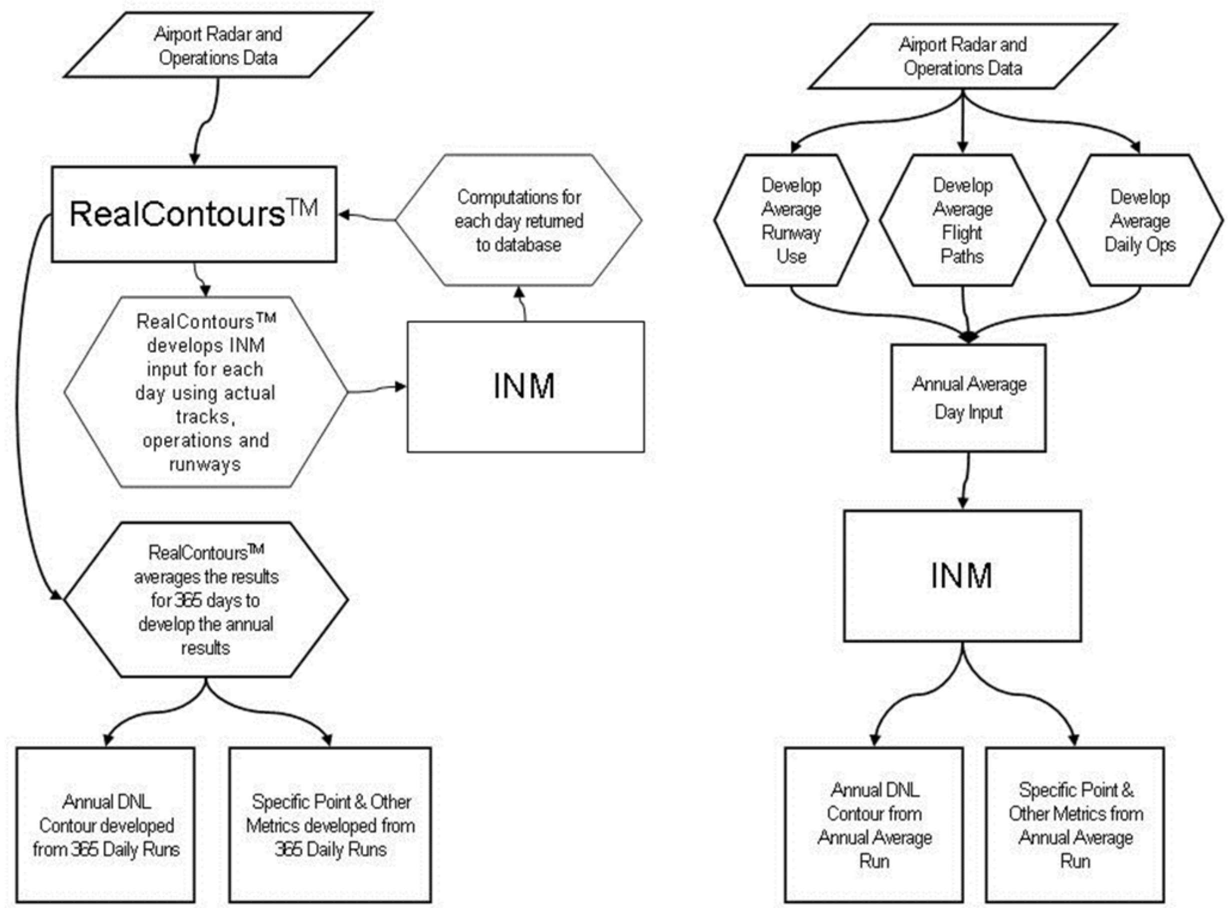
12 Starting in 2010, the Massport system utilized the Airscene.com product of Era Corporation. The radar data source has been updated and the system is now provided by Harris.

- Uses each aircraft's actual performance and altitude profile to develop inputs to the model, which define the actual climb, descent, and speed profile for every operation.

RealContours™ completes the task of computing noise by running the INM in the middle of the night to obtain DNL or other noise metrics for the previous day's operations, and then averages the results to obtain the annual contour.

Figure H-12 provides a schematic representation of the RealContours™ noise modeling process compared to the standard INM process.

Figure H-12 Schematic Noise Modeling Process (Standard INM vs. RealContours™)



Source: FAA, HMMH

INM v7.0d Model

The FAA's INMv7.0d was released for general use on May 23, 2013 with a Software Service Update on September 24, 2013. The latest version has been used for the 2014 and 2015 DNL contour in this report as the primary analytical tool to assess the noise environment at Logan Airport. This version of the model includes data for the Boeing 787-8R, Embraer E170, and Embraer E190, all types in use at Logan Airport.

The remaining sections of this appendix provide several tables describing the data for 2015. Where possible, the data for 2014 are included for comparison and in general the tables listed as (a) are for 2014 and (b) for 2015.

2015 Radar Data

Logan Airport's radar data provide the key to the RealContours™ system. Since February 2004, Massport has collected Passive Surveillance Radar System (PASSUR) radar data, which supplies information to the Airport's web-based Airport Monitor software. This dataset was used for the *2004 Environmental Status and Planning Report (2004 ESPR)* through the *2008 EDR*. Beginning with the *2009 EDR*, Massport began utilizing the radar data from its Exelis NOMS system. These radar data are obtained from a multilateration system of eight sensors deployed around the Airport. The positioning data from all of these sensors are correlated to provide better, more accurate coverage of aircraft (in areas where the traditional FAA radar has limitations) and provide a more complete set of points to define each track. Traditional radar provides points every four to five seconds where the multilateration system provides data every second. In 2015, the Massport system switched to the FAA's Nextgen data which incorporates several different radar systems into one data feed. The system was able to collect 365 complete days of data for 2015 with approximately 88 percent of these tracks usable for the development of the noise exposure contours.

Fleet Mix

The 2015 radar data was first processed to establish a baseline set of operations. After processing the 365 days of radar data (372,930 operations), flight tracks with sufficient operational information were identified to use as the baseline for the 2015 contours. The operations from these tracks were then scaled upwards by airline and aircraft type to match the reported totals provided by Massport for 2015. **Tables H-1a** (2014 for comparison) and **H-1b** (2015) provide the scaled annual operations, by INM aircraft type. Each INM type listed in **Tables H-1a** and **H-1b** is also mapped to a Runway Use group based on its weight and performance characteristics described in the Runway Use section below.

RJs are defined as those aircraft with 90 or fewer seats, consistent with the categorization in Chapter 2, *Activity Levels*.[13] For years prior to 2010, the RJs in this report were classified as aircraft with less than 100 seats. When RJs first started gaining popularity, the aircraft types available were typically 50 seats or less with the traditional air carrier jet being 100 seats and higher. As newer aircraft types have become available, the smaller 35 to 50 seat types have been replaced by 70 to 99-seat types, with the 90 and above seat types flying many of the traditional air carrier routes. The majority of the newer types fall into two categories: the 70 to 75-seat category, which remain categorized as RJs, and the 91- to 99-seat

13 U.S. Code, 2006 Edition, Supplement 3, Title 49 – Transportation Subtitle VII – Aviation Programs Part A – Air Commerce and Safety, Subpart II, Economic Regulation, Chapter 417 - Operations or Carriers, Subchapter III - Regional Air Service Incentive Program, Sec. 41762 – Definitions – defines RJ air carrier service to be aircraft with a maximum of 75 seats. Therefore, this report categorizes aircraft with 70-75 seats and below as RJ and aircraft with 90 seats and higher aircraft as air carrier (Note: there are no types with 75 to 90 seats).

category, which are categorized as air carrier jets. The Embraer 190 falls into this category and is now in the Light Jet B group.

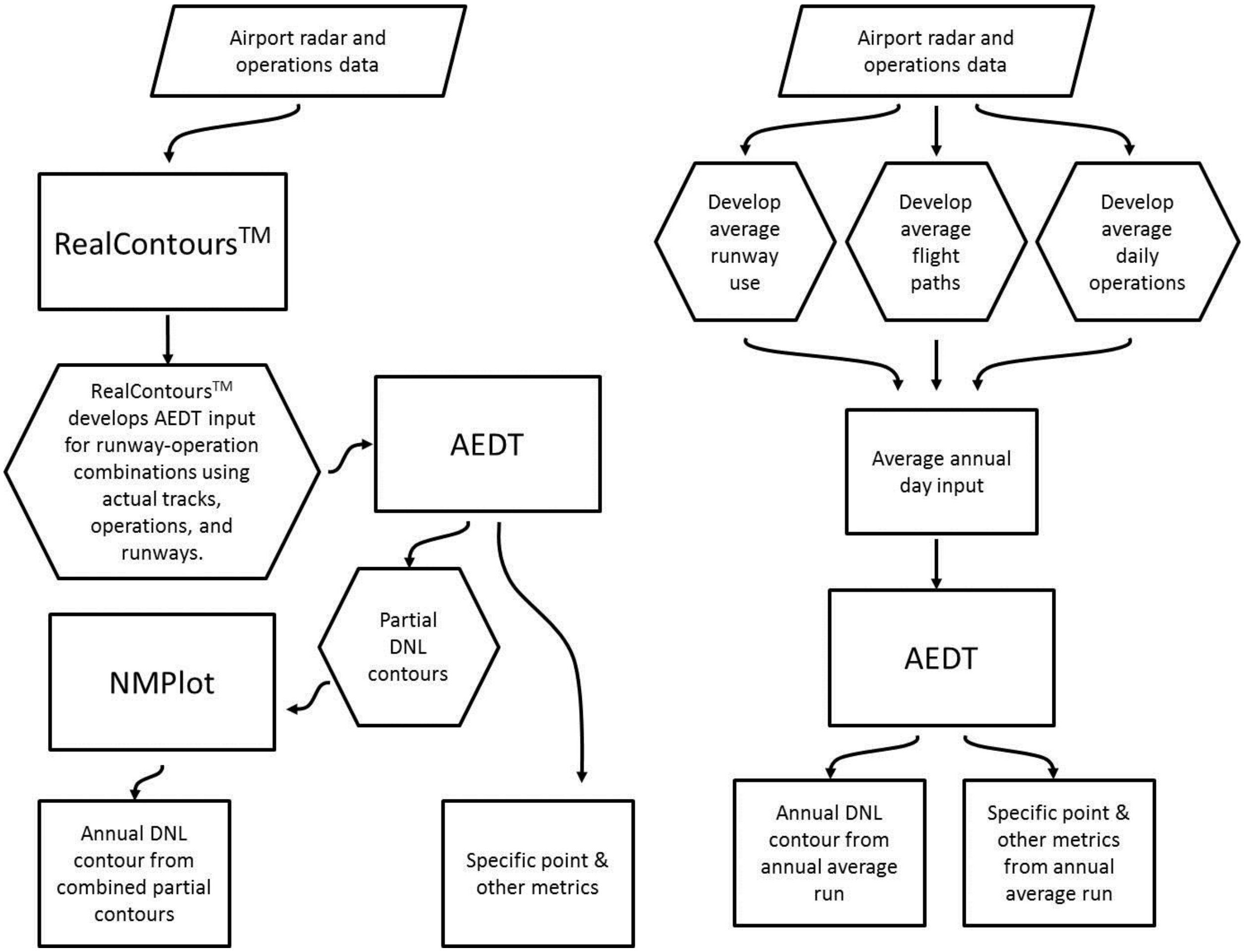
AEDT 2b Model Evaluation

The FAA's AEDT version 2b was released for general use on May 29, 2015 with a service pack SP2 released on December 22, 2015. Massport has been evaluating this version for use in the EDR. In September 2016, FAA released AEDT 2C with adjustments and modifications to the model. The AEDT model incorporates several new features including updated atmospheric absorption and bank angle adjustments. The FAA recommends, the atmospheric absorption type "SAE-ARP-5534" must be selected in AEDT Processing Options. This function uses the method described in Society of Automotive Engineers' (SAE) Aerospace Recommended Practice (ARP) 5534, taking into account changes in atmospheric absorption due to airport specific temperature, relative humidity, and atmospheric pressure.[14] The bank angle is calculated based on ground track curvature and an airplane speed and takes into account the position of the aircraft engines as it passes through a turn.

The INM modeling for Logan Airport includes several specific adjustments that are incorporated into the model and these need to be developed and evaluated for use with AEDT. Massport is working with FAA to develop the proper adjustments and to seek their approval for its use. Massport expects to have these AEDT adjustments ready for inclusion in the *2016 ESPR* and AEDT is expected to be the official model for next year's ESPR.

Similar to the INM modeling, the Logan Airport radar data will be processed through the RealContours™ AEDT pre-processor. This prepares each ground track to be modeled in AEDT (the same as INM) and assigns the same model aircraft type as INM. These data will be entered into the AEDT model database and run as shown in **Figure H-13.**

Figure H-13 Schematic Noise Modeling Process (Standard AEDT vs. RealContours™ AEDT Process)



Source: FAA, HMMH

Table H-1a 2014 Annual Modeled Operations

		Arrivals		Departures		
INM Type	**Group**	**Day**	**Night**	**Day**	**Night**	**Total**
Commercial Jet						
747400	Heavy Jet A	1,223	9	859	373	2,463
7478	Heavy Jet A	2	0	0	2	3
A340-211	Heavy Jet A	701	4	348	357	1,408
A340-642	Heavy Jet A	398	1	207	193	799
A380-841	Heavy Jet A	1	0	1	0	2
767300	Heavy Jet B	356	243	331	269	1,198
767400	Heavy Jet B	203	1	201	3	408
767CF6	Heavy Jet B	13	14	13	13	53
767JT9	Heavy Jet B	165	79	1	243	489
777200	Heavy Jet B	775	88	726	137	1,726
7773ER	Heavy Jet B	308	0	11	298	616
7878R	Heavy Jet B	507	0	504	3	1,013
A300-622R	Heavy Jet B	185	481	318	348	1,331
A310-304	Heavy Jet B	266	7	34	238	545
A330-301	Heavy Jet B	1,441	10	1,174	277	2,901
A330-343	Heavy Jet B	646	1	469	179	1,294
DC1010	Heavy Jet B	256	171	137	289	853
DC1030	Heavy Jet B	72	63	50	84	269
MD11GE	Heavy Jet B	216	84	153	147	599
MD11PW	Heavy Jet B	125	60	93	92	370
717200	Light Jet A	2,501	458	2,608	351	5,918
727EM2	Light Jet A	5	0	1	4	10
MD9025	Light Jet A	886	73	879	80	1,917
MD9028	Light Jet A	450	41	455	36	982
737300	Light Jet B	1,607	166	1,625	148	3,547
7373B2	Light Jet B	110	12	107	15	243
737400	Light Jet B	60	25	63	22	170
737500	Light Jet B	6	1	7	0	14
737700	Light Jet B	6,032	2,493	7,071	1,454	17,049
737800	Light Jet B	13,591	5,544	16,370	2,765	38,270
737N17	Light Jet B	1	0	1	0	2
757300	Light Jet B	242	96	329	9	678
757PW	Light Jet B	2,833	572	3,007	398	6,809
757RR	Light Jet B	3,294	707	3,596	405	8,000
A319-131	Light Jet B	8,127	2,275	8,837	1,566	20,806
A320-211	Light Jet B	3,630	716	3,880	466	8,693
A320-232	Light Jet B	15,555	5,506	18,160	2,902	42,123
A321-232	Light Jet B	2,043	698	2,312	428	5,481
EMB190	Light Jet B	29,268	2,968	28,378	3,858	64,472

Table H-1a 2014 Annual Modeled Operations

		Arrivals		Departures		
INM Type	**Group**	**Day**	**Night**	**Day**	**Night**	**Total**
EMB195	Light Jet B	13	1	14	0	28
MD82	Light Jet B	9	0	6	3	18
MD83	Light Jet B	878	55	827	106	1,866
CL601	RJ	5,140	334	5,305	168	10,947
CRJ9-ER	RJ	3,489	285	3,342	432	7,547
CRJ9-LR	RJ	1,680	109	1,571	218	3,577
EMB145	RJ	60	1	55	6	122
EMB14L	RJ	1,947	64	1,798	213	4,022
EMB170	RJ	4,621	288	4,539	370	9,818
EMB175	RJ	3,946	126	3,861	211	8,143
LEAR35	RJ	21	6	22	5	54
Commercial Jets Subtotal		**119,899**	**24,934**	**124,652**	**20,181**	**289,666**
Commercial Non-Jet						
BEC58P	Non-jet	17,245	295	17,414	126	35,080
CNA182	Non-jet	2	0	2	0	4
CNA208	Non-jet	210	2	210	2	424
DHC8	Non-jet	1,519	13	1,519	13	3,063
DHC830	Non-jet	2,224	147	2,152	220	4,743
DO328	Non-jet	10	0	10	0	19
SF340	Non-jet	2,183	8	2,186	5	4,382
Commercial Non-Jet Operations Subtotal		**23,392**	**465**	**23,492**	**366**	**47,715**
Commercial Aircraft Total		**143,291**	**25,400**	**148,143**	**20,547**	**337,381**
General Aviation						
74720B	Heavy Jet A	1	1	2	0	4
DC870	Heavy Jet A	8	0	8	0	15
767300	Heavy Jet B	1	1	2	0	4
7878R	Heavy Jet B	8	0	8	0	15
727EM1	Light Jet A	4	0	3	1	9
727EM2	Light Jet A	1	2	0	3	6
737400	Light Jet B	4	1	5	0	11
737700	Light Jet B	26	0	23	2	51
737800	Light Jet B	13	15	21	7	55
757PW	Light Jet B	3	1	4	0	9
MD83	Light Jet B	6	2	7	1	17
1900D	Non-jet	2	0	2	0	4
BEC58P	Non-jet	480	22	476	26	1,004

Table H-1a 2014 Annual Modeled Operations

		Arrivals		Departures		
INM Type	**Group**	**Day**	**Night**	**Day**	**Night**	**Total**
CNA172	Non-jet	84	0	83	1	168
CNA182	Non-jet	59	0	59	0	117
CNA206	Non-jet	97	0	95	2	193
CNA208	Non-jet	1,140	109	1,172	82	2,503
CNA20T	Non-jet	3	1	4	0	8
CNA441	Non-jet	566	76	563	80	1,285
DHC8	Non-jet	7	0	7	0	14
DHC830	Non-jet	12	1	12	1	27
DO228	Non-jet	430	38	442	29	938
DO328	Non-jet	8	0	8	0	16
GASEPF	Non-jet	8	0	8	0	16
GASEPV	Non-jet	512	36	526	23	1,096
PA28	Non-jet	20	2	23	0	45
PA30	Non-jet	1	0	1	0	2
PA31	Non-jet	54	3	54	2	113
SF340	Non-jet	14	0	14	0	29
CIT3	RJ	48	4	50	2	105
CL600	RJ	1,079	83	1,079	85	2,326
CL601	RJ	1,067	84	1,092	61	2,304
CNA500	RJ	72	6	70	8	156
CNA510	RJ	53	7	50	10	121
CNA525C	RJ	346	36	340	42	764
CNA55B	RJ	212	22	215	19	466
CNA560E	RJ	526	44	539	31	1,140
CNA560U	RJ	137	8	129	15	289
CNA560XL	RJ	969	81	987	69	2,107
CNA680	RJ	493	34	498	31	1,055
CNA750	RJ	522	45	539	28	1,133
CRJ9-ER	RJ	3	0	3	0	6
ECLIPSE500	RJ	31	4	33	2	70
EMB145	RJ	71	10	73	8	162
F10062	RJ	484	57	504	40	1,084
GII	RJ	4	0	4	0	8
GIIB	RJ	17	1	16	2	37
GIV	RJ	539	51	542	48	1,181
GV	RJ	737	68	748	57	1,610
IA1125	RJ	91	2	90	3	187
LEAR25	RJ	6	0	5	1	12
LEAR35	RJ	1,349	127	1,355	120	2,950
MU3001	RJ	553	42	554	41	1,191

Table H-1a 2014 Annual Modeled Operations

		Arrivals		Departures		
INM Type	**Group**	**Day**	**Night**	**Day**	**Night**	**Total**
ECLIPSE500	RJ	30	2	31	1	64
EMB145	RJ	74	15	74	15	177
F10062	RJ	455	47	470	32	1,004
GIIB	RJ	23	2	25	1	51
GIV	RJ	692	70	700	62	1,524
GV	RJ	686	78	690	74	1,528
IA1125	RJ	125	12	127	10	273
LEAR25	RJ	4	0	4	0	9
LEAR35	RJ	1,423	159	1,427	155	3,163
MU3001	RJ	537	38	542	33	1,149
General Aviation Total		**12,110**	**1,099**	**12,198**	**1,010**	**26,417**
Grand Total		**155,401**	**26,499**	**160,341**	**21,557**	**363,799**

Source: HMMH, 2014.
Notes: BEC58P is the AEDT substitution for the Cessna 402.
The CRJ9-ER in the RJ category is the CRJ700 aircraft.
Annual operations modeled in the 2014 Annual contour.
Some totals may not match due to rounding.

Table H-1b 2015 Annual Modeled Operations

		Arrivals		Departures		
INM Type	**Group**	**Day**	**Night**	**Day**	**Night**	**Total**
Commercial Jet						
74720B	Heavy Jet A	1	0	0	1	2
747400	Heavy Jet A	1,260	33	862	431	2,586
7478	Heavy Jet A	156	0	150	5	311
A340-211	Heavy Jet A	564	6	191	379	1,139
A340-642	Heavy Jet A	350	0	230	120	701
767300	Heavy Jet B	976	489	824	641	2,931
767400	Heavy Jet B	282	3	252	33	570
767CF6	Heavy Jet B	69	7	49	27	151
767JT9	Heavy Jet B	95	28	19	104	245
777200	Heavy Jet B	583	110	578	116	1,387
7773ER	Heavy Jet B	581	66	129	518	1,293
7878R	Heavy Jet B	870	0	747	123	1,739
A300-622R	Heavy Jet B	182	448	314	316	1,259
A310-304	Heavy Jet B	240	18	58	200	517
A330-301	Heavy Jet B	1,399	9	1,050	359	2,817
A330-343	Heavy Jet B	553	7	395	165	1,119
DC1010	Heavy Jet B	217	186	218	185	806
DC1030	Heavy Jet B	64	50	53	60	227
MD11GE	Heavy Jet B	32	9	27	15	82
MD11PW	Heavy Jet B	12	12	9	15	48
717200	Light Jet A	3,814	656	3,892	579	8,942
727EM2	Light Jet A	0	2	2	0	4
MD9025	Light Jet A	1,129	114	1,172	72	2,487
MD9028	Light Jet A	554	44	569	30	1,197
737300	Light Jet B	1,963	353	1,939	377	4,633
7373B2	Light Jet B	127	27	128	26	308
737400	Light Jet B	27	14	26	15	82
737500	Light Jet B	0	0	0	0	0
737700	Light Jet B	6,690	2,432	7,468	1,657	18,247
737800	Light Jet B	13,986	5,609	16,305	3,289	39,188
757300	Light Jet B	558	290	615	233	1,696
757PW	Light Jet B	2,193	550	2,392	352	5,487
757RR	Light Jet B	2,677	473	2,670	480	6,300
A319-131	Light Jet B	9,100	2,030	9,717	1,413	22,260
A320-211	Light Jet B	3,809	1,085	4,255	639	9,788
A320-232	Light Jet B	16,664	5,833	19,778	2,719	44,994
A321-232	Light Jet B	2,704	877	2,975	607	7,163
EMB190	Light Jet B	27,031	3,582	26,711	3,908	61,232
EMB195	Light Jet B	1,720	198	1,732	186	3,836
MD82	Light Jet B	15	0	15	0	30

Table H-1b	2015 Annual Modeled Operations					
		Arrivals		Departures		
INM Type	**Group**	**Day**	**Night**	**Day**	**Night**	**Total**
MD83	Light Jet B	992	33	974	51	2,049
CL600	Light Jet B	2	0	2	0	4
CL601	RJ	4,713	266	4,805	176	9,960
CNA680	RJ	1	3	4	0	9
CRJ9-ER	RJ	3,650	192	3,510	331	7,683
CRJ9-LR	RJ	1,610	75	1,509	176	3,369
EMB145	RJ	114	1	114	1	229
EMB14L	RJ	2,124	14	2,088	49	4,275
EMB170	RJ	2,458	111	2,445	124	5,138
EMB175	RJ	3,744	54	3,695	103	7,595
F10062	RJ	9	0	9	0	17
GV	RJ	1	0	1	0	1
LEAR35	RJ	14	1	13	2	30
Commercial Jets Subtotal		**122,677**	**26,398**	**127,682**	**21,403**	**298,160**
Commercial Non-Jet						
BEC58P	Non-jet	17,650	308	17,864	172	35,994
CNA208	Non-jet	227	0	222	5	454
DHC8	Non-jet	970	2	960	13	1,944
DHC830	Non-jet	2,081	150	2,002	229	4,463
DO228	Non-jet	1	0	1	0	2
SF340	Non-jet	1,873	0	1,875	0	3,747
Commercial Non-Jet Operations Subtotal		**22,801**	**461**	**22,923**	**419**	**46,604**
Commercial Aircraft Total		**145,479**	**26,858**	**150,605**	**21,822**	**344,764**
General Aviation						
74720B	Heavy Jet A	2	2	2	2	8
777200	Heavy Jet B	1	0	1	0	2
A330-301	Heavy Jet B	3	0	2	1	6
DC93LW	Light Jet A	0	1	1	0	2
737700	Light Jet B	12	2	12	1	27
757PW	Light Jet B	10	0	6	4	21
757RR	Light Jet B	3	3	4	1	10
A319-131	Light Jet B	3	2	5	0	10
EMB195	Light Jet B	0	2	1	1	4
MD81	Light Jet B	4	3	4	3	14
MD83	Light Jet B	6	2	7	1	17
1900D	Non-jet	2	0	2	0	4

Table H-1b 2015 Annual Modeled Operations

		Arrivals		Departures		
INM Type	**Group**	**Day**	**Night**	**Day**	**Night**	**Total**
BEC58P	Non-jet	480	22	476	26	1,004
CNA172	Non-jet	84	0	83	1	168
CNA182	Non-jet	59	0	59	0	117
CNA206	Non-jet	97	0	95	2	193
CNA208	Non-jet	1,140	109	1,172	82	2,503
CNA20T	Non-jet	3	1	4	0	8
CNA441	Non-jet	566	76	563	80	1,285
DHC8	Non-jet	7	0	7	0	14
DHC830	Non-jet	12	1	12	1	27
DO228	Non-jet	430	38	442	29	938
DO328	Non-jet	8	0	8	0	16
GASEPF	Non-jet	8	0	8	0	16
GASEPV	Non-jet	512	36	526	23	1,096
PA28	Non-jet	20	2	23	0	45
PA30	Non-jet	1	0	1	0	2
PA31	Non-jet	54	3	54	2	113
SF340	Non-jet	14	0	14	0	29
CIT3	RJ	48	4	50	2	105
CL600	RJ	1,079	83	1,079	85	2,326
CL601	RJ	1,067	84	1,092	61	2,304
CNA500	RJ	72	6	70	8	156
CNA510	RJ	53	7	50	10	121
CNA525C	RJ	346	36	340	42	764
CNA55B	RJ	212	22	215	19	466
CNA560E	RJ	526	44	539	31	1,140
CNA560U	RJ	137	8	129	15	289
GV	RJ	737	68	748	57	1,610
IA1125	RJ	91	2	90	3	187
LEAR25	RJ	6	0	5	1	12
LEAR35	RJ	1,349	127	1,355	120	2,950
MU3001	RJ	553	42	554	41	1,191
General Aviation Total		**12,951**	**1,122**	**13,110**	**983**	**28,166**
Grand Total		**158,430**	**27,980**	**163,715**	**22,805**	**372,930**

Source: HMMH, 2016.

Notes: BEC58P is the AEDT substitution for the Cessna 402.
The CRJ9-ER in the RJ category is the CRJ700 aircraft
Annual operations modeled in the 2015 Annual contour.
Some totals may not match due to rounding.

Runway Use

RealContours™ determines which runway was used by each aircraft type and whether it was a daytime or nighttime operation directly from the radar data. The summary of daytime and nighttime runway usages presented here is broken into six representative aircraft groups listed below with example aircraft types from each group, grouped in this format to allow comparison with prior years (see **Tables H-2a** and **H-2b**):

- Heavy Jet A – B747s, A340s, DC-8s;
- Heavy Jet B – B767s, B777s, A300s, A310s, A330s, DC-10s, L1011s, MD-11s;
- Light Jet A – B717s, B727s, DC-9s, F100s, MD-90s;
- Light Jet B – B737s, B757s, A319s, A320s, B-146s, MD-80s, E190;
- Regional Jet (RJ) – E135, E145, E170, CRJ2, CRJ7, CRJ9, J328 and Corporate Jets; and
- Turboprops and Piston Aircraft (non-jets).

Table H-2a shows the runway use that was used to model the 2014 noise conditions. **Table H-2b** shows the runway used to model the 2015 noise conditions. As described above, turbojet aircraft in the table were grouped into different categories for reporting purposes. Because the 2014 and 2015 contours developed using RealContours™ reflect the individual use of the runways by each INM aircraft type, they accurately represent Logan Airport's noisiest aircraft by modeling them on the actual runways that they used during the year. The modeled runway use for each particular aircraft type may be different from the overall group runway use presented in **Table H-2a** for 2014 and **Table H-2b** for 2015.

Comparing **Table H-2b** (2015) with the similar **Table H-2a** (2014) in this *2015 EDR*, the largest change was a 15 percent decrease in the share of nighttime arrivals of the Heavy Jet A group on Runway 22L. These operations shifted to Runway 33L, with an increase of 14 percent, and Runway 4R, with an increase of 3 percent.

Departures on Runway 15R and 22R showed the broadest increases. Heavy Jet departures from Runway 15R had increased shares for both nighttime and daytime operations. The shares of Runway 22R departures increased mainly in the Light Jet and Regional Jet categories, again for both nighttime and daytime operations.

The share of operations on Runway 4R fell broadly across all aircraft groups, with the largest decrease (7 percent) among Heavy Jet A aircraft.

Table H-2a 2014 Modeled Runway Use Percentages by Aircraft Group

	Heavy Jet A		Heavy Jet B		Light Jet A		Light Jet B		Regional Jets		Turboprops	
ARRIVALS												
Runway	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**
04L	0.11	0.00	0.21	0.07	2.83	0.70	4.53	0.62	11.28	2.60	23.60	6.42
04R	40.88	26.86	41.56	24.41	32.38	24.16	32.33	22.47	25.78	25.15	13.56	25.24
09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00
15R	1.86	0.00	2.38	3.74	2.61	1.90	1.90	2.17	2.00	1.30	2.33	1.18
22L	28.13	45.31	23.90	26.43	17.89	32.24	22.86	34.61	22.27	34.95	25.98	34.13
22R	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.03	0.05	3.65	3.25
27	10.94	3.83	16.91	6.02	27.65	16.29	24.43	11.80	20.16	11.97	7.56	8.19
32	0.10	0.00	0.00	0.00	0.00	0.00	0.99	0.00	4.73	0.10	9.36	0.17
33L	17.98	24.01	15.04	39.33	16.63	24.72	12.94	28.33	13.75	23.89	10.32	19.15
33R	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.26	2.28
Total	100.0	100.00	100.00	100.0	100.00	100.00	100.00	100.00	100.00	100.00	100.0	100.0
DEPARTURES												
Runway	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**
04L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.67	14.30
04R	16.59	10.98	14.53	5.83	3.10	4.24	5.07	5.02	1.08	3.01	6.63	3.00
09	9.72	4.55	16.94	16.95	33.52	26.64	31.62	19.14	38.20	24.12	10.51	4.67
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00
15L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
15R	18.12	30.27	10.20	17.22	2.28	10.92	2.67	17.31	1.07	13.51	2.37	13.52
22L	8.65	5.36	7.35	1.83	0.26	0.45	1.86	1.48	0.12	0.19	1.00	1.25
22R	22.13	22.42	22.20	28.73	27.07	24.51	28.75	26.62	29.76	28.75	35.28	36.17
27	0.93	3.43	7.34	6.78	16.55	28.40	12.17	18.70	12.87	19.30	4.84	5.15
32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
33L	23.86	22.99	21.45	22.65	17.21	4.83	17.87	11.72	16.89	11.13	16.59	21.94
33R	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
Total	100.0	100.0	100.00	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Massport, HMMH. 2015.

Notes: Night for noise modeling is defined as 10:00 PM to 7:00 AM.
Nighttime runway restrictions are from 11:00 PM to 6:00 AM.
Values may not add to 100 percent due to rounding.

Table H-2b 2015 Modeled Runway Use by Aircraft Group

	Heavy Jet A		Heavy Jet B		Light Jet A		Light Jet B		Regional Jets		Turboprops	
ARRIVALS												
Runway	**Day (%)**	**Nigh t (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**
04L	0.12	0.00	0.37	0.14	4.38	0.48	4.01	0.24	12.19	0.88	26.03	6.79
04R	38.22	30.12	37.97	20.64	30.88	21.47	32.03	19.12	24.13	22.54	10.80	18.79
09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
15L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00
15R	2.02	2.12	1.61	0.76	1.51	2.29	1.39	2.27	1.22	2.11	0.77	1.21
22L	31.61	29.97	26.64	30.61	17.68	37.07	21.87	35.96	22.52	35.94	29.28	38.31
22R	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.06	0.00	3.65	0.97
27	9.80	0.00	17.55	3.06	30.12	19.26	26.60	12.85	22.50	12.41	7.66	7.61
32	0.00	0.00	0.00	0.00	0.00	0.00	0.87	0.00	3.95	0.13	8.19	0.27
33L	18.23	37.80	15.85	44.79	15.40	19.43	13.22	29.57	13.43	25.99	8.43	21.20
33R	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	4.68	4.85
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
DEPARTURES												
Runway	**Day (%)**	**Nigh t (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Night (%)**	**Day (%)**	**Nigh t (%)**
04L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	19.75	12.19
04R	9.75	7.64	12.31	4.25	1.15	1.25	5.14	3.99	0.94	1.47	4.29	3.61
09	9.02	4.93	15.79	12.78	34.53	25.65	29.41	18.12	36.19	22.01	16.78	11.35
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00
15L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
15R	26.50	34.25	11.91	23.69	1.64	8.72	3.02	18.45	1.05	15.88	2.29	10.86
22L	11.42	4.33	9.34	3.09	0.32	0.15	2.61	1.66	0.06	0.50	0.81	0.32
22R	22.96	23.00	24.48	26.77	33.76	31.56	32.52	25.63	35.84	30.20	35.20	33.48
27	1.09	0.22	6.46	1.59	16.00	27.38	11.55	19.68	11.79	17.18	5.12	7.31
32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
33L	19.27	25.63	19.71	27.83	12.59	5.28	15.76	12.45	14.12	12.76	15.53	20.88
33R	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Massport, HMMH. 2016.

Notes: Night for noise modeling is defined as 10:00 PM to 7:00 AM.
Nighttime runway restrictions are from 11:00 PM to 6:00 AM.
Values may not add to 100 percent due to rounding.

While **Tables H-2a** and **H-2b** present runway use by aircraft groups, **Tables H-3a** and **H-3b** present the total runway use (jets and non-jets) by runway and time of day. The first section of the table displays the operations by runway and time of day for an average day. The second section displays the same information for the year and the last section displays the percent that each runway is used by operation type and time of day. **Table H-3a** shows that on an average day in 2014, Runway 22R had the most departures (146.62 per day) and Runway 4R had the most arrivals (137.42 per day). At night, Runway 22R had the most departures (16.03 per night) but Runway 22L had the most arrivals (24.81 per night). **Table H-3b** shows that on an average day in 2015 Runway 22R had the most departures (165.6 per day) and Runway 4R had the most arrivals (134.85 per day). At night, Runway 22R had the most departures (16.5 per night) but Runway 22L had the most arrivals (27.42 per night).

Table H-3a Summary of Jet and Non-Jet Aircraft Runway Use: 2014

	Runway												
	4L	**4R**	**9**	**14[2]**	**15L**	**15R**	**22L**	**22R**	**27**	**32**	**33L**	**33R**	**Total**
2014 Daily Operations													
Dep Day	16.2	21.4	126.9	0.1	0.0	11.6	6.8	130.6	48.3	0.0	77.4	0.0	439.3
Dep Night	0.2	3.0	11.0	0.0	0.0	10.2	0.9	16.0	9.8	0.0	8.0	0.0	59.1
Arr Day	37.3	120.8	0.1	0.0	0.2	8.6	99.0	2.7	86.8	13.0	55.0	2.3	425.8
Arr Night	0.7	16.6	0.0	0.0	0.0	1.6	24.8	0.1	8.4	0.0	20.5	0.0	72.6
Total Daily Operations	54.4	161.9	138.0	0.1	0.2	32.0	131.6	149.3	153.2	13.0	160.8	2.4	996.7
2014 Annual Operations													
Dep Day	5,901	7,820	46,322	21	3	4,244	2,498	47,667	17,620	0	28,239	6	160,341
Dep Night	83	1,095	4,005	0	0	3,705	327	5,852	3,560	0	2,930	0	21,557
Arr Day	13,630	44,096	40	0	63	3,149	36,146	970	31,680	4,727	20,055	846	155,402
Arr Night	236	6,064	0	0	0	569	9,056	23	3,057	3	7,475	16	26,499
Total Annual Operations	19,850	59,075	50,367	21	65	11,668	48,026	54,511	55,917	4,730	58,699	868	363,797
2014 Percentage Operations													
Dep Day	4%	5%	29%	<1%	<1%	3%	2%	30%	11%	<1%	18%	<1%	100%
Dep Night	<1%	5%	19%	<1%	<1%	17%	2%	27%	17%	<1%	14%	<1%	100%
Arr Day	9%	28%	<1%	<1%	<1%	2%	23%	1%	20%	3%	13%	1%	100%
Arr Night	1%	23%	<1%	<1%	<1%	2%	34%	<1%	12%	<1%	28%	<1%	100%

Source: Massport Noise Office and HMMH 2015.

Notes: The data reflect actual percentages of aircraft operations on each runway end. They should not be confused with effective runway use, which is used by the Preferential Runway Advisory System (PRAS) to derive recommendations for use of a particular runway.
Runway 14-32 is unidirectional.
Values may not add to 100 percent due to rounding.

Table H-3b Summary of Jet and Non-Jet Aircraft Runway Use: 2015

	Runway												
	4L	**4R**	**9**	**14**[2]	**15L**	**15R**	**22L**	**22R**	**27**	**32**	**33L**	**33R**	**Total**
2015 Daily Operations													
Dep Day	14.3	19.7	126.1	0.1	0.0	13.4	9.3	149.0	46.9	0.0	69.4	0.1	448.4
Dep Night	0.2	2.4	10.8	0.0	0.0	11.9	1.1	16.5	10.2	0.0	9.4	0.0	62.5
Arr Day	38.7	118.9	0.1	0.0	0.3	5.6	101.6	2.8	96.6	11.1	55.2	3.4	434.2
Arr Night	0.4	14.9	0.0	0.0	0.0	1.7	27.4	0.0	9.5	0.0	22.7	0.1	76.7
Total Daily Operations	53.6	156.0	137.0	0.1	0.3	32.5	139.4	168.4	163.2	11.1	156.7	3.5	1021.7
2015 Annual Operations													
Dep Day	5,228	7,200	46,028	24	6	4,878	3,405	54,397	17,134	0	25,343	17	163,660
Dep Night	82	889	3,927	0	0	4,347	406	6,022	3,713	0	3,418	0	22,804
Arr Day	14,135	43,410	33	0	106	2,027	37,065	1,033	35,259	4,038	20,146	1,233	158,485
Arr Night	126	5,445	0	0	0	602	10,007	8	3456	4	8,295	36	27,979
Total Annual Operations	19,571	56,944	49,988	24	112	11,854	50,884	61,460	59,562	4,042	57,201	1,287	372,930
2015 Percentage Operations													
Dep Day	3%	4%	28%	<1%	<1%	3%	2%	33%	10%	<1%	15%	<1%	100%
Dep Night	<1%	4%	17%	<1%	<1%	19%	2%	26%	16%	<1%	15%	<1%	100%
Arr Day	9%	27%	<1%	<1%	<1%	1%	23%	1%	22%	3%	13%	1%	100%
Arr Night	<1%	19%	<1%	<1%	<1%	2%	36%	<1%	12%	<1%	30%	<1%	100%

Source: Massport Noise Office and HMMH 2016.

Notes: The data reflect actual percentages of aircraft operations on each runway end. They should not be confused with effective runway use, which is used by the Preferential Runway Advisory System (PRAS) to derive recommendations for use of a particular runway.
Runway 14-32 is unidirectional.
Values may not add to 100 percent due to rounding.

Runway use can also be presented in terms of percent of total operations as shown in **Table H-4** for 2014 and 2015. **Tables H-2a** and **H-2b** total the runway use by aircraft group and time of day. **Tables H-3a** and **H-3b** total the runway use by operation type and time of day. **Table H-4** presents the 2014 and 2015 runway use for all operations which use Logan Airport.

In 2014, Runway 4R was the runway with the highest activity (primarily by jet arrivals) with Runway 33L a very close second (primarily by jet departures), whereas in 2015, Runway 22R was the runway with the highest activity (primarily jet departures) with Runway 27 a very close second (primarily by jet arrivals).

Each year, non-jet activity makes up approximately 8.0 percent of the arrivals and 8.0 percent of the departures at Logan Airport.

Table H-4 Total 2014 and 2015 Modeled Runway Use by All Operations

	Jet Arrivals		Non-Jet Arrivals		Jet Departures		Non-Jet		All Operations
	Day	Night	Day	Night	Day	Night	Day	Night	
Runway					**2014 Operations**				
04L	2.1%	<0.1%	1.7%	<0.1%	0.0%	0.0%	1.6%	<0.1%	5.5%
04R	11.2%	1.6%	1.0%	<0.1%	1.7%	<0.1%	<0.1%	<0.1%	16.2%
9	0.0%	0.0%	<0.1%	0.0%	12.0%	1.1%	0.8%	<0.1%	13.8%
14	0.0%	0.0%	0.0%	0.0%	<0.1%	0.0%	<0.1%	0.0%	<0.1%
15L	0.0%	0.0%	<0.1%	0.0%	0.0%	0.0%	<0.1%	0.0%	<0.1%
15R	0.7%	<0.1%	<0.1%	<0.1%	1.0%	1.0%	<0.1%	<0.1%	3.2%
22L	8.1%	2.4%	1.9%	<0.1%	0.6%	<0.1%	<0.1%	<0.1%	13.2%
22R	<0.1%	<0.1%	<0.1%	<0.1%	10.6%	1.6%	2.5%	<0.1%	15.0%
27	8.2%	0.8%	0.5%	<0.1%	4.5%	1.0%	<0.1%	<0.1%	15.4%
32	0.6%	<0.1%	0.7%	<0.1%	0.0%	0.0%	0.0%	0.0%	1.3%
33L	4.8%	2.0%	0.7%	<0.1%	6.6%	0.8%	1.2%	<0.1%	16.1%
33R	0.0%	<0.1%	<0.1%	<0.1%	0.0%	0.0%	<0.1%	0.0%	<0.1%
Total	35.6%	7.1%	7.1%	<0.1%	36.9%	5.8%	7.2%	<0.1%	100.0%
Runway					**2015 Operations**				
04L	2.0%	<0.1%	1.8%	<0.1%	<0.1%	<0.1%	1.4%	<0.1%	5.2%
04R	10.9%	1.4%	0.8%	<0.1%	1.6%	<0.1%	<0.1%	<0.1%	15.3%
9	0.0%	0.0%	<0.1%	0.0%	11.2%	1.0%	1.2%	<0.1%	13.4%
14	0.0%	0.0%	<0.1%	0.0%	<0.1%	0.0%	<0.1%	0.0%	<0.1%
15L	0.0%	0.0%	<0.1%	0.0%	0.0%	0.0%	<0.1%	0.0%	<0.1%
15R	<0.1%	<0.1%	<0.1%	<0.1%	1.1%	1.1%	<0.1%	<0.1%	3.2%
22L	7.9%	2.6%	2.1%	<0.1%	0.9%	<0.1%	<0.1%	<0.1%	13.6%
22R	<0.1%	<0.1%	<0.1%	<0.1%	12.1%	1.6%	2.5%	<0.1%	16.5%
27	8.9%	0.9%	0.5%	<0.1%	4.2%	1.0%	<0.1%	<0.1%	16.0%
32	0.5%	<0.1%	0.6%	<0.1%	0.0%	0.0%	<0.1%	0.0%	1.1%
33L	4.8%	2.2%	0.6%	<0.1%	5.7%	0.9%	1.1%	<0.1%	15.3%
33R	<0.1%	0.0%	<0.1%	<0.1%	0.0%	0.0%	<0.1%	0.0%	<0.1%
Total	35.4%	7.3%	7.1%	<0.1%	36.8%	5.9%	7.1%	<0.1%	100.0%

Flight Tracks

RealContours™ converts each radar track to an INM model track and then models the scaled aircraft operation on that track. This method keeps the lateral and vertical dispersion of the aircraft types consistent with the radar data, and ensures that anomalies in the departure paths are captured in the RealContours™ system. **Table H-5** lists the number of flight tracks used in the RealContours™ modeling system for 2014 and 2015. Flight tracks from October 2015 are displayed in **Figures 6-3** through **6-9** in Chapter 6, *Noise Abatement*.

Table H-5 Total Count of Flight Tracks Modeled in RealContours™ (2014 and 2015)

	Runway											
	4L	**4R**	**9**	**14**	**15L**	**15R**	**22L**	**22R**	**27**	**32**	**33L**	**33R**
2014												
Departures	5,984	8,915	50,327	21	3	7,950	2,825	53,518	21,180	0	31,169	6
Arrivals	13,866	50,160	39	0	63	3,718	45,201	993	34,736	4,730	27,530	862
2015												
Departures	5,310	8,089	49,955	24	6	9,225	3,811	60,419	20,847	0	28,761	17
Arrivals	14,261	48,855	33	0	106	2,629	47,073	1,041	38,715	4,042	28,440	1,269

Source: HMMH, 2014/2015; Harris NOMS data.

Flight Profiles

To enhance the results from RealContours™, Massport elected to use the companion RealProfiles™ software. By using the actual radar information along with the equations developed for the INM, RealProfiles™ develops an altitude profile for each aircraft operation. This profile is then modeled in the RealContours™ system. As a result, the modeled aircraft follows both the actual radar track on the ground and the actual radar altitude profile in the sky.

RealProfiles™ provides several advantages over the standard INM profile modeling. The standard INM modeling uses a "Stagelength" to identify an aircraft's departure weight and then models a standard departure profile for that Stagelength. Using RealProfiles™, the RealContours™ system selects a weight similar to the standard modeling but then develops a profile to allow the INM aircraft to follow the actual path flown for that route. For example, if aircraft departing from a particular runway are required to remain level at 3,000 feet for a certain distance, RealProfiles™ will develop a profile that remains level for that distance along the track. In contrast, the standard modeling would use the standard INM profile and would not model the level segment.

For 2014, RealProfiles™ was able to compute profiles based on the actual radar data for 98.6 percent of the available departure tracks and 94.8 percent of the available arrivals. For 2015, RealProfiles™ was able to compute profiles based on the actual radar data for 56.3 percent of the available departure tracks and 53.2 percent of the available arrivals. RealProfiles™ uses the INM supplied aircraft performance database to develop its unique profiles; however, for several aircraft in the INM database the aircraft performance data are not available. For those profiles, the INM database contains fixed profiles, which are not modified and are used as supplied with the INM data.

Fleet Mix

As in the past, operations by aircraft types have been summarized into several key categories: commercial (passenger and cargo) operations, Stage 2 or Stage 3 jet aircraft, and turboprop and propeller (non-jet) aircraft. In addition, the operations are split into daytime and nighttime periods, where nighttime hours are defined as 10:00 PM to 7:00 AM, consistent with the definition of DNL. **Table H-6** summarizes the numbers of operations by categories of aircraft operating at Logan Airport from 1990 through 2015. General aviation (GA) operations were not included in the noise modeling prior to 1998 and commercial jet operations were not separated until 1999.

Table H-6 Modeled Daily Operations by Commercial and General Aviation (GA) Aircraft[1] – 1990 to 2015

(Data for the years 2000 to 2015 are shown on the subsequent pages)

		1990	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Commercial Aircraft										
Stage 2 Jets[2]	Day	312.40	228.89	203.34	189.40	156.90	132.40	108.46	84.93	83.30
	Night	19.99	13.13	7.44	10.10	5.50	4.79	7.75	5.92	6.66
	Total	**332.39**	**242.02**	**210.78**	**199.50**	**162.40**	**137.19**	**116.21**	**90.85**	**89.96**
Stage 3 Jets	Day	288.89	384.49	418.99	425.70	429.40	439.81	505.08	541.43	597.28
	Night	57.25	58.29	65.47	62.80	69.00	80.16	85.06	95.54	98.59
	Total	**346.14**	**442.78**	**484.46**	**488.50**	**498.40**	**519.97**	**590.14**	**636.97**	**695.87**
Air Carrier	Day	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	569.18
	Night	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	96.21
	Total	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	**665.39**
Regional Jets	Day	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	28.10
	Night	N/A[3]	NA[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	2.38
	Total	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	**30.48**
Non-Jets	Day	444.41	411.84	598.16	541.97	526.85	505.31	514.70	552.56	448.82
	Night	11.72	69.32	46.84	13.59	11.14	13.73	27.27	21.86	16.63
	Total	**456.13**	**481.16**	**645.00**	**555.56**	**537.99**	**519.04**	**541.97**	**574.42**	**465.45**
Total Commercial										
Operations	Day	1045.70	1025.22	1220.49	1157.07	1113.15	1077.52	1128.24	1178.92	1129.90
	Night	88.96	140.74	119.75	86.49	85.64	98.68	120.08	123.32	121.88
	Total	**1134.6**	**1165.9**	**1340.2**	**1243.5**	**1198.7**	**1176.2**	**1248.3**	**1302.2**	**1251.7**
GA Aircraft										
Stage 2 Jets[2]	Day	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	5.25	9.89
	Night	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	0.40	0.74
	Total	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	**5.65**	**10.63**
Stage 3 Jets	Day	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	30.54	48.46
	Night	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	4.21	6.55
	Total	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	**34.75**	**55.01**
Non-Jets	Day	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	37.29	19.36
	Night	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	16.28	18.89
	Total	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	**53.57**	**38.25**
Total GA										
Operations	Day	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	73.08	77.71
	Night	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	20.89	26.17
	Total	NA[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	N/A[4]	**93.97**	**103.88**
Total	Day	1045.70	1025.22	1220.49	1157.07	1113.15	1077.52	1128.24	1252.00	1207.61
	Night	88.96	140.74	119.75	86.49	85.64	98.68	120.08	144.21	148.05
	Total[3]	**1134.6**	**1165.9**	**1340.2**	**1243.5**	**1198.7**	**1176.2**	**1248.3**	**1396.2**	**1355.6**

Table H-6 Modeled Daily Operations by Commercial and General Aviation (GA) Aircraft[1] – 1990 to 2015

(Data for the years 1990 to 1999 are shown on the prior page)

		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Commercial Aircraft											
Stage 2 Jets[2]	Day	5.13	1.18	0.05	0.08	0.03	0.05	0.03	0.03	0.01	0.00
		0.26	0.05	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00
	Total	**5.39**	**1.23**	**0.05**	**0.08**	**0.05**	**0.06**	**0.03**	**0.04**	**0.02**	**0.00**
Stage 3 Jets	Day	727.09	756.24	740.75	717.85	772.39	765.76	767.55	748.13	699.39	668..32
	Night	103.66	109.77	97.04	92.69	113.24	113.66	114.81	118.29	114.30	103.11
	Total	**830.75**	**866.01**	**837.79**	**810.54**	**885.63**	**879.42**	**882.36**	**866.42**	**813.69**	**771.43**
Air Carrier Jets	Day	648.95	569.99	500.70	461.06	518.96	505.48	490.63	472.39	443.15	421.51
	Night	99.79	101.30	83.52	72.69	89.24	91.99	92.71	96.28	89.89	82.19
	Totals	**748.74**	**671.29**	**584.22**	**533.75**	**608.20**	**597.47**	**583.34**	**568.66**	**533.04**	**503.70**
Regional Jets	Day	78.14	186.25	240.05	256.80	253.43	260.34	276.95	275.77	256.24	246.81
	Night	3.87	8.47	13.52	19.99	24.00	21.68	22.11	22.03	24.40	20.93
	Total	**82.01**	**194.72**	**253.57**	**276.79**	**277.43**	**282.01**	**299.06**	**297.80**	**280.64**	**267.73**
Non-Jets	Day	409.62	317.62	165.45	135.18	133.24	148.77	140.81	145.27	132.52	136.45
	Night	21.58	10.97	3.45	2.41	3.03	3.02	3.26	3.47	4.00	5.54
	Total	**431.20**	**328.58**	**168.89**	**137.59**	**136.28**	**151.79**	**144.07**	**148.73**	**136.52**	**141.99**
Total Commercial											
Operations	Day	1141.8	1075.0	906.25	853.10	905.66	914.59	908.41	893.43	831.92	804.77
	Night	125.51	120.79	100.49	95.10	116.29	116.68	118.09	121.77	118.31	108.65
	Total	**1267.35**	**1195.82**	**1006.7**	**948.20**	**1021.9**	**1031.2**	**1026.5**	**1015.1**	**950.23**	**913.42**
GA Aircraft											
Stage 2 Jets[2]	Day	7.29	5.15	3.65	2.84	0.94	2.29	1.90	1.24	0.36	0.09
	Night	0.64	0.50	0.41	0.26	0.14	0.25	0.17	0.19	0.03	0.01
	Total	**7.93**	**5.65**	**4.08**	**3.10**	**1.08**	**2.54**	**2.07**	**1.43**	**0.38**	**0.10**
Stage 3 Jets	Day	40.08	34.23	37.83	46.21	53.72	58.84	61.08	54.82	43.98	22.31
	Night	3.21	3.28	6.42	6.98	8.37	9.33	6.57	6.39	4.52	2.28
	Total	**43.29**	**37.51**	**44.25**	**53.19**	**62.09**	**68.16**	**67.65**	**61.21**	**48.49**	**23.59**
Non-Jets	Day	34.57	37.31	17.36	17.81	16.95	14.00	15.05	11.98	15.13	8.19
	Night	1.83	1.92	4.45	4.40	5.20	4.75	1.39	3.61	1.08	0.74
	Total	**36.40**	**39.23**	**21.81**	**22.21**	**22.14**	**18.75**	**16.44**	**15.58**	**16.20**	**8.93**
Total GA											
Operations	Day	81.94	76.68	58.84	66.88	71.60	75.12	78.03	68.04	59.46	30.46
	Night	5.68	5.71	11.29	11.64	13.71	14.33	8.13	10.19	5.62	3.08
	Total	**87.62**	**82.39**	**70.13**	**78.52**	**85.31**	**89.46**	**86.15**	**78.22**	**65.05**	**33.54**
Total	Day	1223.7	1151.7	965.09	919.98	977.27	989.71	986.43	961.46	891.39	834.33
	Night	131.19	126.50	111.78	106.74	130.00	131.02	126.22	131.96	123.93	111.70
	Total[3]	**1354.9**	**1278.2**	**1076.8**	**1026.7**	**1107.2**	**1120.7**	**1112.6**	**1093.4**	**1015.3**	**946.03**

Table H-6 Modeled Daily Operations by Commercial and General Aviation (GA) Aircraft[1] – 1990 to 2015

(Data for the years 1990 to 2009 are shown on the prior pages)

		2010	2011	2012	2013	2014	2015	Change 2014 to 2015
Commercial Aircraft								
Stage 2 Jets[2]	Day	0.01	0.01	0.01	0.01	0.00	0.00	0.00
	Night	0.01	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**0.02**	**0.01**	**0.01**	**0.01**	**0.00**	**0.00**	**0.00**
Stage 3 Jets (All)	Day	674.25	684.19	649.22	667.65	670.00	685.92	15.91
	Night	107.92	109.38	106.55	115.91	123.60	130.96	7.36
	Total	**782.17**	**793.57**	**755.77**	**783.56**	**793.61**	**816.88**	**23.27**
Air Carrier Jets	Day	521.64	571.03	530.76	546.27	556.59	585.55	28.96
	Night	93.98	99.17	98.68	107.17	115.84	126.36	10.53
	Totals	**615.62**	**670.20**	**629.44**	**653.44**	**672.43**	**711.92**	**39.49**
Regional Jets	Day	152.61	113.16	118.46	121.38	113.41	100.36	-13.05
	Night	13.94	10.21	7.87	8.74	7.77	4.60	-3.17
	Total	**166.55**	**123.37**	**126.33**	**130.12**	**121.18**	**104.96**	**-16.22**
Non-Jets	Day	138.53	135.18	133.92	132.33	128.45	125.27	-3.18
	Night	5.21	4.73	3.06	3.21	2.28	2.41	0.13
	Total	**143.74**	**139.91**	**136.98**	**135.54**	**130.73**	**127.68**	**-3.04**
Total Commercial								
Operations	Day	812.78	819.39	783.14	799.99	798.45	811.19	12.74
	Night	113.13	114.11	109.62	119.12	125.88	133.37	7.49
	Total	**925.91**	**933.50**	**892.76**	**919.12**	**924.33**	**944.56**	**20.23**
GA Aircraft								
Stage 2 Jets[2]	Day	0.27	0.08	0.25	0.31	0.00	0.28	0.28
	Night	0.04	0.00	0.04	0.02	0.00	0.02	0.02
	Total	**0.30**	**0.08**	**0.29**	**0.33**	**0.00**	**0.30**	**0.30**
Stage 3 Jets	Day	27.80	52.51	52.93	51.21	52.64	51.82	-0.82
	Night	3.21	5.35	7.20	5.10	4.65	4.28	-0.37
	Total	**31.01**	**57.87**	**60.13**	**56.31**	**57.29**	**56.10**	**-1.19**
Non-Jets	Day	8.19	18.18	15.16	13.06	13.95	19.31	5.35
	Night	0.72	1.29	1.29	1.15	1.13	1.46	0.33
	Total	**8.92**	**19.48**	**16.45**	**14.22**	**15.08**	**20.77**	**5.69**
Total GA								
Operations	Day	36.26	70.78	68.35	64.58	66.59	71.40	4.81
	Night	3.97	6.65	8.52	6.28	5.78	5.77	-0.01
	Total	**40.22**	**77.43**	**76.86**	**70.85**	**72.37**	**77.17**	**4.79**
Total	Day	849.03	890.16	851.49	864.57	865.05	882.59	17.54
	Night	117.10	120.76	118.13	125.40	131.66	139.14	7.48
	Total[3]	**966.13**	**1,010.92**	**969.61**	**989.97**	**996.70**	**1,021.73**	**25.02**

Source: Massport's Noise Monitoring System and Revenue Office numbers, HMMH 2015.

Notes: Data from 1991 not available.

1 Includes scheduled and unscheduled operations.

2 Stage 2 aircraft are exempt from meeting newer federal Stage 3 noise limits when their maximum gross takeoff weight is less than or equal to 75,000 pounds.

3 RJ operations were not tracked separately prior to 1999.

4 Totals prior to 1998 do not include GA operations.

5 The definition of RJ for the EDR changed between 2009 and 2010. A RJ in 2010 is a jet in commercial service with less than 80 seats. Prior to 2010, a RJ was a jet in commercial service with 100 seats or less.

Commercial Jet Aircraft by Part 36 Stage Category

The FAA categorizes jet aircraft currently operating at Logan Airport into three groups: Stage 2, Stage 3, and Stage 4. As described in Chapter 6, *Noise Abatement*, the designation refers to a noise classification specified in Federal Aviation Regulation Part 36 that sets noise emission standards at three measurement locations – takeoff, landing, and sideline – based on an aircraft's maximum certificated weight. The heavier the aircraft, the more noise it is permitted to make within limits. Aircraft are allowed to be recertificated to the higher standard when modifications are made to the aircraft engine or design. Because of the substantial differences in noise between Stage 2, recertificated Stage 3, Stage 3, and Stage 4 aircraft, Massport tracks operations by these separate categories to follow their trends. **Table H-7** shows the percentage of commercial jet operations by stage category from 1999 through 2015. One of the most significant changes occurring after the economic downturn in 2001 was the almost immediate retirement of the re-certificated aircraft from airlines' fleets due to their high operating costs. This type of accelerated retirement is not as prevalent during the 2008 to 2009 economic downturn since it is no longer the major airlines operating these aircraft. However, these aircraft still have high operating costs and are being replaced wherever possible.

Table H-7 Percentage of Commercial Jet Operations by Part 36 Stage Category – 1999 to 2015

	Stage 4 Requirements[3]	Certificated Stage 3[1]	Recertificated Stage 3[2]	Stage 2	Total
1999	N/A	70.0%	21.0%	9.0%	100%
2000	N/A	75.0%	24.0%	1.0%	100%
2001	N/A	86.3%	13.6%	0.1%	100%
2002	N/A	92.8%	7.2%	0.0%	100%
2003	N/A	95.8%	4.1%	0.0%	100%
2004	N/A	97.8%	2.2%	0.0%	100%
2005	N/A	98.0%	2.0%	0.0%	100%
2006	N/A	98.6%	1.4%	0.0%	100%
2007	N/A	98.9%	1.1%	0.0%	100%
2008	N/A	99.1%	0.9%	0.0%	100%
2009	N/A	99.1%	0.9%	0.0%	100%
2010	93.2%[4]	98.9%	1.1%	0.0%	100%
2011	95.5%[4]	99.5%	0.5%	0.0%	100%
2012	95.8%[4]	99.9%	0.1%	0.0%	100%
2013	97.4%[4]	100.0%	<0.1%	<0.1%	100%
2014	97.4%[4]	100.0%	<0.1%	0.0%	100%
2015	96.7%[4]	100.0%	<0.1%	<0.1%	100%

Source: Massport and FAA radar data.

Notes:

1 New Stage 3 aircraft are aircraft originally manufactured as a certified Stage 3 aircraft under Federal Regulation Part 36.

2 Recertificated Stage 3 aircraft are aircraft originally manufactured as a certified Stage 1 or 2 aircraft under Federal Regulation Part 36, which either have been treated with hushkits or have been re-engineered to meet Stage 3 requirements.

3 Aircraft that meet Stage 4 requirements are aircraft that are certificated Stage 4 or would qualify if recertificated. Certificated Stage 4 aircraft were not available until 2006 and the level of aircraft that meet Stage 4 requirements has not been determined prior to 2010.

4 All aircraft listed as meeting Stage 4 requirements are also listed as Stage 3 aircraft.

Nighttime Operations

Massport tracks flights that operate between the broader DNL nighttime periods of 10:00 PM to 7:00 AM, when each flight is penalized 10 dB in calculations of noise exposure. **Table H-8** shows this nighttime activity by different groups of aircraft. Nighttime flights by commercial jet operators increased by 6 percent in 2015, following increases of 8.8 percent in 2013 and 6.6 percent in 2014. Commercial non-jet operations increased by 5.7 percent in 2015 following increases of 4.9 percent in 2013 and 29 percent in 2014. GA traffic was essentially unchanged in 2015, falling by 0.25 percent, following decreases of 26.4 percent in 2013 and 8 percent in 2014. Overall, nighttime operations at Logan Airport increased by 5.7 percent in 2015, after increasing 6.2 percent in 2013 and 5.0 percent in 2014. The majority of nighttime operations (between 10:00 PM and 7:00 AM) occurred either before midnight or after 5:00 AM.

Table H-8 Modeled Nighttime Operations at Logan Airport – 1990 to 2014

	Commercial Jets	Commercial Non-Jets	General Aviation	Total
1990	77.24	11.72	NA	88.96
1991	NA	NA	NA	NA
1992	71.42	69.32	NA	140.74
1993	72.91	46.84	NA	119.75
1994	72.90	13.59	NA	86.49
1995	74.50	11.14	NA	85.64
1996	84.95	13.73	NA	98.68
1997	92.81	27.27	NA	120.08
1998	101.46	21.86	NA	123.32
1999	105.25	16.63	26.17	148.05
2000	103.92	21.58	5.68	131.19
2001	109.82	10.97	5.71	126.50
2002	97.04	3.45	11.29	111.78
2003	92.69	2.41	11.64	106.74
2004	113.26	3.03	13.71	130.00
2005	113.67	3.02	14.33	131.02
2006	114.81	3.26	8.13	126.22
2007	118.30	3.47	10.19	131.96
2008	114.31	4.00	5.62	123.93
2009	103.05	5.56	3.08	111.70
2010	107.93	5.21	3.97	117.10
2011	109.38	4.73	6.65	120.76
2012	106.55	3.06	8.52	118.13
2013	115.91	3.21	6.28	125.40
2014	123.60	2.28	5.78	131.66
2015	130.96	2.41	5.77	139.14
Change (2014 to 2015)	**7.36**	**0.13**	**-0.01**	**7.48**
Percent Change	**5.96%**	**5.70%**	**-0.25%**	**5.68%**

Source: Massport, HMMH, 2015.
Note: NA = Not available.

Jet Runway Use

Table H-9 presents a summary of runway use by jets. Since 2009, the radar data have been analyzed with Massport's Harris Noise and Operational Monitoring System (NOMS), data from 2001 through 2008 was compiled with Massport's PreFlight^{TM} software. PreFlight^{TM} was an analysis package used to compile fleet, day/night splits, and runway use information from radar data. Data prior to 2001 were derived from Massport's original noise monitoring system, supplemented with field records. Note that Logan Airport Noise Rules prevent arrivals to Runway 22R and departures from Runway 4L by jet aircraft.

Table H-9	Summary of Jet Aircraft Runway Use – 1990 to 2015									
Runway	**4L**	**4R**	**9**	**14[1]**	**15R**	**22L**	**22R**	**27**	**32[1]**	**33L**
1990										
Departures	0%[2]	3%	21%	NA	10%	2%	36%	20%	NA	7%
Arrivals	1%	25%	0%	NA	2%	14%	0%	28%	NA	29%
1992[2]										
Departures	0%	6%	31%	NA	7%	2%	38%	10%	NA	6%
Arrivals	1%	37%	0%	NA	3%	12%	0%	30%	NA	17%
1993										
Departures	0%	9%	33%	NA	7%	3%	40%	4%	NA	4%
Arrivals	2%	44%	0%	NA	1%	11%	0%	28%	NA	15%
1994										
Departures	0%	9%	33%	NA	4%	3%	32%	12%	NA	5%
Arrivals	3%	42%	0%	NA	1%	8%	0%	27%	NA	19%
1995										
Departures	0%	8%	36%	NA	5%	5%	29%	11%	NA	5%
Arrivals	3%	41%	0%	NA	2%	8%	0%	27%	NA	17%
1996										
Departures	0%	8%	32%	NA	5%	6%	33%	12%	NA	5%
Arrivals	2%	38%	0%	NA	2%	11%	0%	29%	NA	18%
1997										
Departures	0%	8%	30%	NA	5%	6%	31%	15%	NA	5%
Arrivals	2%	36%	0%	NA	2%	9%	0%	30%	NA	20%
1998										
Departures	0%	8%	35%	NA	6%	5%	28%	14%	NA	5%
Arrivals	2%	41%	0%	NA	2%	7%	0%	28%	NA	19%
1999										
Departures	0%	8%	31%	NA	5%	4%	30%	15%	NA	6%
Arrivals	3%	37%	0%	NA	2%	10%	0%	28%	NA	21%
2000										
Departures	0%	8%	35%	NA	4%	3%	30%	15%	NA	6%
Arrivals	4%	40%	0%	NA	1%	7%	0%	28%	NA	20%
2001										
Departures	0%	7%	34%	NA	4%	3%	35%	12%	NA	5%
Arrivals	5%	36%	0%	NA	1%	8%	0%	32%	NA	18%

Table H-9 Summary of Jet Aircraft Runway Use – 1990 to 2015

Runway	4L	4R	9	14[1]	15R	22L	22R	27	32[1]	33L
2002										
Departures	0%	4%	31%	NA	6%	3%	35%	16%	NA	6%
Arrivals	6%	31%	0%	NA	1%	12%	0%	30%	NA	21%
2003										
Departures	0%	4%	33%	NA	7%	2%	34%	14%	NA	6%
Arrivals	7%	33%	0%	NA	1%	14%	0%	28%	NA	18%
2004										
Departures	0%	5%	34%	NA	10%	4%	24%	18%	NA	6%
Arrivals	6%	34%	0%	NA	1%	12%	0%	24%	NA	23%
2005										
Departures	0%	5%	36%	NA	7%	1%	31%	13%	NA	7%
Arrivals	8%	33%	0%	NA	1%	11%	0%	29%	NA	17%
2006										
Departures	0%	4%	33%	0%	3%	1%	40%	13%	-	6%
Arrivals	7%	29%	0%	-	1%	14%	0%	33%	0.2%	16%
2007										
Departures	0%	5%	31%	0%	4%	1%	33%	7%	-	19%
Arrivals	5%	31%	0%	-	1%	15%	0%	36%	2%	11%
2008										
Departures	0%	6%	33%	<1%	3%	<1%	36%	6%	-	16%
Arrivals	6%	30%	-	-	2%	17%	-	33%	2%	11%
2009										
Departures	0%	7%	32%[3]	0%	3%	2%	34%	6%[3]	-	16%
Arrivals	7%	31%	-	-	3%	17%	0%	30%[3]	1%	11%
2010										
Departures	0%	4%	28%	<1%	8%	2%	31%	10%	-	17%
Arrivals	5%	28%	-	-	1%	15%	0%	32%	1%	16%
2011										
Departures	0%	6%	36%	<1%	5%[4]	2%	36%	7%	-	7%[4]
Arrivals	7%	37%	-	-	<1%[4]	16%	0%	28%	1%	11%[4]
2012										
Departures	0%	6%	33%	<1%	5%[4]	3%	38%	6%	-	9%[4]
Arrivals	6%	34%	-	-	1%[4]	16%	0%	33%	<1%	9%[4]

Table H-9 Summary of Jet Aircraft Runway Use – 1990 to 2015

Runway	4L	4R	9	14[1]	15R	22L	22R	27	32[1]	33L
2013										
Departures	<1%	5%	30%	<1%	5%	2%	35%	12%	--	12%
Arrivals	6%	29%	--	--	1%	16%	<1%	32%	1%	15%
2014										
Departures	0%	5%	31%	<1%	5%	2%	28%	13%	-	17%
Arrivals	5%	30%	0%	-	2%	25%	<1%	21%	1%	16%
2015										
Departures	<1%	4%	29%	<1%	5%	2%	32%	12%	-	15%
Arrivals	5%	29%	0%	-	2%	25%	<1%	23%	1%	16%

Source: HMMH 2015, Massport Noise Office.

Notes: The data reflect actual percentages of jet aircraft operations on each runway end. They should not be confused with effective runway use, which is used by the PRAS to derive recommendations for use of a particular runway. Effective runway percentages include a factor of 10 applied to nighttime operations so that use of a runway at night more closely reflects its effect on total noise exposure.

Jet aircraft are not able to use Runway 15L or 33R due to its length of only 2,557 feet.

Values may not add to 100 percent due to rounding.

NA = Not available.

1 Runway 14-32 opened in late November 2006. (Runway 14-32 is unidirectional with no arrivals to Runway 14 and no departures from Runway 32).

2 The *1990 Final Generic Environmental Impact Report* was published and submitted to the Secretary of Environmental Affairs in July 1993. It included modeled operations and resulting noise contours for 1987, 1990, and a 1996-forecast year. The *1993 Annual Update* published in July 1994 included operations and contours for 1992 and 1993. 1991 data are not available.

3 Runway 9-27 had extended weekend closings for resurfacing during 2009.

4 Runway 15R-33L was closed for 3 months in 2011 and in 2012.

Annual Model Results and Status of Mitigation Programs

Noise Exposed Population

Table H-10 presents the noise-exposed population by community through 2014. This table includes population within the DNL 60 to 65 dB contours, although a DNL of 65 dB is the federally-defined noise criterion used as a guideline to identify when residential land use is considered incompatible with aircraft noise.

Table H-10 Noise-Exposed Population by Community

Year	Census Data	80+ dB DNL	75+ dB DNL	70-75 dB DNL	65-70 dB DNL[1]	Total (65+)	60-65 dB DNL
BOSTON[2]							
1990	1980	0	0	1,778	28,970	30,748	NA
1992	1980	0	0	800	4,316	5,116	NA
1993	1980	0	0	264	2,820	3,084	NA
1994	1990	0	106	265	7,698	8,069	30,895
1995	1990	0	106	851	8,815	9,772	33,765
1996	1990	0	106	374	8,775	9,255	40,992
1997	1990	0	106	719	13,857	14,682	54,804
1998	1990	0	58	580	10,877	11,515	52,201
1999[3]	1990	0	58	364	11,632	12,054	45,948
2000[3]	1990	0	58	183	7,880	8,121	32,474
2000[3]	2000	0	0	234	9,014	9,248	35,785
2001[3]	2000	0	0	315	6,515	6,700	27,778
2002[3]	2000	0	0	132	2,625	2,757	23,225
2003[3]	2000	0	0	164	1,730	1,894	21,763
2004[3,4]	2000	0	65	192	4,142	4,399	24,473
2005[3,4]	2000	0	65	104	2,020	2,189	17,661
2006[4]	2000	0	65	99	1,054	1,218	14,866
2007 (INMv7.0a)[4]	2000	0	0	169	4,094	4,263	21,446
2008 (INMv7.0b)[4]	2000	0	5	0	3,487	3,492	18,890
2009 (INMv7.0b)[4]	2000	0	5	67	937	1,009	12,284
2010 (INMv7.0b)[4]	2000	0	0	67	644	711	14,900
2010 (INMv7.0b)[4]	2010	0	0	0	689	689	17,646
2011 (INMv7.0c)[4]	2010	0	0	0	331	331	11,600
2012 (INMv7.0c)[4]	2010	0	0	0	439	439	12,076
2012 (INMv7.0d)[4]	2010	0	0	0	421	421	11,037
2013 (INMv7.0d)[4]	2010	0	0	0	612	612	14,835
2014 (INMv7.0d)[4]	2010	0	0	34	4,151	4,185	23,343
2015 (INMv7.0d)[4]	2010	0	0	110	7,225	7,365	32,309
CHELSEA							
1990	1980	0	0	0	4,813	4,813	NA
1992	1980	0	0	0	3,952	3,952	NA
1993	1980	0	0	0	0	0	NA

Table H-10	Noise-Exposed Population by Community						
Year	**Census Data**	**80+ dB DNL**	**75+ dB DNL**	**70-75 dB DNL**	**65-70 dB DNL[1]**	**Total (65+)**	**60-65 dB DNL**
1994	1990	0	0	0	0	0	8,510
1995	1990	0	0	0	95	95	9,750
1996	1990	0	0	0	0	0	8,744
1997	1990	0	0	0	0	0	10,001
1998	1990	0	0	0	0	0	9,222
1999	1990	0	0	0	95	95	9,249
2000	1990	0	0	0	0	0	5,622
2000	2000	0	0	0	0	0	7,361
2001	2000	0	0	0	0	0	4,508
2002	2000	0	0	0	0	0	3,995
2003	2000	0	0	0	0	0	3,591
2004[4]	2000	0	0	0	0	0	7,756
2005[4]	2000	0	0	0	0	0	5,772
2006[4]	2000	0	0	0	0	0	2,477
2007 (INMv7.0a)[4]	2000	0	0	0	0	0	9,774
2008 (INMv7.0b)[4]	2000	0	0	0	0	0	7,793
2009 (INMv7.0b)[4]	2000	0	0	0	0	0	5,462
2010 (INMv7.0b)[4]	2000	0	0	0	0	0	4,880
2010 (INMv7.0b)[4]	2010	0	0	0	0	0	4,897
2011 (INMv7.0c)[4]	2010	0	0	0	0	0	0
2012 (INMv7.0c)[4]	2010	0	0	0	0	0	0
2012 (INMv7.0d)[4]	2010	0	0	0	0	0	0
2013 (INMv7.0d)[4]	2010	0	0	0	0	0	3,485
2014 (INMv7.0d)[4]	2010	0	0	0	0	0	9,236
2015 (INMv7.0d)[4]	2010	0	0	0	0	0	0
EVERETT							
1990	1980	0	0	0	0	0	NA
1992	1980	0	0	0	0	0	NA
1993	1980	0	0	0	0	0	NA
1994	1990	0	0	0	0	0	0
1995	1990	0	0	0	0	0	0
1996	1990	0	0	0	0	0	0
1997	1990	0	0	0	0	0	0
1998	1990	0	0	0	0	0	0

Table H-10 Noise-Exposed Population by Community

Year	Census Data	80+ dB DNL	75+ dB DNL	70-75 dB DNL	65-70 dB DNL[1]	Total (65+)	60-65 dB DNL
1999[3]	1990	0	0	0	0	0	0
2000[3]	1990	0	0	0	0	0	0
2000[3]	2000	0	0	0	0	0	0
2001[3]	2000	0	0	0	0	0	0
2002[3]	2000	0	0	0	0	0	0
2003[3]	2000	0	0	0	0	0	0
2004[3,4]	2000	0	0	0	0	0	0
2005[3,4]	2000	0	0	0	0	0	0
2006[4]	2000	0	0	0	0	0	0
2007 (INMv7.0a)[4]	2000	0	0	0	0	0	0
2008 (INMv7.0b)[4]	2000	0	0	0	0	0	0
2009 (INMv7.0b)[4]	2000	0	0	0	0	0	0
2010 (INMv7.0b)[4]	2000	0	0	0	0	0	0
2010 (INMv7.0b)[4]	2010	0	0	0	0	0	0
2011 (INMv7.0c)[4]	2010	0	0	0	0	0	0
2012 (INMv7.0c)[4]	2010	0	0	0	0	0	0
2012 (INMv7.0d)[4]	2010	0	0	0	0	0	0
2013 (INMv7.0d)[4]	2010	0	0	0	0	0	0
2014 (INMv7.0d)[4]	2010	0	0	0	0	0	0
2015 (INMv7.0d)[4]	2010	0	0	0	0	0	0
MEDFORD							
1990	1980	0	0	0	0	0	NA
1992	1980	0	0	0	0	0	NA
1993	1980	0	0	0	0	0	NA
1994	1990	0	0	0	0	0	0
1995	1990	0	0	0	0	0	0
1996	1990	0	0	0	0	0	0
1997	1990	0	0	0	0	0	0
1998	1990	0	0	0	0	0	0
1999	1990	0	0	0	0	0	0
2000	1990	0	0	0	0	0	0
2000	2000	0	0	0	0	0	0
2001	2000	0	0	0	0	0	0
2002	2000	0	0	0	0	0	0

Table H-10 Noise-Exposed Population by Community

Year	Census Data	80+ dB DNL	75+ dB DNL	70-75 dB DNL	65-70 dB DNL[1]	Total (65+)	60-65 dB DNL
2003	2000	0	0	0	0	0	0
2004[4]	2000	0	0	0	0	0	0
2005[4]	2000	0	0	0	0	0	0
2006[4]	2000	0	0	0	0	0	0
2007 (INMv7.0a)[4]	2000	0	0	0	0	0	0
2008 (INMv7.0b)[4]	2000	0	0	0	0	0	0
2009 (INMv7.0b)[4]	2000	0	0	0	0	0	0
2010 (INMv7.0b)[4]	2000	0	0	0	0	0	0
2010 (INMv7.0b)[4]	2010	0	0	0	0	0	0
2011 (INMv7.0c)[4]	2010	0	0	0	0	0	0
2012 (INMv7.0c)[4]	2010	0	0	0	0	0	0
2012 (INMv7.0d)[4]	2010	0	0	0	0	0	0
2013 (INMv7.0d)[4]	2010	0	0	0	0	0	0
2014 (INMv7.0d)[4]	2010	0	0	0	0	0	0
2015 (INMv7.0d)[4]	2010	0	0	0	0	0	0
QUINCY							
1990	1980	0	0	0	0	0	NA
1992	1980	0	0	0	0	0	NA
1993	1980	0	0	0	0	0	NA
1994	1990	0	0	0	0	0	0
1995	1990	0	0	0	0	0	0
1996	1990	0	0	0	0	0	0
1997	1990	0	0	0	0	0	0
1998	1990	0	0	0	0	0	0
1999	1990	0	0	0	0	0	0
2000	1990	0	0	0	0	0	0
2000	2000	0	0	0	0	0	636
2001	2000	0	0	0	0	0	610
2002	2000	0	0	0	0	0	610
2003	2000	0	0	0	0	0	610
2004[4]	2000	0	0	0	0	0	610
2005[4]	2000	0	0	0	0	0	610
2006[4]	2000	0	0	0	0	0	610
2007 (INMv7.0a)[4]	2000	0	0	0	0	0	0

Table H-10 Noise-Exposed Population by Community

Year	Census Data	80+ dB DNL	75+ dB DNL	70-75 dB DNL	65-70 dB DNL[1]	Total (65+)	60-65 dB DNL
2008 (INMv7.0b)[4]	2000	0	0	0	0	0	0
2009 (INMv7.0b)[4]	2000	0	0	0	0	0	0
2010 (INMv7.0b)[4]	2000	0	0	0	0	0	0
2010 (INMv7.0b)[4]	2010	0	0	0	0	0	0
2011 (INMv7.0c)[4]	2010	0	0	0	0	0	0
2012 (INMv7.0c)[4]	2010	0	0	0	0	0	0
2012 (INMv7.0d)[4]	2010	0	0	0	0	0	0
2013 (INMv7.0d)[4]	2010	0	0	0	0	0	0
2014 (INMv7.0d)4	2010	0	0	0	0	0	0
2015 (INMv7.0d)[4]	2010	0	0	0	0	0	0
REVERE							
1990	1980	0	0	0	4,274	4,274	NA
1992	1980	0	0	0	3,848	3,848	NA
1993	1980	0	0	0	4,617	4,617	NA
1994	1990	0	0	0	3,569	3,569	2,099
1995	1990	0	0	0	3,364	3,364	2,304
1996	1990	0	0	172	3,292	3,464	2,505
1997	1990	0	0	0	3,293	3,293	2,047
1998	1990	0	0	0	3,168	3,168	2,132
1999	1990	0	0	128	3,165	3,293	2,047
2000	1990	0	0	0	2,552	2,552	2,386
2000	2000	0	0	0	2,496	2,496	3,100
2001	2000	0	0	0	2,496	2,496	3,100
2002	2000	0	0	0	2,822	2,822	2,399
2003	2000	0	0	0	2,994	2,994	2,227
2004[4]	2000	0	0	82	2,969	3,051	2,678
2005[4]	2000	0	0	82	2,540	2,622	2,731
2006[4]	2000	0	0	82	2,540	2,622	2,698
2007 (INMv7.0a)[4]	2000	0	0	0	2,450	2,450	2,853
2008 (INMv7.0b)[4]	2000	0	0	0	2,434	2,434	1,802
2009 (INMv7.0b)[4]	2000	0	0	0	2,512	2,512	1,452
2010 (INMv7.0b)[4]	2000	0	0	0	2,505	2,505	1,385
2010 (INMv7.0b)[4]	2010	0	0	0	2,413	2,413	2,473

Table H-10 Noise-Exposed Population by Community

Year	Census Data	80+ dB DNL	75+ dB DNL	70-75 dB DNL	65-70 dB DNL[1]	Total (65+)	60-65 dB DNL
2011 (INMv7.0c)[4]	2010	0	0	0	2,547	2,547	3,123
2012 (INMv7.0c)[4]	2010	0	0	0	2,772	2,772	3,236
2012 (INMv7.0d)[4]	2010	0	0	0	2,762	2,762	3,191
2013 (INMv7.0d)[4]	2010	0	0	0	2,505	2,505	2,791
2014 (INMv7.0d)[4]	2010	0	0	0	2,832	2,832	3,829
2015 (INMv7.0d)[4]	2010	0	0	0	3,789	3,789	3,385
WINTHROP							
1990	1980	0	676	1,211	2,420	4,307	NA
1992	1980	0	626	1,146	2,488	4,262	NA
1993	1980	0	648	1,211	1,773	3,632	NA
1994	1990	0	417	1,343	5,154	6,914	7,512
1995	1990	0	482	1,611	5,757	7,850	7,077
1996	1990	0	417	1,376	5,930	7,723	7,333
1997	1990	0	417	1,659	6,386	8,462	6,839
1998	1990	0	519	1,522	6,572	8,613	6,507
1999	1990	0	353	1,408	5,946	7,707	7,135
2000	1990	0	277	991	5,240	6,508	7,296
2000	2000	0	247	1,070	4,684	6,001	7,776
2001	2000	0	244	683	4,123	5,050	8,104
2002	2000	0	2	481	2,247	2,730	7,921
2003	2000	0	0	339	1,956	2,295	7,386
2004[4]	2000	0	2	337	1,649	1,988	6,508
2005[4]	2000	0	39	347	1,280	1,666	6,353
2006[4]	2000	0	39	416	1,288	1,743	6,845
2007 (INMv7.0a)[4]	2000	0	0	247	1,139	1,386	6,749
2008 (INMv7.0b)[4]	2000	0	0	244	1,409	1,653	6,547
2009 (INMv7.0b)[4]	2000	0	0	171	643	814	4,221
2010 (INMv7.0b)[4]	2000	0	0	131	523	654	3,960
2010 (INMv7.0b)[4]	2010	0	0	130	598	728	3,720
2011 (INMv7.0c)[4]	2010	0	0	130	939	1069	4,303
2012 (INMv7.0c)[4]	2010	0	0	200	1,325	1,525	5,564
2012 (INMv7.0d)[4]	2010	0	0	200	1,186	1,386	5,305

Table H-10 Noise-Exposed Population by Community

Year	Census Data	80+ dB DNL	75+ dB DNL	70-75 dB DNL	65-70 dB DNL[1]	Total (65+)	60-65 dB DNL
2013 (INMv7.0d)[4]	2010	0	0	130	1,060	1,190	5,466
2014 (INMv7.0d)[4]	2010	0	0	130	1,775	1,905	6,456
2015 (INMv7.0d)[4]	2010	0	0	320	2,623	2,943	6,375
All Communities							
1990	1980	0	676	2,989	40,477	44,142	NA
1992	1980	0	628	2,352	14,604	17,584	NA
1993	1980	0	648	1,475	9,210	11,333	NA
1994	1990	0	523	1,608	16,421	18,552	49,016
1995	1990	0	588	2,462	18,031	21,081	52,896
1996	1990	0	523	1,922	17,997	20,442	59,574
1997	1990	0	523	2,378	23,536	26,437	73,691
1998	1990	0	577	2,102	20,617	23,296	70,062
1999	1990	0	411	1,900	20,838	23,149	64,379
2000	1990	0	335	1,174	15,672	17,181	47,778
2000	2000	0	247	1,304	16,194	17,745	54,190
2001	2000	0	244	998	13,004	14,246	43,616
2002	2000	0	2	613	7,694	8,309	38,150
2003	2000	0	0	503	6,680	7,183	35,577
2004[4]	2000	0	67	611	8,760	9,438	41,975
2005[4]	2000	0	104	533	5,840	6,477	33,127
2006[4]	2000	0	104	597	4,882	5,583	27,496
2007(INMv7.01)[4]	2000	0	0	416	7,683	8,099	40,822
2008(INMv7.0b)[4]	2000	0	5	244	7,330	7,579	35,122
2009 (INMv7.0b)[4]	2000	0	5	238	4,092	4,335	23,419
2010 (INMv7.0b)[4]	2000	0	0	198	3,672	3,870	25,125
2010 (INMv7.0b)[4]	2010	0	0	130	3,700	3,830	28,736
2011 (INMv7.0c)[4]	2010	0	0	130	3,817	3,947	19,026

Table H-10 Noise-Exposed Population by Community

Year	Census Data	80+ dB DNL	75+ dB DNL	70-75 dB DNL	65-70 dB DNL[1]	Total (65+)	60-65 dB DNL
All Communities							
2012 (INMv7.0c)[4]	2010	0	0	200	4,536	4,736	20,876
2012(INMv7.0d)[4]	2010	0	0	200	4,369	4,569	19,533
2013(INMv7.0d)[4]	2010	0	0	130	4,177	4,307	26,577
2014(INMv7.0d)[4]	2010	0	0	164	8,758	8,922	42,864
2015 (INMv7.0d)[4]	2010	0	0	430	13,667	14,097	52,748

Source: Data prepared for Massport by HMMH 2015.
Notes: South End is included in Boston totals.
NA Not available.
1 65 dB DNL is the federally-defined noise criterion.
2 Portions of Dorchester, East Boston, Roxbury, South Boston
3 Boston population by community changed in 1999 due to employment of more accurate hill effects methodology and reporting change.
4 All results since 2004 are from the RealContours™ modeling system.

Residential Sound Insulation Program (RSIP)

In 2015, no new dwelling units received sound insulation from Massport, leaving totals of 5,467 residential buildings and 11,515 dwelling units that have been sound insulated since 1986 when the program was first implemented. **Table H-11** lists the yearly progress of this mitigation effort.

Following the FAA's approval of model adjustments based on the effects of terrain (discussed in the *1999 ESPR*), Massport submitted, and the New England Region of the FAA approved, a new sound insulation program. The revised contour, approved for a two-year period beginning in 1999, included dwelling units in East Boston, South Boston, and Winthrop that previously had not been eligible for insulation. Massport received notice of FAA funding for $5 million. Subsequently, Massport updated its program contour, first with the *2001 EDR* contour and more recently with the Logan Airside Improvements Project approved contour. These updates have allowed Massport to continue the program with additional funds every year since 1999. This latest update takes into account runway use changes due to the new Runway 14-32 which opened in late November 2006. This update expands the focus of the sound insulation program into Chelsea to satisfy the mitigation commitments made in the Airside Improvements Program Record of Decision (ROD). Massport has also utilized a program where they have contacted properties that are still eligible within the RSIP boundaries that had previously declined to participate. They have been offered a second chance to participate in the program.

Table H-11 Residential Sound Insulation Program (RSIP) Status (1986-2015)

Construction Year	Residential Buildings[1]	Dwelling Units[2]
1986	4	8
1987	43	51
1988	102	159
1989	94	133
1990	121	200
1991	175	360
1992	197	354
1993	318	654
1994	310	542
1995	372	753
1996	323	577
1997	364	808
1998	328	806
1999	330	718
2000	195	601
2001	260	278
2002	205	354
2003	230	468
2004	320	791
2005	314	471
2006	286	827
2007	160	548
2008	94	388
2009	111	287
2010	56	83
2011	62	114
2012[3]	0	0
2013	45	76
2014	48	106
2015	0	0
Total	**5,467**	**11,515**

Source: Massport, 2015.
Notes:
1 Includes multiple units.
2 Individual units.
3 Federal funding was delayed in 2012

Table H-12 provides a list of all schools that have been treated under Massport's sound insulation program. To date, Massport has provided sound insulation to 36 schools at a cost of over $8 million.

Table H-12 Schools Treated Under Massport Sound Insulation Program

Boston:	
East Boston	**Winthrop**
East Boston High	Winthrop Jr. High School
St. Mary's Star of the Sea	E. B. Newton
St. Dominic Savio High	A. T. Cummings (Ctr.) School
St. Lazarus	3 Total Winthrop Schools
James Otis	
Samuel Adams	
Curtis Guild	**Revere**
Dante Alighieri	Beachmont School
P.J. Kennedy	1 Total Revere School
Donald McKay	
Hugh Roe O'Donnell	
E Boston Central Catholic	**Chelsea**
Manassah Bradley	Shurtleff School
13 East Boston Schools	Williams School
	St. Rose Elementary
South Boston	St. Stanislaus
St. Augustine	Chelsea High School
Cardinal Cushing	5 Total Chelsea Schools
Patrick Gavin	
St. Bridgid's	**36 Total Schools**
Oliver Hazard Perry	
Condon School	
6 South Boston Schools	
Roxbury and Dorchester	
Samuel Mason	
Dearborn Middle	
Ralph Waldo Emerson	
Lewis Middle	
Nathan Hale Elem.	
Phillis Wheatley Elem.	
Davis Ellis Elem.	
Henry L. Higginson	
8 Roxbury and Dorchester Schools	
27 Total Boston Schools	

Source: Massport, 2015.

Noise Complaints

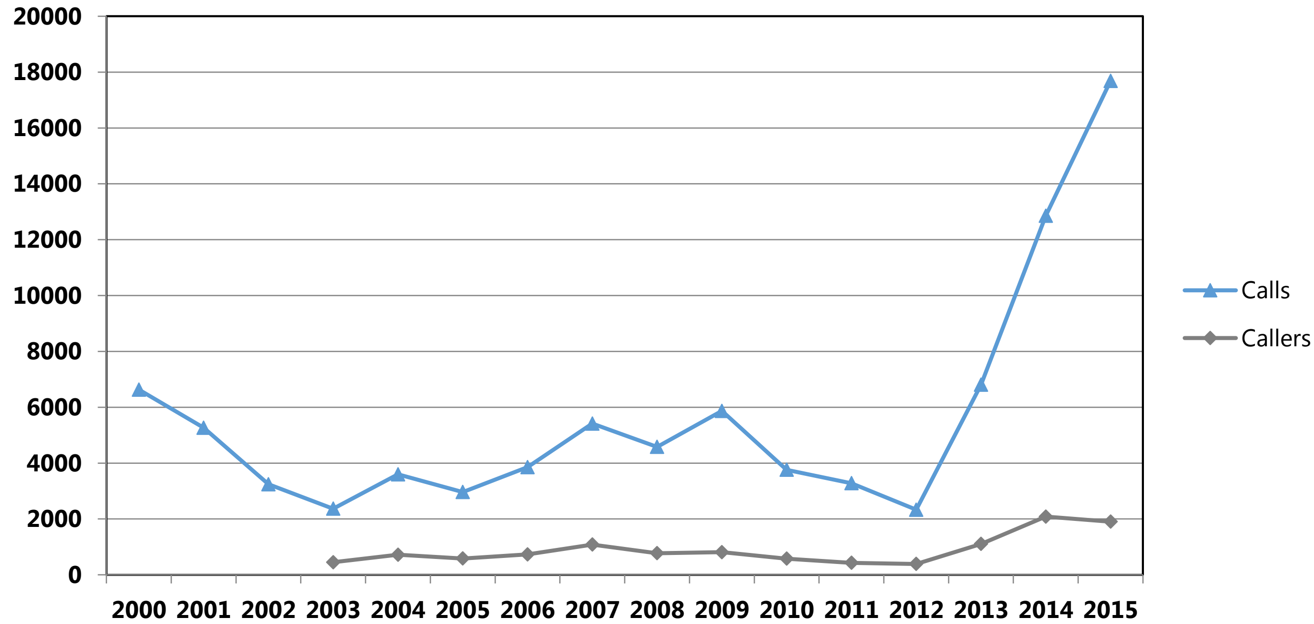
Table H-13 presents a detailed list by community of the total complaints made in 2014 and 2015, which can be filed either on Massport's Noise Complaint Line, through a form on Massport's website or through the PublicVue flight track portal. The Noise Complaint Line provides individuals the ability to express their concerns about aviation noise (activities) or to ask questions regarding noise at Logan Airport. Callers ask a range of questions such as "Why is this runway in use?"; "What times do the planes stop flying?" and "Was that aircraft off-course?"

The Noise Abatement Office (NAO) staff documents noise line complaints by obtaining information from the caller about the nature of the complaint, time of the occurrence, location of caller's residence, and the activity that was disturbed. The NAO uses the collected information to determine the probable activity responsible for the complaint and writes a letter report to the complainant. The letter includes the original complaint, a response that identifies the activity responsible for the call (arrivals, departures, run-up, etc.), meteorological information at the time of the call (a major factor in aviation activities), runways in use at the time of the call, and a notice that the FAA will receive a copy of the report.

In 2015, Massport received 17,685 noise complaints from 82 communities (**Figure H-13**), an increase of 37.6 percent compared to 2014. The number of individual complainants, however, declined by 9 percent (from 2,084 individuals in 2014 to 1,903 individuals in 2015), indicating that noise annoyance is growing among a concentrated population rather than spreading to a larger population. This is consistent with a recent survey of U.S. airports that finds noise complaints concentrated among relatively small numbers of complainants.[15] This research, completed by George Mason University, shows that a small number of people account for a disproportionately high share of the total number of noise complaints (the full article is included at the end of this appendix).

15 Dourado, E. and Russell, R. October 2016. *Airport Noise NIMBYism: An Empirical Investigation.* Mercatus Center at George Mason University. https://www.mercatus.org/system/files/dourado-airport-noise-mop-v1.pdf. Accessed December 10, 2016.

Figure H-13 Number of Callers and Complaints between 2000 and 2015



Source: Massport, HMMH 2015.
Notes: Number of callers is not available before 2003.

Massport's website, (www.massport.com/environment/environmental-reporting/noise-abatement/noise-complaints/), provides for additional general questions and answers regarding the Noise Complaint Line.

Table H-13 Noise Complaint Line Summary

Town	2014		2015		Change 2014 to 2015
	Calls	Callers	Calls	Callers	
Arlington	332	106	1,851	92	1,519
Athol	1	1	0	0	-1
Auburndale	0	0	2	1	2
Belmont	1,658	116	715	95	-943
Berkley	0	0	1	1	1
Beverly	2	2	1	1	-1
Boston	136	17	120	10	-16
Boxford	0	0	1	1	1
Braintree	2	2	2	2	0
Brighton	1	1	0	0	-1
Brockton	1	1	3	1	2

Table H-13	Noise Complaint Line Summary				
Town	**2014**		**2015**		**Change 2014 to 2015**
	Calls	**Callers**	**Calls**	**Callers**	
Brookline	3	2	5	3	2
Burlington	3	2	0	0	-3
Cambridge	585	71	1,697	136	1,112
Canton	21	4	10	2	-11
Charlestown	5	3	6	3	1
Chelsea	66	36	116	37	50
Cohasset	46	14	110	12	64
Danvers	0	0	8	2	8
Dartmouth	1	1	0	0	-1
Dedham	24	5	10	5	-14
Dorchester	38	17	115	20	77
Duxbury	1	1	1	1	0
East Boston	354	106	250	69	-104
East Bridgewater	0	0	1	1	1
Essex	27	1	0	0	-27
Everett	270	54	114	30	-156
Fitchburg	0	0	1	1	1
Framingham	25	2	19	2	-6
Gloucester	5	1	4	1	-1
Hamilton	2	1	5	2	3
Hanover	1	1	1	1	0
Harvard	1	1	0	0	-1
Hingham	86	17	55	16	-31
Hull	1,855	332	1,136	152	-719
Hyde Park	50	16	28	7	-22
Jamaica Plain	268	89	288	60	20
Kingston	1	1	1	1	0
Leominster	2	2	1	1	-1
Lexington	1	1	0	0	-1
Littleton	0	0	6	1	6
Lunenburg	3	2	2	2	-1
Lynn	482	5	424	13	-58

Table H-13 Noise Complaint Line Summary

Town	2014		2015		Change 2014 to 2015
	Calls	Callers	Calls	Callers	
Lynnfield	2	1	4	3	2
Malden	8	5	36	6	28
Manchester	2	2	0	0	-2
Marblehead	61	3	10	5	-51
Marshfield	7	6	2	1	-5
Mattapan	1	1	6	1	5
Medford	742	154	508	116	-234
Medway	1	1	0	0	-1
Melrose	1	1	8	4	7
Middleton	3	2	1	1	-2
Millis	0	0	1	1	1
Milton	2,669	189	4,991	343	2,322
Nahant	109	20	50	19	-59
Natick	3	2	7	1	4
Needham	0	0	7	2	7
Newton	12	6	20	7	8
Norton	0	0	1	1	1
Norwell	3	2	4	3	1
Peabody	30	11	64	12	34
Pembroke	0	0	1	1	1
Quincy	27	17	89	11	62
Randolph	6	2	1	1	-5
Reading	2	2	0	0	-2
Revere	86	29	57	25	-29
Roslindale	127	27	285	55	158
Roxbury	113	9	129	11	16
Ruxbury	2	2	0	0	-2
Salem	20	13	7	6	-13
Saugus	0	0	1	1	1
Scituate	4	4	3	3	-1
Sharon	0	0	9	2	9
Shirley	6	2	12	6	6

Table H-13 Noise Complaint Line Summary

Town	2014		2015		Change 2014 to 2015
	Calls	Callers	Calls	Callers	
Somerville	938	239	1,910	191	972
South Boston	67	26	263	48	196
South Easton	1	1	0	0	-1
South End	272	35	216	38	-56
Southborough	0	0	1	1	1
Stoneham	0	0	7	2	7
Stoughton	1	1	2	2	1
Swampscott	5	3	3	3	-2
Tewksbury	0	0	1	1	1
Wakefield	1	1	0	0	-1
Waltham	5	3	1	1	-4
Watertown	541	72	298	34	-243
Wayland	0	0	1	1	1
Wellesley	1	1	0	0	-1
Wenham	3	2	285	2	282
West Roxbury	24	9	205	28	181
Weston	1	1	0	0	-1
Weymouth	83	7	41	6	-42
Wilmington	1	1	0	0	-1
Winchendon	1	1	0	0	-1
Winchester	246	31	733	24	487
Winthrop	237	98	242	74	5
Woburn	8	3	33	10	25
Grand Total	**12,855**	**2,084**	**17,685**	**1,903**	**4,830**

Source: Massport, HMMH 2015

Cumulative Noise Index (CNI)

Massport reports total annual fleet noise at Logan Airport, defined in the Logan Airport Noise Rules by a metric referred to as the CNI. The CNI is a single number representing the sum of the entire set of single-event noise levels experienced at the Airport over a full year of operation, weighted similarly to DNL so that activity occurring at night is penalized by adding an extra 10 dB to each event. This penalty is mathematically equivalent to multiplying the number of nighttime events by each aircraft by a factor of 10. The Logan Airport Noise Rules define CNI in terms of Effective Perceived Noise Level (EPNL) and require that the index be computed for the fleet of commercial aircraft operating at Logan Airport throughout the year. In addition, in EDRs and ESPRs, Massport reports partial CNI values of noise at Logan Airport, so that various subsets of the fleet (cargo, night operations, passenger jets, etc.) are identified (see **Table H-14**).

The Noise Rules, adopted by Massport following public hearings held in February 1986, established a CNI limit of 156.5 Effective Perceived Noise Decibels (EPNdB). The CNI generally has decreased since 1990, remaining below that cap, with changes from year to year on the order of a few tenths of a decibel. The 2015 CNI remains well below the cap of 156.5 EPNL.

Table H-14 Cumulative Noise Index (EPNL) – 1990 to 2015 (limit 156.5)										
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Full CNI (Entire Commercial Jet Fleet)	**156.4**	**155.8**	**155.5**	**155.3**	**155.4**	**155.3**	**155.1**	**154.8**	**154.7**	**154.9**
Total Passenger Jets	155.2	154.8	154.6	154.4	154.4	154.2	154.1	153.9	153.7	153.9
Total Cargo Jets	150.1	148.9	148.0	147.9	148.3	148.8	148.6	147.5	147.9	148.0
Total Daytime	152.5	152.1	152.4	152.1	152.1	151.6	151.2	150.8	150.4	150.4
Total Nighttime	154.4	153.4	152.6	152.4	152.6	152.9	152.9	152.5	152.7	153.1
Total Stage 2 Jets	NA	NA	NA	NA	151.0	150.2	149.4	149.2	147.7	147.1
Total Stage 3 Jets	NA	NA	NA	NA	153.4	153.8	153.8	153.4	153.8	154.2
Daytime Stage 2	NA	NA	NA	NA	149.0	148.5	147.6	146.5	145.2	144.1
Nighttime Stage 2	NA	NA	NA	NA	146.7	145.1	144.8	145.8	144.1	144.0
Daytime Stage 3	NA	NA	NA	NA	149.1	148.8	148.7	148.8	148.9	149.2
Nighttime Stage 3	NA	NA	NA	NA	151.4	152.1	152.2	151.5	152.1	152.5
Passenger Jet Stage 2	NA	NA	NA	NA	150.5	149.9	149.2	148.9	147.5	146.8
Passenger Jet Stage 3	NA	NA	NA	NA	152.2	152.3	152.3	152.2	152.6	153.0
Cargo Jet Stage 2	NA	NA	NA	NA	141.5	137.4	136.8	137.4	139.0	134.5
Cargo Jet Stage 3	NA	NA	NA	NA	147.3	148.5	148.3	147.0	147.3	147.9
Daytime Passenger	NA	152.0	152.2	152.0	152.0	151.5	151.1	150.6	150.1	150.1
Nighttime Passenger	NA	151.6	150.9	150.6	150.8	151.0	151.0	151.1	151.2	151.6
Daytime Cargo	137.1	137.1	137.6	135.2	136.1	138.0	136.7	136.2	138.0	138.2
Nighttime Cargo	149.9	148.6	147.6	147.6	148.0	148.4	148.3	147.1	147.5	147.6
Daytime Passenger Stage 2	NA	NA	NA	NA	148.9	148.4	147.6	146.5	145.0	143.9
Daytime Passenger Stage 3	NA	NA	NA	NA	149.0	148.5	148.4	148.5	148.6	149.0
Nighttime Passenger Stage 2	NA	NA	NA	NA	149.0	148.5	148.4	148.5	142.8	143.7
Nighttime Passenger Stage 3	NA	NA	NA	NA	149.4	149.9	150.1	149.8	150.5	150.8
Daytime Cargo Stage 2	NA	NA	NA	NA	128.3	126.7	124.6	126.4	131.6	131.5
Daytime Cargo Stage 3	NA	NA	NA	NA	135.3	137.7	136.4	135.7	136.9	137.1
Nighttime Cargo Stage 2	NA	NA	NA	NA	141.3	137.0	136.5	137.0	138.2	131.5
Nighttime Cargo Stage 3	NA	NA	NA	NA	147.0	148.1	148.0	146.6	146.9	147.5

Table H-14 Cumulative Noise Index (EPNL) – 1990 to 2015 (limit 156.5)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Full CNI (Entire Commercial Jet Fleet)	**154.7**	**154.1**	**153.2**	**152.7**	**153.4**	**153.2**	**152.6**	**152.7**	**152.9**	**152.3**
Total Passenger Jets	153.6	152.9	151.8	151.3	152.2	152.1	151.4	151.5	151.9	151.1
Total Cargo Jets	148.2	147.8	147.4	147.1	147.0	146.6	146.5	146.4	146.1	145.9
Total Daytime	149.5	149.0	148.5	148.0	148.5	148.2	147.5	147.2	147.6	147.1
Total Nighttime	153.1	152.4	151.3	150.9	151.7	151.6	151.0	151.2	151.4	150.7
Total Stage 2 Jets	124.7	121.5	114.3	114.1	118.1	NA	NA	NA	NA	NA
Total Stage 3 Jets	154.7	154.1	153.2	152.7	153.4	153.2	152.6	152.7	152.9	152.3
Daytime Stage 2	122.6	119.3	111.2	113.7	109.4	NA	NA	NA	NA	NA
Nighttime Stage 2	120.5	117.3	111.4	103.2	117.5	NA	NA	NA	NA	NA
Daytime Stage 3	149.5	149.0	148.5	148.0	148.5	148.2	147.5	147.2	147.6	147.1
Nighttime Stage 3	153.1	152.4	151.3	150.9	151.7	151.6	151.0	151.2	151.4	150.7
Passenger Jet Stage 2	124.2	116.3	NA	NA	NA	NA	NA	NA	NA	NA
Passenger Jet Stage 3	153.6	152.9	151.8	151.3	152.2	152.1	151.4	151.5	151.9	151.1
Cargo Jet Stage 2	114.8	119.9	114.3	114.1	118.1	NA	NA	NA	NA	NA
Cargo Jet Stage 3	148.2	147.8	147.4	147.1	147.0	146.6	146.5	146.4	146.1	145.9
Daytime Passenger	149.3	148.7	148.2	147.7	148.2	147.9	147.2	146.9	147.3	146.8
Nighttime Passenger	151.6	150.8	149.4	148.8	150.0	150.1	149.3	149.7	150.0	149.1
Daytime Cargo	137.5	137.1	137.0	136.2	135.7	135.8	135.5	135.8	135.8	135.2
Nighttime Cargo	147.8	147.4	147.0	146.8	146.7	146.2	146.1	146.0	145.6	145.5
Daytime Passenger Stage 2	122.3	115.0	NA	NA	NA	NA	NA	NA	NA	NA
Daytime Passenger Stage 3	149.2	148.7	148.2	147.7	148.2	147.9	147.2	146.9	147.3	146.8
Nighttime Passenger Stage 2	119.8	110.2	NA	NA	NA	NA	NA	NA	NA	NA
Nighttime Passenger Stage 3	151.6	150.8	149.4	148.8	150.0	150.1	149.3	149.7	150.0	149.1
Daytime Cargo Stage 2	111.1	117.3	111.2	113.7	109.4	NA	NA	NA	NA	NA
Daytime Cargo Stage 3	137.5	137.0	137.0	136.1	135.7	135.8	135.5	135.8	135.8	135.2
Nighttime Cargo Stage 2	112.3	116.4	111.4	103.2	117.5	NA	NA	NA	NA	NA
Nighttime Cargo Stage 3	147.8	147.4	147.0	146.8	146.7	146.2	146.1	146.0	145.6	145.5

Table H-14 Cumulative Noise Index (EPNL) – 1990 to 2015 (limit 156.5)							
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**Change 2014 to 2015**
Full CNI (Entire Commercial Jet Fleet)	**151.9**	**152.1**	**152.2**	**152.3**	**152.9**	**152.7**	**-0.2**
Total Passenger Jets	150.9	150.6	151.3	151.4	152.2	152.0	-0.2
Total Cargo Jets	145.1	146.7	144.9	145.1	144.5	144.2	-0.3
Total Daytime	146.8	146.9	147	147.0	147.5	147.2	-0.3
Total Nighttime	150.3	150.6	150.6	150.8	151.3	151.2	-0.1
Total Stage 2 Jets	113.6	110.8	104.9	111.3	NA	NA	NA
Total Stage 3 Jets	151.9	152.1	152.2	152.3	152.9	152.7	-0.2
Daytime Stage 2	103.6	NA	104.9	101.4	NA	NA	NA
Nighttime Stage 2	113.1	110.8	NA	110.8	NA	NA	NA
Daytime Stage 3	146.8	146.9	147	147.0	147.5	147.2	-0.3
Nighttime Stage 3	150.3	150.6	150.6	150.8	151.3	151.2	-0.1
Passenger Jet Stage 2	NA	NA	104.9	101.4	NA	NA	NA
Passenger Jet Stage 3	150.9	150.6	151.3	151.4	152.2	152.0	-0.2
Cargo Jet Stage 2	113.6	110.8	NA	110.8	NA	NA	NA
Cargo Jet Stage 3	145.1	146.7	144.9	145.1	144.5	144.2	-0.3
Daytime Passenger	146.6	146.5	146.8	146.8	147.3	147.0	-0.3
Nighttime Passenger	149.0	148.5	149.4	149.6	150.5	150.3	-0.2
Daytime Cargo	134.5	136.6	134	133.6	134.9	134.4	-0.5
Nighttime Cargo	144.7	146.3	144.5	144.8	144.0	143.7	-0.3
Daytime Passenger Stage 2	NA	NA	104.9	101.4	NA	NA	NA
Daytime Passenger Stage 3	146.6	146.5	146.8	146.8	147.3	147.0	-0.3
Nighttime Passenger Stage 2	NA	NA	NA	NA	NA	NA	NA
Nighttime Passenger Stage 3	149.0	148.5	149.4	149.6	150.5	150.3	-0.2
Daytime Cargo Stage 2	103.6	NA	NA	NA	NA	NA	NA
Daytime Cargo Stage 3	134.4	136.6	134	133.6	134.9	134.4	-0.5
Nighttime Cargo Stage 2	113.1	110.8	NA	110.8	NA	NA	NA
Nighttime Cargo Stage 3	144.7	146.3	144.5	144.8	144.0	143.7	-0.3

Source: HMMH, 2015.
Notes: GA and non-jet aircraft are not included in the calculation.
NA = Not available.

Flight Track Monitoring Report

As part of its ongoing commitment to mitigate noise at Logan Airport, Massport has undertaken evaluating the flight tracks of turbojet aircraft engaged in the implementation of established FAA noise abatement procedures. As is true for any airport operator, however, Massport has no authority to control where individual aircraft actually fly. That remains the responsibility of the FAA, while the individual pilots are responsible for safely executing the FAA's instructions. The flight procedures, which are used by the Air Traffic Control (ATC) staff at Boston Tower to achieve desired noise abatement tracks, are contained in the FAA's Tower Order (BOS TWR 7040.1).

This is the thirteenth annual report for flight track monitoring. Prior to 2002, Massport had issued semi-annual reports, an outgrowth of the Flight Track Monitoring Program study. That study was contained in the *Generic Environmental Impact Report* filed with Massachusetts Environmental Policy Act (MEPA) in July 1996, and was the subject of two Community Working Group workshops in September and October 1996. The thirteenth annual report was published in Appendix H, *Noise Abatement* in the *2014 EDR*. The information for 2014 is repeated in this report for reference. The period covered by this *2015 EDR* is January 1, 2015 through December 31, 2015.

The purpose of the ongoing monitoring program is to identify any systematic changes in flight tracks that may occur and to reduce flight track dispersion, where appropriate. The next report will cover the period January 1, 2016 through December 31, 2016, and will be included in the *2016 ESPR*.

FAA Air Traffic Control (ATC) Procedures

FAA Tower Order BOS TWR 7040.1 entitled "Noise Abatement" describes the series of noise abatement policies, rules, regulations, and the procedures to be followed by the FAA air traffic controllers in meeting their designated responsibilities to be "a good neighbor, while meeting our operational objectives/ responsibilities to the National Airspace System." Section 7.a.3 of the Order, subtitled "Turbojet Departure Noise Abatement Procedures," states that all turbojet departures shall be issued the Standard Instrument Departure (SID) procedure appropriate for the departure runway. They are paraphrased from the LOGAN NINE SID[16] below.

Note in the descriptions that follow that terms such as "BOS 2 DME" are used frequently. Here, BOS refers to an aid to navigation known as the BOSTON VORTAC, a radio beacon physically located on Logan Airport near the eastern shoreline between the ends of Runways 27 and 33L (see **Figure H-14**). DME refers to "Distance Measuring Equipment," a co-located aid to navigation that provides pilots with a cockpit display of the number of nautical miles that the aircraft is from the designated radio beacon. Thus, BOS 2 DME means an aircraft should be two nautical miles away from the BOS. The term "vectored" means the pilot is assigned to fly a magnetic heading given by and at the discretion of the FAA air traffic controller to maintain the safe separation of aircraft. "MSL" is defined as feet above mean sea level and is the indicator of aircraft altitude used both by the pilot in the cockpit and the air traffic controller on the ground.

16 Accessed 04/07/2016

During 2010, several of the conventional-only (or radar vector) and RNAV procedures from the Boston Logan Airport Noise Study Categorical Exclusion (CATEX)[17] were implemented. There are eight new RNAV procedures for departures from Logan Airport. These eight procedures are used by aircraft departing Runways 4R, 9, 15R, 22L, 22R, 27, and 33L (Runways 27 and 33L were added in 2014). These procedures primarily affected departures flying over the North and South shores and were designed to increase the amount of jet traffic crossing back over land above 6,000 feet to minimize noise impacts to communities. A ninth RNAV procedure, which is used by Runway 27, has been in use at the Airport and has been modified several times.

For departures, the conventional procedures (flown by non-RNAV equipped aircraft) from the LOGAN NINE SID are:

- For Runway 4R, climb heading 036 degrees to BOS 4 DME, then turn right to a heading of 090 degrees, and then expect radar vectors to assigned route/navaid/fix. Aircraft that are initially vectored over water can expect to cross the coastline above 6,000 MSL before proceeding on course.
- For Runway 9, climb heading 093 degrees, and then expect radar vectors to assigned route/navaid/fix. Aircraft that are initially vectored over water can expect to cross the coastline above 6,000 MSL before proceeding on course.
- For Runway 14, climb heading 142 degrees to BOS 1 DME, then turn left to heading 120 degrees, then expect radar vectors to assigned route/navaid/fix. Aircraft that are initially vectored over water can expect to cross the coastline above 6,000 MSL before proceeding on course.
- For Runway 15R, climb heading 151 degrees to BOS 1 DME then turn left to 120 degrees, then expect radar vectors to assigned route/navaid/fix. Aircraft that are initially vectored over water can expect to cross the coastline above 6,000 MSL before proceeding on course.
- For Runways 22R and 22L, climbing left turn to a heading of 140 degrees, then expect radar vectors to assigned route/navaid/fix. Aircraft that are initially vectored over water can expect to cross the coastline above 6,000 MSL before proceeding on course.
- For Runway 33L, climb heading 331 degrees to BOS 2 DME then turn left to 316 degrees, then expect radar vectors to assigned route/navaid/fix.
- For Runway 27, climb heading 273 to BOS 2.2 DME, then turn left heading 235 degrees, then expect radar vectors to assigned route/navaid/fix.

The RNAV procedures (used only by Turbojets)[18] and the runways they serve:

- BLZZR THREE – Runways 4L, 9, 15R, 22L, 22R, 27, and 33L: This procedure directs most jet traffic in a well-defined flight corridor over the ocean and crossing back over the South Shore near Cohasset and Scituate.
- BRUWN FOUR – Runways 4L, 9, 15R, 22L, 22R, 27, and 33L: This procedure directs most jet traffic in a well-defined flight corridor over the ocean towards Cape Cod.

17 Federal Aviation Administration (FAA) Boston Logan Airport Noise Study Categorical Exclusion Record of Decision (CATEX ROD), Issued October 16, 2007

18 These are the procedures as defined on April 7, 2016. Procedures may be adjusted at points throughout the year.

- CELTK FOUR – Runways 4L, 9, 15R, 22L, 22R, 27, and 33L: This procedure directs most jet traffic in a well-defined flight corridor over the ocean.
- HYLND FOUR – 4L, 9, 15R, 22L, 22R, 27, and 33L: This procedure directs most jet traffic in a well-defined flight corridor over the ocean and crossing back over the North Shore near Beverly.
- LBSTA FOUR – 4L, 9, 15R, 22L, 22R, 27, 33L: This procedure directs most jet traffic in a well-defined flight corridor over the ocean and crossing back over the North Shore near Manchester and Gloucester.
- PATSS FOUR – 4L, 9, 15R, 22L, 22R, 27, 33L: This procedure directs most jet traffic in a well-defined flight corridor over the ocean and crossing back over the South Shore near Cohasset and Scituate.
- REVSS THREE – 4L, 9, 15R, 22L, 22R, 27, 33L: This procedure directs most jet traffic in a well-defined flight corridor over the ocean and crossing back over the South Shore near Cohasset and Scituate.
- SSOXS FOUR – 4L, 9, 15R, 22L, 22R, 27, 33L: This procedure directs most jet traffic in a well-defined flight corridor over the ocean and crossing back over the South Shore over Marshfield.
- WYLYY TWO – 27: This procedure directs most jet traffic in a well-defined flight corridor on a heading of 273 degrees then a turn to 235 degrees over South Boston.

These brief procedural statements form the basis of the verbal instructions and flight clearances that are passed from controller to pilot to achieve reduced noise in the communities surrounding Logan Airport while also maintaining the safe and efficient flow of aircraft in and out of the Airport. However, consistency with which these procedures are used varies due to air traffic demands, controller workloads, weather conditions, and other operational factors, as noted in the Flight Track Monitoring Program Study.

Figure H-14 presents the gates used in the analysis for the Flight Track Monitoring Report. These gates are virtual vertical planes, which are used in the analysis to capture the aircraft flight paths. The gates are defined using a geographic coordinate for each end of the gate along with a floor and a ceiling altitude. The gates also capture direction of flights (in or out). The edges of each gate in **Figure H-14** point in the direction that the aircraft is coming from. This information is used to evaluate the performance of the flight procedures off each runway end and is presented below. **Figure H-14** also displays the BOS location, which is used for the distance measurements for the conventional procedures.

The RNAV procedures are still captured by the original flight track monitoring gates. Traffic crossing over the North Shore passes through the Marblehead Gate and traffic passing over the South Shore passes through the Hull 2, Hull 3, and Cohasset Gates. Turbojets departing Runway 27 on the RNAV pass through the Runway 27 gates and the new Runway 33L RNAV flight tracks still pass between the Somerville and Everett gates as expected.

Source: HMMH, MassGIS, USDA NAIP 2010

Logan Airport Flight Track Monitor Gates

Logan Flight Gates

Boston VOR/DME

Figure H-14

Statistical Analyses of Flight Tracks - Runway 4R

The Nahant Gate (**Figure H-14**) monitors aircraft after the first turn at 4 DME. The Swampscott and Marblehead Gates monitor northbound shoreline crossings, while the Hull 2, Hull 3, and Cohasset Gates monitor southbound shoreline crossings.

Tables H-15a and **H-15b** show that Runway 4R departures for 2015 were concentrated, with 99.2 percent "over the Causeway," and about 0.3 percent over the south end of the gate compared to 99.0 percent over the Causeway in 2014 and 0.2 percent over the south end of the gate. Departures through the north end of the gate decreased from 0.8 percent in 2014 to 0.5 percent in 2015.

Table H-15a Runway 4R Nahant Gate Summary for 2014

	Number of Tracks Through Gate Segment	Total Number of Tracks Through Gate	Percentage of Tracks Through Gate Segment
North End of Gate	54	6,787	0.8%
Over Causeway	6,717	6,787	99.0%
South End of Gate	16	6,787	0.2%
Total	**6,787**	**6,787**	**100.00%**

Source: Massport, HMMH 2014.

Table H-15b Runway 4R Nahant Gate Summary for 2015

	Number of Tracks Through Gate Segment	Total Number of Tracks Through Gate	Percentage of Tracks Through Gate Segment
North End of Gate	35	6,851	0.5%
Over Causeway	6,797	6,851	99.2%
South End of Gate	19	6,851	0.3%
Total	**6,851**	**6,851**	**100.00%**

Source: Massport, HMMH 2015.

Table H-16a and **H-16b** show how many of the shoreline crossings from Runway 4R were above 6,000 feet. For 2015, 97.2 percent of the flights were above 6,000 feet compared to 96.9 percent in 2014. The Swampscott gate had 23.3 percent of flights above 6,000 feet in 2015 compared to 24.2 percent in 2014. The number of flights through the Swampscott gate decreased in 2015 (124 in 2014, down to 116 in 2015). The crossing percentage for this gate is historically lower than most gates due to its proximity to the Nahant gate itself. As seen in **Figure H-14**, the Swampscott gate is adjacent to the Nahant gate and aircraft would have to climb very quickly to be above 6,000 feet when crossing the Swampscott gate.

Table H-16a Runway 4R Shoreline Crossings Above 6,000 Feet for 2014

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Swampscott Gate	124	30	24.2%
Marblehead Gate	2,856	2,817	98.6%
Hull 2 Gate	280	280	100.0%
Hull 3 Gate	856	855	99.9%
Cohasset Gate	181	181	100.0%
Total	**4,297**	**4,163**	**96.9%**

Source: Massport, HMMH 2014.

Table H-16b Runway 4R Shoreline Crossings Above 6,000 Feet for 2015

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Swampscott Gate	116	27	23.3%
Marblehead Gate	2,770	2,735	98.7%
Hull 2 Gate	345	345	100.0%
Hull 3 Gate	1,034	1,033	99.9%
Cohasset Gate	196	196	100.0%
Total	**4,461**	**4,336**	**97.2%**

Source: Massport, HMMH 2015.

Statistical Analyses of Flight Tracks - Runway 9

The Winthrop 1 and Winthrop 2 gates (**Figure H-14**) monitor early turns for departures off Runway 9. The Revere, Swampscott, or Marblehead gates monitor northbound shoreline crossings, while the Hull 2, Hull 3, or Cohasset gates monitor southbound shoreline crossings.

Tables H-17a and **H-17b** show how many tracks turned prior to the BOS 2 DME. Northbound turns before BOS 2 DME pass through the Winthrop 1 Gate. Southbound traffic would pass through the Winthrop 2 Gate. In 2015, between both gates there were a total of 44 such turns, 0.1 percent. In 2014, 52 tracks or 0.1 percent of the total also crossed these gates.

Table H-17a Runway 9 Gate Summary — Winthrop Gates 1 and 2 for 2014

	Number of Departure Tracks	Number of Tracks Through Gate	Percent Turning Before BOS 2 DME
Winthrop 1 Gate	44,979	27	0.1%
Winthrop 2 Gate	44,979	25	0.1%
Total	**44,979**	**52**	**0.1%**

Source: Massport, HMMH 2014.

Table H-17b Runway 9 Gate Summary — Winthrop Gates 1 and 2 for 2015

	Number of Departure Tracks	Number of Tracks Through Gate	Percent Turning Before BOS 2 DME
Winthrop 1 Gate	45,371	20	<0.1%
Winthrop 2 Gate	45,371	24	0.1%
Total	**45,371**	**44**	**0.1%**

Source: Massport, HMMH 2015.

Table H-18a and **H-18b** indicate that 99.3 percent of Runway 9 departures were above 6,000 feet when crossing the shoreline in 2015, compared with 98.5 percent in 2014. The number of Runway 9 departures crossing back over the South Shore increased from 31,370 in 2014 to 33,807 in 2015.

An increase in the percentage above 6,000 feet occurred at the Revere gate (46.7 percent in 2014 to 60.6 percent in 2014) and a slight increase at the Hull 2 gate (99.0 percent in 2014 to 99.4 percent in 2015).

The number of crossings increased for the Revere gate (45 in 2014 to 60 in 2015) and increased at the Swampscott gate (316 in 2014 to 435 in 2015). The Marblehead gate had an increase in crossings (from 10,596 in 2014 to 11,333 in 2015), and an increase in the percent above 6,000 feet (from 99.6 percent in 2014 to 99.7 percent in 2015). Both the Hull 2 and Hull 3 gates had an increase in crossings compared to 2014. Hull 2 increased from 1,939 in 2014 to 2,120 in 2015 and Hull 3 increased from 4,318 in 2014 to 4,834 in 2014. The Hull 2 crossing percentage increased slightly from 99.0 percent in 2014 to 99.4 percent in 2015, and the Hull 3 gate crossings increased from 95.6 percent to 98.1 percent. The crossings through the Cohasset gate increased (from 14,156 in 2014 to 15,019 in 2015) and the percent above 6,000 feet increased slightly from 98.9 percent in 2014 to 99.8 percent in 2015.

Table H-18a Runway 9 Shoreline Crossings Above 6,000 Feet for 2014

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Revere Gate	45	21	46.7%
Swampscott Gate	316	278	88.0%
Marblehead Gate	10,596	10,552	99.6%
Hull 2 Gate	1,939	1,920	99.0%
Hull 3 Gate	4,318	4,126	95.6%
Cohasset Gate	14,156	13,994	98.9%
Total	**31,370**	**30,891**	**98.5%**

Source: Massport, HMMH 2014

Table H-18b Runway 9 Shoreline Crossings Above 6,000 Feet for 2015

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Revere Gate	66	40	60.6%
Swampscott Gate	435	398	91.5%
Marblehead Gate	11,333	11,298	99.7%
Hull 2 Gate	2,120	2,108	99.4%
Hull 3 Gate	4,834	4,742	98.1%
Cohasset Gate	15,019	14,993	99.8%
Total	**33,807**	**33,579**	**99.3%**

Source: Massport, HMMH 2015.

Statistical Analyses of Flight Tracks - Runway 15R

After takeoff, Runway 15R departures turn left approximately 30 degrees to avoid Hull, head out over Boston Harbor, and return back over the shore through the Swampscott and Marblehead Gates (**Figure H-14**) to the north, or through the Hull 2, Hull 3, and Cohasset Gates to the south. **Tables H-19a** and **H-19b** indicate that 99.4 percent of Runway 15R departures were above 6,000 feet when crossing the shoreline in 2015, compared with 98.2 percent in 2014. At 98.3 percent, the percent above 6,000 feet for the Swampscott Gate decreased in 2015, from 99.2 percent in 2014. The Marblehead gate had an increase in crossings (from 1,638 in 2014 to 2,025 in 2015) and achieved 100 percent compliance above 6,000 feet. The Hull 2 gate percentage remained at 100 percent in 2015, and the Hull 3 gate increased from 83.2 percent in 2014 to 94.3 percent in 2015. The Cohasset gate had an increasein crossings (from 2,207 in 2014 to 2,554 in 2015) and the percent above 6,000 feet increased from 98.1 percent to 99.6 percent.

Table H-19a Runway 15R Shoreline Crossings Above 6,000 Feet for 2014

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Swampscott Gate	120	119	99.2%
Marblehead Gate	1,638	1,636	99.9%
Hull 2 Gate	4	4	100.0%
Hull 3 Gate	191	159	83.2%
Cohasset Gate	2,207	2,166	98.1%
Total	**4,160**	**4,084**	**98.2%**

Source: Massport, HMMH 2014.

Table H-19b Runway 15R Shoreline Crossings Above 6,000 Feet for 2015

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Swampscott Gate	179	176	98.3%
Marblehead Gate	2,025	2,025	100.0%
Hull 2 Gate	14	14	100.0%
Hull 3 Gate	282	266	94.3%
Cohasset Gate	2,554	2,544	99.6%
Total	**5,054**	**5,025**	**99.4%**

Source: Massport, HMMH 2015.

Statistical Analyses of Flight Tracks - Runways 22R and 22L

The Squantum 2 and Hull 1 Gates (**Figure H-14**) are used to monitor the turn to 140 degrees over Boston Harbor and north of Hull. The shoreline gates are used to monitor shoreline crossings, as for Runways 4R, 9, and 15R above.

Tables H-20a and **H-20b** show the dispersion of the jet departures from Runways 22R and 22L as they pass through the Squantum 2 Gate. The first segment of the gate is the northernmost segment and is primarily over Boston Harbor. The other segments extend southward toward Quincy. The percentage of tracks passing through the first two segments of this gate decreased from 89.5 percent in 2014 to 89.2 percent in 2015.

Table H-20a Runways 22R and 22L Squantum 2 Gate Summary for 2014

	Number of Tracks Through Gate Segment	Total Number of Tracks Through All Gate Segments	Percentage of Tracks Through Gate Segment
0 - 12,000 ft	2,297	44,093	5.2%
12,000 - 14,000 ft	37,161	44,093	84.3%
14,000 - 21,000 ft	4,594	44,093	10.4%
21,000 - 27,000 ft	41	44,093	0.1%
Total	**44,093**	**44,093**	**100.0%**

Source: Massport, HMMH 2014.

Note: Percentages sum to more than 100 percent due to rounding.

Table H-20b Runways 22R and 22L Squantum 2 Gate Summary for 2015

	Number of Tracks Through Gate Segment	Total Number of Tracks Through All Gate Segments	Percentage of Tracks Through Gate Segment
0 - 12,000 ft	3,183	53,958	5.9%
12,000 - 14,000 ft	44,923	53,958	83.3%
14,000 - 21,000 ft	5,806	53,958	10.8%
21,000 - 27,000 ft	46	53,958	0.1%
Total	**53,958**	**53,958**	**100.0%**

Source: Massport, HMMH 2015.

Note: Percentages sum to more than 100 percent due to rounding.

Tables H-21a and **H-21b** show that the percent of tracks crossing north of the Hull peninsula as they passed through the Hull 1 Gate was 98.9 percent in 2014 and 98.8 percent in 2015.

Table H-21a Runways 15R, 22R, and 22L Hull 1 Gate Summary – North of Hull Peninsula for 2014

	Number of Tracks Through Gate Segment	Total Number of Tracks Through Gate	Percentage of Tracks Through Gate Segment
North of Hull Peninsula	50,327	50,909	98.9%
Over Hull	582	50,909	1.1%
Total	**50,909**	**50,909**	**100.0%**

Source: Massport, HMMH 2014

Table H-21b	**Runways 15R, 22R, and 22L Hull 1 Gate Summary – North of Hull Peninsula for 2015**		
	Number of Tracks Through Gate Segment	**Total Number of Tracks Through Gate**	**Percentage of Tracks Through Gate Segment**
North of Hull Peninsula	61,537	62,259	98.8%
Over Hull	722	62,259	1.2%
Total	**62,259**	**62,259**	**100.0%**

Source: Massport, HMMH 2015.

Tables H-22a and **H-22b** indicate that 99.7 percent of Runway 22R/22L departures were above 6,000 feet when crossing the shoreline in 2015, compared with 98.9 percent in 2014. For the Revere gate, the percent above 6,000 feet increased from 95.9 percent in 2014 to 97.6 percent in 2015. The Swampscott gate increased from 99.1 percent in 2014 to 100 percent in 2015. The Marblehead gate had an increasein crossings (from 11,027 in 2014 to 13,932 in 2015) and the percent above 6,000 feet remained the same as 2011 at 100 percent. The Hull 2 gate decreased in percent above 6,000 feet from 96.3 percent in 2013 to 91.3 percent in 2014. The Hull 3 gate decreased in percent above 6,000 feet from 91.3 percent in 2014 to 87.5 percent in 2015. The number of crossings for the Cohasset gate increased (17,117 in 2014 to 20,704 in 2015) and the percentage slightly increased from 98.9 percent in 2014 to 99.7 percent in 2015.

Table H-22a	**Runways 22R and 22L Shoreline Crossings Above 6,000 Feet for 2014**		
	Number of Tracks Through Gate	**Number Above 6,000 ft**	**Percentage Above 6,000 ft**
Revere Gate	73	70	95.9%
Swampscott Gate	444	440	99.1%
Marblehead Gate	11,027	11,021	99.9%
Hull 2 Gate	23	21	91.3%
Hull 3 Gate	1,318	1227	93.1%
Cohasset Gate	17,117	16,904	98.8%
Total	**30,002**	**29,683**	**98.9%**

Source: Massport, HMMH 2014.

Table H-22b Runways 22R and 22L Shoreline Crossings Above 6,000 Feet for 2015

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Revere Gate	127	124	97.6%
Swampscott Gate	1114	1114	100.0%
Marblehead Gate	13,932	13,929	100.0%
Hull 2 Gate	32	28	87.5%
Hull 3 Gate	2,119	2057	97.1%
Cohasset Gate	20,704	20,651	99.7%
Total	**38,028**	**37,903**	**99.7%**

Source: Massport, HMMH 2015.

Runway 27

On September 15, 1996, the FAA implemented a new departure procedure for Runway 27 called the WYLYY RNAV procedure. In accordance with the provisions of the ROD issued for the Runway 27 Environmental Impact Statement, Massport has been providing on-going radar flight track data and analysis to the FAA with respect to the procedure.

In 2012, for the first time since 1997 when flight track monitoring began, each gate (Gates A through E) averaged over 68 percent for every month the Airport had all runways open and for the annual average. The percent of flight tracks through all gates (a number tracked but not required per the 1996 ROD) rounded up to 68 percent for the last two months of 2011 and continued for all of 2012. The FAA had discussed these data internally and concluded that acceptable flight track dispersion had been achieved and that no subsequent action by FAA is required per the 1996 ROD requirements.[19]

Massport will continue to provide **Tables H-23a** and **H-23b** in the subsequent annual reports. **Table H-23a** presents the conformance results for the Runway 27 corridor for 2013 and **Table H-23b** for 2014. The average percentage of tracks through the corridor was 76.8 percent for 2014 and 83.7 percent for 2015.

Each gate is further from the runway and falls along the procedure. The gates also increase in width as the distance is increased along the flight path and they form a noise abatement corridor. A consistent percentage of traffic through each gate means that flights are not entering the corridor late or exiting the corridor too early. The average percent through each gate was 92.2 percent in 2014 and 95.1 percent in 2015, which means that the majority of the traffic remained in the corridor.

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Table H-23a Runway 27 Corridor Percent of Tracks Through Each Gate for 2014

Month	**Total # of Tracks**	**Total # of Tracks Through All Gates**	**Percent of Tracks Through All Gates**	**Gate A**	**Gate B**	**Gate C**	**Gate D**	**Gate E**	**Average Percent Through Each Gate**
				1,400[1]	**2,200[1]**	**2,900[1]**	**4,700[1]**	**6,300[1]**	
January	1,841	1,396	75.8%	78.0%	91.6%	95.8%	97.7%	97.3%	92.1%
February	2,132	1591	74.6%	78.0%	90.9%	95.2%	97.1%	96.1%	91.4%
March	1,461	1,134	77.6%	80.4%	92.0%	96.9%	98.0%	97.0%	92.9%
April	1,609	1,237	76.9%	80.1%	91.9%	95.3%	96.7%	96.1%	92.0%
May	1301	1045	80.3%	82.5%	93.4%	97.7%	98.6%	98.1%	94.1%
June	1135	863	76.0%	78.4%	91.0%	95.2%	97.4%	97.1%	91.8%
July	1192	876	73.5%	75.5%	89.1%	94.1%	96.5%	95.6%	90.2%
August	1033	770	74.5%	76.7%	89.5%	96.1%	98.4%	97.6%	91.6%
September	1381	1117	80.9%	83.1%	91.8%	94.7%	96.0%	95.9%	92.3%
October	1,836	1373	74.8%	78.2%	91.1%	95.0%	97.3%	96.2%	91.6%
November	2,797	2,194	78.4%	81.3%	92.8%	96.1%	97.6%	97.0%	92.9%
December	1,410	1,100	78.0%	80.6%	92.8%	96.8%	98.2%	97.3%	93.1%
Average	**1,594**	**1,225**	**76.8%**	**79.4%**	**91.5%**	**95.7%**	**97.5%**	**96.8%**	**92.2%**

Source: Massport, HMMH 2014.
Notes: Gray shading indicates the percentage rounds up to 68 percent or greater.
1 Width of each gate in feet.

Table H-23b	Runway 27 Corridor Percent of Tracks Through Each Gate for 2015								
Month	**Total # of Tracks**	**Total # of Tracks Through All Gates**	**Percent of Tracks Through All Gates**	**Gate A**	**Gate B**	**Gate C**	**Gate D**	**Gate E**	**Average Percent Through Each Gate**
				1,400[1]	**2,200[1]**	**2,900[1]**	**4,700[1]**	**6,300[1]**	
January	2,586	2,118	81.9%	2,212	2,435	2,524	2,560	2,538	94.9%
February	3,142	2604	82.9%	2,725	2,944	3,059	3,111	3,076	94.9%
March	2,706	2,207	81.6%	2,314	2,547	2,633	2,675	2,642	94.7%
April	1,245	1,059	85.1%	1,100	1,189	1,222	1,235	1,224	95.9%
May	685	539	78.7%	581	647	649	657	640	92.7%
June	772	642	83.2%	681	727	747	760	753	95.0%
July	1005	837	83.3%	868	954	975	995	989	95.1%
August	996	861	86.4%	891	940	968	984	980	95.6%
September	855	721	84.3%	742	809	834	846	840	95.2%
October	1,821	1569	86.2%	1,604	1,736	1,794	1,806	1,793	95.9%
November	1,868	1,612	86.3%	1,650	1,789	1,826	1,848	1,831	95.8%
December	1,634	1,379	84.4%	1,410	1,563	1,603	1,611	1,592	95.2%
Average	**1,610**	**1,346**	**83.7%**	**1,398**	**1,523**	**1,570**	**1,591**	**1,575**	**95.1%**

Source: Massport, HMMH 2015.
Notes: Gray shading indicates the percentage rounds up to 68 percent or greater.
1 Width of each gate in feet.

Statistical Analyses of Flight Tracks — Runway 33L

The Somerville and Everett Gates (**Figure H-14**) extend from BOS 2 DME to BOS 5 DME and are used to monitor the departure procedure for Runway 33L. Turns to the left prior to the BOS 5 DME would pass through the Somerville Gate. Turns to the right prior to the BOS 5 DME would pass through the Everett Gate.

Tables H-24a and **H-24b** indicate the percentage of tracks turning before BOS 5 DME decreases from 2.0 percent in 2014 to 1.7 percent in 2015. The total number of tracks decreased from 25,412 in 2014 to 24,203 in 2015.

Table H-24a Runway 33L Gates — Passages Below 3,000 Feet for 2015

	Number of Departure Tracks	Number of Tracks Turning Before BOS 5 DME	Percentage of Tracks Turning Before BOS 5 DME
Everett Gate	25,412	229	0.9%
Somerville Gate	25,412	285	1.1%
Total	**25,412**	**514**	**2.0%**

Source: Massport, HMMH 2015.

Table H-24b Runway 33L Gates — Passages Below 3,000 Feet for 2015

	Number of Departure Tracks	Number of Tracks Turning Before BOS 5 DME	Percentage of Tracks Turning Before BOS 5 DME
Everett Gate	24,203	205	0.8%
Somerville Gate	24,203	197	0.8%
Total	**24,203**	**402**	**1.7%**

Source: Massport, HMMH 2015.

Table H-25 provides the level of traffic off each runway end in 2014 and 2015. These percent's represent the amount of activity experienced off each runway end for a given year.

Table H-25 Runway Usage by Runway End

		2014		2015	
By Runway End	**Operations(s)**	**Total Flights**	**% of Total**	**Total Flights**	**% of Total**
04L	R4L A + R22R D	67,385	18.5%	74,695	20.0%
04R	R4R A + R22L D	52,984	14.6%	52,664	14.1%
09	R9 A + R27 D	21,220	5.8%	20,892	5.6%
14	N/A	0	0.0%	0	0.0%
15L	R15L A + R33R D	69	0.0%	123	0.0%
15R	R15R A + R33L D	34,887	9.6%	31,388	8.4%
22L	R22L A + R4R D	54,116	14.9%	55,164	14.8%
22R	R22R A + R4L D	6,977	1.9%	6,312	1.7%
27	R27 A + R9 D	85,064	23.4%	88,683	23.8%
32	R32 A + R14 D	4,751	1.3%	4,066	1.1%
33L	R33L A + R15R D	35,480	9.8%	37,667	10.1%
33R	R33R A + R15L D	865	0.2%	1,275	0.3%
All		**363,797**	**100.0%**	**372,930**	**100.0%**

Notes: A=Arrivals
1 D=Departures

2015 DNL Levels for Census Block Group Locations

Table H-26 reports the DNL value for each Census block group down to the DNL 50 dB.

Table H-26 2015 DNL Levels for Census Block Group Locations within the DNL 50 dB

U.S. Census 2010 Block Group					
Block Group ID	**Name**	**Population**	**Housing units**	**Average Block DNL**	**DNL at centroid**
250250203021	Back Bay	1,181	721	48.2	48.2
250250202001	Back Bay	1,266	897	47.6	47.6
250250703001	Back Bay	1,065	804	49.0	49.0
250173521012	Cambridge	1,473	1,187	46.8	46.8
250250408012	Charlestown	828	263	53.1	53.1
250250408013	Charlestown	2,011	1,296	50.6	50.6
250250402001	Charlestown	775	304	50.6	50.6
250250408011	Charlestown	1,061	530	50.0	50.0
250250402002	Charlestown	831	423	49.4	49.4
250250403001	Charlestown	739	334	49.7	49.7
250250403004	Charlestown	617	320	49.3	49.3
250250403003	Charlestown	657	366	48.8	48.8
250250401001	Charlestown	958	555	48.6	48.6
250250403002	Charlestown	1,247	662	48.7	48.7
250250406001	Charlestown	863	491	48.7	48.7
250250406002	Charlestown	1,581	843	48.7	48.7
250250401002	Charlestown	1,210	684	48.1	48.1
250250403005	Charlestown	622	355	48.3	48.3
250250404011	Charlestown	1,689	766	47.8	47.8
250250404012	Charlestown	750	456	47.6	47.6
250251602003	Chelsea	1,497	494	63.0	63.0
250251601015	Chelsea	1,025	261	62.7	62.7
250251602002	Chelsea	1,210	374	61.6	61.6
250251601013	Chelsea	1,730	568	59.9	59.9
250251601011	Chelsea	1,332	353	59.9	59.9
250251603002	Chelsea	596	366	62.5	62.5
250251604002	Chelsea	1,783	683	59.9	59.9
250251602001	Chelsea	1,336	357	59.1	59.1
250251603001	Chelsea	1,469	913	59.9	59.9
250251604001	Chelsea	933	345	58.4	58.4
250251601012	Chelsea	1,372	438	56.9	56.9
250251605022	Chelsea	1,359	477	52.1	52.1
250251601014	Chelsea	2,092	539	55.7	55.7

Table H-26 2015 DNL Levels for Census Block Group Locations within the DNL 50 dB					
U.S. Census 2010 Block Group					
Block Group ID	**Name**	**Population**	**Housing units**	**Average Block DNL**	**DNL at centroid**
250251605021	Chelsea	1,703	624	51.9	51.9
250251605013	Chelsea	774	233	54.5	54.5
250251605023	Chelsea	1,398	488	52.5	52.5
250251605012	Chelsea	1,231	396	52.8	52.8
250251605014	Chelsea	754	392	53.2	53.2
250251605015	Chelsea	748	304	52.0	52.0
250251605011	Chelsea	2,097	646	52.6	52.6
250251606011	Chelsea	2,158	1,005	49.9	49.9
250251606012	Chelsea	1,905	565	50.7	50.7
250251606024	Chelsea	780	271	48.6	48.6
250251606025	Chelsea	985	409	49.0	49.0
250251606021	Chelsea	1,290	470	50.1	50.1
250251606022	Chelsea	795	304	48.1	48.1
250251606023	Chelsea	825	346	47.1	47.1
250251006032	Dorchester	598	284	58.1	58.1
250251007002	Dorchester	1,027	527	57.5	57.5
250251006031	Dorchester	1,306	556	55.6	55.6
250251007003	Dorchester	672	290	55.9	55.9
250250907004	Dorchester	651	302	53.6	53.6
250250909012	Dorchester	2,103	1,034	52.8	52.8
250250913002	Dorchester	1,131	388	52.7	52.7
250251007001	Dorchester	1,050	484	54.0	54.0
250250913001	Dorchester	1,368	480	51.3	51.3
250250907002	Dorchester	1,253	644	51.1	51.1
250250914001	Dorchester	1,672	584	50.5	50.5
250251008004	Dorchester	1,117	666	51.4	51.4
250251007004	Dorchester	856	371	52.4	52.4
250250907003	Dorchester	1,153	526	50.2	50.2
250250912003	Dorchester	742	296	50.2	50.2
250250921013	Dorchester	729	321	50.7	50.7
250251006011	Dorchester	1,094	488	51.7	51.7
250251007005	Dorchester	717	303	51.9	51.9
250250912001	Dorchester	1,081	451	50.0	50.0
250250907001	Dorchester	1,218	518	50.0	50.0
250250921011	Dorchester	1,113	467	50.3	50.3
250250910013	Dorchester	682	335	49.6	49.6

Table H-26 2015 DNL Levels for Census Block Group Locations within the DNL 50 dB

U.S. Census 2010 Block Group

Block Group ID	Name	Population	Housing units	Average Block DNL	DNL at centroid
250250912002	Dorchester	1,411	492	49.0	49.0
250250915002	Dorchester	1,494	547	48.7	48.7
250250911005	Dorchester	817	297	49.2	49.2
250250909011	Dorchester	1,627	606	50.3	50.3
250250915001	Dorchester	1,978	744	49.0	49.0
250251006012	Dorchester	898	382	50.1	50.1
250251008003	Dorchester	899	412	49.9	49.9
250250918003	Dorchester	933	357	48.6	48.6
250250918001	Dorchester	1,517	517	48.8	48.8
250250919001	Dorchester	1,042	329	48.4	48.4
250250918002	Dorchester	1,002	340	48.8	48.8
250250911001	Dorchester	1,395	625	49.0	49.0
250250203031	Downtown Boston	878	693	47.8	47.8
250250203033	Downtown Boston	1,179	789	47.5	47.5
250250701011	Downtown Boston	850	529	54.2	54.2
250250702002	Downtown Boston	1,133	444	52.9	52.9
250250303001	Downtown Boston	1,757	1,283	51.6	51.6
250250305001	Downtown Boston	704	442	50.2	50.2
250250305002	Downtown Boston	1,025	687	50.4	50.4
250250305003	Downtown Boston	809	527	50.0	50.0
250250701018	Downtown Boston	449	246	52.1	52.1
250250702001	Downtown Boston	1,460	599	52.3	52.3
250250304001	Downtown Boston	1,519	994	50.2	50.2
250250303002	Downtown Boston	1,262	709	50.7	50.7
250250301001	Downtown Boston	1,053	790	49.3	49.3
250250304002	Downtown Boston	932	665	50.0	50.0
250250701017	Downtown Boston	1,102	701	51.9	51.9
250250301002	Downtown Boston	901	587	49.2	49.2
250250302001	Downtown Boston	1,665	1,103	49.4	49.4
250250303004	Downtown Boston	548	465	50.4	50.4
250250701012	Downtown Boston	303	90	50.5	50.5
250250702003	Downtown Boston	2,625	647	51.0	51.0
250250303003	Downtown Boston	1,305	503	49.4	49.4
250250701016	Downtown Boston	366	325	50.4	50.4
250250701015	Downtown Boston	451	161	50.1	50.1
250250701013	Downtown Boston	494	390	49.6	49.6

Table H-26 2015 DNL Levels for Census Block Group Locations within the DNL 50 dB

U.S. Census 2010 Block Group					
Block Group ID	**Name**	**Population**	**Housing units**	**Average Block DNL**	**DNL at centroid**
250250203032	Downtown Boston	1,343	365	48.2	48.2
250250701014	Downtown Boston	1,887	941	49.7	49.7
250250703002	Downtown Boston	733	449	50.0	50.0
250250203012	Downtown Boston	1,673	1,209	47.1	47.1
250250203011	Downtown Boston	350	205	47.0	47.0
250250509011	Eagle Hill East Boston	1,283	420	65.8	65.8
250250509013	Eagle Hill East Boston	918	309	63.6	63.6
250250509012	Eagle Hill East Boston	1,964	717	64.1	64.1
250250507003	Eagle Hill East Boston	1,476	505	60.5	60.5
250250502004	Eagle Hill East Boston	1,055	349	61.4	61.4
250250502003	Eagle Hill East Boston	836	283	61.3	61.3
250250507002	Eagle Hill East Boston	1,344	484	58.7	58.7
250250501011	Eagle Hill East Boston	1,713	534	60.3	60.3
250250507001	Eagle Hill East Boston	1,684	617	56.3	56.3
250250501013	Eagle Hill East Boston	1,930	684	59.2	59.2
250250502001	Eagle Hill East Boston	2,189	757	57.4	57.4
250250502002	Eagle Hill East Boston	1,151	445	55.8	55.8
250250501012	Eagle Hill East Boston	1,472	632	57.8	57.8
250173424004	Everett	1,348	517	56.6	56.6
250173424002	Everett	1,132	480	56.8	56.8
250173424003	Everett	905	346	56.7	56.7
250173424001	Everett	1,878	847	55.1	55.1
250173425003	Everett	2,200	970	54.5	54.5
250173423003	Everett	2,137	858	52.9	52.9
250173426002	Everett	904	347	52.0	52.0
250173423004	Everett	1,807	805	51.4	51.4
250173424005	Everett	792	363	51.5	51.5
250173426003	Everett	2,336	941	51.1	51.1
250173425002	Everett	2,169	870	51.1	51.1
250173426001	Everett	1,125	395	50.0	50.0
250173423002	Everett	1,555	596	50.5	50.5
250173421014	Everett	943	362	47.9	47.9
250173423001	Everett	1,327	495	49.7	49.7
250235001012	Hull	819	452	51.0	51.0
250235001011	Hull	1,502	836	53.7	53.7
250251202013	Jamaica Plain	451	221	49.6	49.6

Table H-26 2015 DNL Levels for Census Block Group Locations within the DNL 50 dB

U.S. Census 2010 Block Group

Block Group ID	Name	Population	Housing units	Average Block DNL	DNL at centroid
250251202012	Jamaica Plain	1,841	894	49.7	49.7
250251202011	Jamaica Plain	1,147	611	48.6	48.6
250251204002	Jamaica Plain	676	363	48.1	48.1
250251201041	Jamaica Plain	516	252	47.0	47.0
250250512002	Jefferies Point	1,548	692	56.1	56.1
250250512001	Jefferies Point	32	19	54.9	54.9
250250512003	Jefferies Point	799	449	55.0	55.0
250092072001	Lynn	1,212	391	56.2	56.2
250092070002	Lynn	1,235	456	56.6	56.6
250092072002	Lynn	1,727	789	56.7	56.7
250092071002	Lynn	992	307	56.8	56.8
250092061002	Lynn	2,051	665	56.6	56.6
250092055002	Lynn	2,552	961	56.2	56.2
250092060001	Lynn	1,443	478	55.8	55.8
250092071001	Lynn	1,446	444	55.4	55.4
250092062002	Lynn	2,267	786	55.3	55.3
250092061001	Lynn	1,793	797	54.9	54.9
250092052004	Lynn	1,435	511	55.3	55.3
250092060002	Lynn	1,916	642	54.5	54.5
250092052002	Lynn	714	277	54.7	54.7
250092052005	Lynn	854	385	52.4	52.4
250092051005	Lynn	637	264	54.4	54.4
250092071003	Lynn	1,075	342	54.4	54.4
250092052003	Lynn	1,510	564	54.2	54.2
250092051004	Lynn	1,527	556	53.4	53.4
250092052001	Lynn	806	410	52.7	52.7
250092062003	Lynn	1,859	573	53.7	53.7
250092062001	Lynn	1,128	327	53.4	53.4
250092051003	Lynn	919	361	53.1	53.1
250092070001	Lynn	963	585	53.6	53.6
250092058002	Lynn	1,089	342	52.2	52.2
250092063004	Lynn	1,040	367	52.3	52.3
250092058001	Lynn	1,044	362	51.8	51.8
250092059001	Lynn	1,743	598	51.9	51.9
250092068002	Lynn	1,792	915	51.6	51.6
250092063001	Lynn	712	250	51.3	51.3

Table H-26 2015 DNL Levels for Census Block Group Locations within the DNL 50 dB

U.S. Census 2010 Block Group

Block Group ID	Name	Population	Housing units	Average Block DNL	DNL at centroid
250092055001	Lynn	2,054	736	51.3	51.3
250092059002	Lynn	1,262	443	51.0	51.0
250092051002	Lynn	1,077	413	51.0	51.0
250092051001	Lynn	1,192	534	50.6	50.6
250092058003	Lynn	1,179	435	50.4	50.4
250092063003	Lynn	1,030	379	50.3	50.3
250173412003	Malden	1,070	451	52.4	52.4
250173412004	Malden	978	383	52.2	52.2
250173414005	Malden	769	389	51.3	51.3
250173412005	Malden	1,693	713	51.0	51.0
250173412006	Malden	976	362	50.4	50.4
250173412002	Malden	976	386	49.8	49.8
250259811004	Mattapan	400	128	49.1	49.1
250250924004	Mattapan	1,142	413	49.2	49.2
250251001001	Mattapan	167	61	48.5	48.5
250173398012	Medford	617	263	55.3	55.3
250173398011	Medford	2,101	1,369	55.7	55.7
250173398021	Medford	1,308	586	54.6	54.6
250173398013	Medford	808	375	55.3	55.3
250173397001	Medford	552	280	52.7	52.7
250173398022	Medford	2,498	1,096	53.6	53.6
250173398014	Medford	884	363	54.2	54.2
250173397003	Medford	785	357	52.5	52.5
250173397002	Medford	1,678	670	52.1	52.1
250173398023	Medford	751	294	52.4	52.4
250173396002	Medford	813	371	51.7	51.7
250173396003	Medford	757	369	51.3	51.3
250173399001	Medford	1,651	719	52.7	52.7
250173396004	Medford	827	363	51.3	51.3
250173396001	Medford	797	392	51.5	51.5
250173397004	Medford	863	377	51.5	51.5
250173399002	Medford	950	380	52.4	52.4
250173396005	Medford	885	377	51.0	51.0
250173399004	Medford	759	346	51.8	51.8
250173395002	Medford	1,312	547	51.0	51.0
250173396006	Medford	945	443	50.6	50.6

Table H-26 2015 DNL Levels for Census Block Group Locations within the DNL 50 dB

U.S. Census 2010 Block Group

Block Group ID	Name	Population	Housing units	Average Block DNL	DNL at centroid
250173395004	Medford	736	307	49.7	49.7
250173399003	Medford	939	425	51.8	51.8
250173399005	Medford	872	342	51.6	51.6
250173400003	Medford	713	303	51.3	51.3
250173391003	Medford	1,169	691	50.8	50.8
250173400001	Medford	1,033	435	51.3	51.3
250173401004	Medford	1,483	609	50.9	50.9
250173395001	Medford	2,710	553	50.1	50.1
250173400002	Medford	848	377	50.9	50.9
250173391002	Medford	1,460	603	50.4	50.4
250173391004	Medford	1,797	1,041	49.8	49.8
250173395003	Medford	641	283	49.6	49.6
250173401006	Medford	826	310	50.2	50.2
250173391001	Medford	617	243	48.3	48.3
250173391005	Medford	1,399	446	48.9	48.9
250214164007	Milton	1,002	386	53.4	53.4
250214164001	Milton	789	302	54.6	54.6
250214164005	Milton	1,028	348	54.7	54.7
250214164006	Milton	978	357	52.7	52.7
250214161012	Milton	1,969	732	53.6	53.6
250214164004	Milton	797	281	49.6	49.6
250214164002	Milton	664	267	49.0	49.0
250092011001	Nahant	629	319	46.9	46.9
250250511013	Orient Heights	1,537	621	61.4	61.4
250250511011	Orient Heights	1,602	598	57.1	57.1
250250511012	Orient Heights	1,949	741	54.8	54.8
250250511014	Orient Heights	1,005	385	60.4	60.4
250259813002	Other East Boston	389	245	63.3	63.3
250250510001	Other East Boston	2,039	855	61.4	61.4
250250510003	Other East Boston	1,088	467	61.2	61.2
250250510002	Other East Boston	962	462	56.1	56.1
250250505001	Other East Boston	1,857	702	56.0	56.0
250250506001	Other East Boston	1,248	494	55.5	55.5
250250506002	Other East Boston	815	312	54.4	54.4
250250504002	Other East Boston	1,735	797	54.1	54.1
250250504001	Other East Boston	637	238	53.5	53.5

Table H-26 2015 DNL Levels for Census Block Group Locations within the DNL 50 dB

U.S. Census 2010 Block Group

Block Group ID	Name	Population	Housing units	Average Block DNL	DNL at centroid
250250503001	Other East Boston	727	282	53.3	53.3
250250503002	Other East Boston*	1,524	759	52.6	52.6
250251805002	Point Shirley Winthrop	572	271	64.1	64.1
250251805004	Point Shirley Winthrop	882	459	65.6	65.6
250251805003	Point Shirley Winthrop	1,156	671	57.7	57.7
250251805001	Point Shirley Winthrop	1,273	613	52.9	52.9
250214173001	Quincy	1,781	1,180	53.4	53.4
250214174001	Quincy	1,125	485	46.6	46.6
250214173002	Quincy	900	630	52.5	52.5
250214172001	Quincy	2,743	1,256	52.4	52.4
250214175023	Quincy	887	337	50.5	50.5
250214176021	Quincy**	1,328	585	41.6	41.6
250251708002	Revere	1,359	577	63.0	63.0
250251708003	Revere	967	419	62.8	62.8
250251708001	Revere	1,815	797	63.5	63.5
250251707012	Revere	1,311	622	61.3	61.3
250251708004	Revere	977	424	63.2	63.2
250251705022	Revere	1,684	998	58.6	58.6
250251705021	Revere	1,134	550	58.2	58.2
250259815021	Revere	9	3	54.5	54.5
250251705012	Revere	1,501	814	54.9	54.9
250251705011	Revere	1,934	1,113	54.8	54.8
250251707025	Revere	1,391	553	55.6	55.6
250251707011	Revere	788	431	56.6	56.6
250251707022	Revere	1,474	509	54.8	54.8
250251706012	Revere	1,413	573	49.9	49.9
250251707021	Revere	1,146	352	53.3	53.3
250251707024	Revere	959	358	52.7	52.7
250251707023	Revere	1,658	547	51.2	51.2
250251706014	Revere	954	380	49.9	49.9
250251706013	Revere	1,387	497	48.6	48.6
250251701003	Revere	773	320	48.6	48.6
250251701007	Revere	1,335	498	47.9	47.9
250251701002	Revere	1,012	384	48.2	48.2
250251701001	Revere	1,671	769	47.4	47.4
250251706011	Revere	1,351	557	48.3	48.3

Table H-26 2015 DNL Levels for Census Block Group Locations within the DNL 50 dB

U.S. Census 2010 Block Group

Block Group ID	Name	Population	Housing units	Average Block DNL	DNL at centroid
250251704002	Revere	1,151	506	49.4	49.4
250251702002	Revere	1,395	499	47.2	47.2
250251702001	Revere	1,228	542	46.9	46.9
250251703007	Revere	729	300	46.4	46.4
250251701004	Revere	727	290	47.1	47.1
250251704003	Revere	1,101	431	47.9	47.9
250251701005	Revere	1,320	514	46.8	46.8
250251703006	Revere	1,209	517	46.7	46.7
250251704004	Revere	2,025	910	46.9	46.9
250251703005	Revere	1,692	659	45.6	45.6
250251704001	Revere	1,102	485	50.0	50.0
250251702004	Revere	1,335	533	45.8	45.8
250251703004	Revere	1,609	637	45.4	45.4
250251702003	Revere	606	240	46.0	46.0
250251703002	Revere	899	344	45.2	45.2
250251701006	Revere	722	289	46.3	46.3
250251703003	Revere	946	338	44.8	44.8
250259811003	Roslindale	6	6	50.4	50.4
250251101031	Roslindale	568	325	50.3	50.3
250251103012	Roslindale	1,271	552	49.6	49.6
250251101036	Roslindale	583	271	49.6	49.6
250251101035	Roslindale	1,440	666	49.5	49.5
250251103011	Roslindale	1,134	403	49.3	49.3
250251101034	Roslindale	620	289	49.3	49.3
250251101033	Roslindale	653	241	48.7	48.7
250251102011	Roslindale	2,051	874	48.6	48.6
250251104011	Roslindale	2,011	733	48.9	48.9
250250801001	Roxbury	2,612	450	55.2	55.2
250250906001	Roxbury	1,094	351	54.4	54.4
250250801002	Roxbury	738	294	54.6	54.6
250250906002	Roxbury	1,254	442	54.2	54.2
250250818002	Roxbury	921	442	54.2	54.2
250250904004	Roxbury	870	294	53.9	53.9
250250818003	Roxbury	820	369	53.6	53.6
250250818001	Roxbury	1,157	577	53.9	53.9
250250820003	Roxbury	841	414	53.3	53.3

Table H-26 2015 DNL Levels for Census Block Group Locations within the DNL 50 dB

U.S. Census 2010 Block Group

Block Group ID	Name	Population	Housing units	Average Block DNL	DNL at centroid
250250904003	Roxbury	763	254	53.3	53.3
250250817002	Roxbury	893	430	53.5	53.5
250250820002	Roxbury	682	298	53.0	53.0
250250820001	Roxbury	1,292	566	52.9	52.9
250250803001	Roxbury	1,769	791	53.7	53.7
250250821003	Roxbury	2,244	1,012	52.8	52.8
250250819001	Roxbury	906	453	53.1	53.1
250250904001	Roxbury	871	311	52.9	52.9
250250817001	Roxbury	619	225	53.2	53.2
250250821001	Roxbury	1,228	526	52.4	52.4
250250904002	Roxbury	1,155	435	52.6	52.6
250250819002	Roxbury	617	259	52.5	52.5
250250819004	Roxbury	992	428	52.3	52.3
250250819003	Roxbury	600	257	52.5	52.5
250250821002	Roxbury	1,553	579	52.1	52.1
250250903003	Roxbury	978	422	52.1	52.1
250250817003	Roxbury	780	291	52.1	52.1
250250914002	Roxbury	1,069	355	51.8	51.8
250259803001	Roxbury	338	2	51.3	51.3
250250817004	Roxbury	887	355	52.2	52.2
250250804011	Roxbury	1,265	526	52.2	52.2
250250903002	Roxbury	1,310	513	50.9	50.9
250250901001	Roxbury	1,631	660	51.2	51.2
250250902003	Roxbury	934	308	51.2	51.2
250250817005	Roxbury	641	298	51.9	51.9
250250813001	Roxbury	1,661	806	51.0	51.0
250250815002	Roxbury	1,346	554	51.1	51.1
250250902002	Roxbury	626	278	50.5	50.5
250251203013	Roxbury	1,543	554	50.5	50.5
250250903001	Roxbury	891	333	50.9	50.9
250251203012	Roxbury	855	331	50.6	50.6
250250901003	Roxbury	693	303	50.3	50.3
250250901002	Roxbury	531	237	49.9	49.9
250250902001	Roxbury	673	244	49.8	49.8
250250815001	Roxbury	788	351	50.1	50.1
250250806013	Roxbury	459	242	50.2	50.2

Table H-26 2015 DNL Levels for Census Block Group Locations within the DNL 50 dB

U.S. Census 2010 Block Group

Block Group ID	Name	Population	Housing units	Average Block DNL	DNL at centroid
250250804012	Roxbury	1,445	723	49.9	49.9
250250814001	Roxbury	1,067	558	49.6	49.6
250250924005	Roxbury	721	276	49.1	49.1
250250901004	Roxbury	1,099	414	49.0	49.0
250251203014	Roxbury	1,231	567	49.1	49.1
250250924003	Roxbury	1,688	711	49.1	49.1
250251203011	Roxbury	1,166	443	49.2	49.2
250250813002	Roxbury	1,749	690	49.1	49.1
250250901005	Roxbury	617	249	48.4	48.4
250250813003	Roxbury	1,350	615	48.6	48.6
250092081021	Saugus	752	301	48.3	48.3
250173501032	Somerville	1,210	520	52.4	52.4
250173504001	Somerville	1,006	368	50.9	50.9
250173501042	Somerville	2,584	947	51.4	51.4
250173504005	Somerville	849	392	50.5	50.5
250173504002	Somerville	1,232	565	50.1	50.1
250173503003	Somerville	849	390	50.0	50.0
250173501041	Somerville	2,119	793	50.4	50.4
250173504003	Somerville	1,017	462	49.4	49.4
250173501044	Somerville	1,384	673	49.8	49.8
250173509001	Somerville	803	398	49.0	49.0
250173501043	Somerville	1,188	485	49.1	49.1
250173503002	Somerville	627	304	48.8	48.8
250173502001	Somerville	1,376	586	49.0	49.0
250173503001	Somerville	965	454	49.6	49.6
250173502006	Somerville	1,044	502	49.0	49.0
250173510005	Somerville	1,056	484	48.3	48.3
250173514031	Somerville	763	309	48.5	48.5
250173502005	Somerville	749	315	48.5	48.5
250173510001	Somerville	1,236	595	47.8	47.8
250173514033	Somerville	587	321	47.8	47.8
250173502004	Somerville	1,410	594	47.9	47.9
250173514035	Somerville	619	288	47.6	47.6
250173514032	Somerville	1,017	391	47.8	47.8
250173514034	Somerville	1,042	369	48.0	48.0
250173502003	Somerville	1,385	533	47.7	47.7

Table H-26 2015 DNL Levels for Census Block Group Locations within the DNL 50 dB

U.S. Census 2010 Block Group

Block Group ID	Name	Population	Housing units	Average Block DNL	DNL at centroid
250173511002	Somerville	912	465	47.5	47.5
250173502002	Somerville	603	233	47.6	47.6
250173514041	Somerville	1,147	448	46.8	46.8
250173504004	Somerville	1,464	721	49.8	49.8
250173506001	Somerville	1,656	2	50.6	50.6
250173506004	Somerville	1,164	487	50.4	50.4
250173510004	Somerville	1,813	870	47.1	47.1
250173510006	Somerville	1,018	523	47.2	47.2
250173506002	Somerville	939	371	50.0	50.0
250173511005	Somerville	1,146	540	46.9	46.9
250173505002	Somerville	811	382	50.1	50.1
250173505001	Somerville	818	390	50.1	50.1
250173511001	Somerville	1,601	747	46.9	46.9
250173506003	Somerville	813	231	49.7	49.7
250173514042	Somerville	1,335	527	46.9	46.9
250173514043	Somerville	1,026	396	46.7	46.7
250250606001	South Boston	2,357	1,530	59.6	59.6
250250612001	South Boston	1,702	1,188	58.4	58.4
250250601011	South Boston	881	441	59.5	59.5
250250607001	South Boston	741	253	57.9	57.9
250250601013	South Boston	981	496	59.0	59.0
250250601012	South Boston	633	350	58.8	58.8
250250607002	South Boston	1,152	383	57.3	57.3
250250601014	South Boston	721	397	58.7	58.7
250250612002	South Boston	627	383	55.4	55.4
250250608003	South Boston	886	470	55.9	55.9
250250608004	South Boston	1,666	943	55.4	55.4
250250605014	South Boston	631	295	56.5	56.5
250250608002	South Boston	757	396	54.7	54.7
250250605015	South Boston	656	333	54.8	54.8
250250602001	South Boston	821	419	55.7	55.7
250250608001	South Boston	655	333	54.2	54.2
250250605013	South Boston	717	431	54.2	54.2
250250605011	South Boston	699	375	54.7	54.7
250250605012	South Boston	868	508	54.0	54.0
250250612003	South Boston	911	470	53.1	53.1

Table H-26 2015 DNL Levels for Census Block Group Locations within the DNL 50 dB

U.S. Census 2010 Block Group

Block Group ID	Name	Population	Housing units	Average Block DNL	DNL at centroid
250250602002	South Boston	1,095	580	54.9	54.9
250250610001	South Boston	1,033	544	53.2	53.2
250250604005	South Boston	960	336	53.2	53.2
250250610002	South Boston	1,164	471	52.7	52.7
250250610003	South Boston	901	393	52.7	52.7
250250603013	South Boston	1,092	561	53.8	53.8
250250604001	South Boston	1,021	542	52.7	52.7
250250611011	South Boston	617	278	52.2	52.2
250250603011	South Boston	1,285	741	53.6	53.6
250250603012	South Boston	699	345	53.3	53.3
250250604002	South Boston	988	530	52.6	52.6
250250604004	South Boston	1,093	669	52.1	52.1
250250604003	South Boston	842	466	52.2	52.2
250250611012	South Boston	1,615	766	51.4	51.4
250250712011	South End	1,899	819	54.7	54.7
250250711012	South End	1,424	750	53.1	53.1
250250712012	South End	1,232	580	53.7	53.7
250250711011	South End	1,498	928	53.9	53.9
250250704021	South End	1,723	680	53.5	53.5
250250711013	South End	831	507	52.6	52.6
250250705001	South End	1,700	1,018	52.3	52.3
250250705003	South End	1,393	803	51.7	51.7
250250705002	South End	999	524	51.1	51.1
250250705004	South End	1,368	721	51.1	51.1
250250709001	South End	2,166	1,231	50.6	50.6
250250703004	South End	1,119	746	50.3	50.3
250250805002	South End	2,020	863	49.9	49.9
250250709002	South End	1,163	567	50.1	50.1
250250706001	South End	1,127	667	50.2	50.2
250250703003	South End	992	707	49.6	49.6
250250706002	South End	1,113	642	49.5	49.5
250251802004	Winthrop	1,343	549	59.0	59.0
250251802001	Winthrop	1,471	610	58.1	58.1
250251802003	Winthrop	648	336	55.5	55.5
250251804002	Winthrop	839	347	55.3	55.3
250251802002	Winthrop	647	299	54.0	54.0

Table H-26 2015 DNL Levels for Census Block Group Locations within the DNL 50 dB

U.S. Census 2010 Block Group

Block Group ID	Name	Population	Housing units	Average Block DNL	DNL at centroid
250251804001	Winthrop	876	435	54.9	54.9
250251801013	Winthrop	2,344	1,194	52.6	52.6
250251801011	Winthrop	1,207	584	50.9	50.9
250251801012	Winthrop	1,215	724	49.7	49.7
250251803014	Winthrop Court Rd	760	297	61.4	61.4
250251803012	Winthrop Court Rd	778	322	58.3	58.3
250251803011	Winthrop Court Rd	652	258	57.2	57.2
250251803013	Winthrop Court Rd	834	351	57.4	57.4

Note: * Centriod location on the Airport, the Block Group includes area off airport property.
** Centriod location displaced over Quincy Bay
Block group boundaries were modified to only include Land areas.
Noise levels reported do not include aircraft or helicopters not arriving to or departing from Logan Airport.
Only Census Blocks with population were used to compute the average.
Only locations within the 2015 EDR modeling were used.
Bold highlighted Groups Indicate Census Block Group Centroid is below 50dB, while census block centroid average is above 50 dB

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MERCATUS ON POLICY

Airport Noise NIMBYism: An Empirical Investigation

Eli Dourado and Raymond Russell

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MERCATUS CENTER
George Mason University

Every growing city encounters criticism from residents who will settle for little else but the status quo. Local governments intent on building or expanding infrastructure must contend with citizens opposed to the inconvenience and nuisance of increased construction, more neighbors, and heavier traffic. This hostility to expansion, called "NIMBYism" (not in my backyard), can be a barrier to denser development, lower housing prices, and ultimately economic growth.

But NIMBYism extends beyond opposition to urban development, and its consequences can hinder economic growth in nonobvious ways. In this policy brief, we explore a particular category of NIMBY complaints surrounding airport noise. Airport noise can be a nuisance, but it is also necessary for economic activity in the modern world. We evaluate noise complaint data from a selection of US airports to quantify opposition to airport noise. We find that the source of airport noise complaints is highly concentrated in a few dedicated complainers.

Airport noise policy must strike a reasonable balance between noise abatement and the economic benefits associated with noisy airplane takeoffs and landings. However, because the majority of noise complaints come from a small number of loud objectors, there is a danger that this balance has been tilted too far in the direction of noise abatement.[1] We hope that increasing awareness of the lopsided distribution of noise complaints can help promote noise standards that strike an appropriate balance and facilitate the advancement of faster and cheaper commercial flight.

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MANY COMPLAINTS COME FROM A SMALL NUMBER OF CALLERS

Most airports in the United States allow the public to submit noise complaints through dedicated hotlines and online portals. Nearly all of the country's largest airports publish data on the calls they receive, but this information varies in thoroughness. Some airport authorities, such as the Port of Seattle, allow public access to each complainant's name, their personal information, and a summary of the call. Others, like Boston's Massport, only publish the number of complaints received and the number of unique callers. But even this summary information is useful; data from Massport on Boston Logan International Airport still illustrate the distribution and origin of complaints.

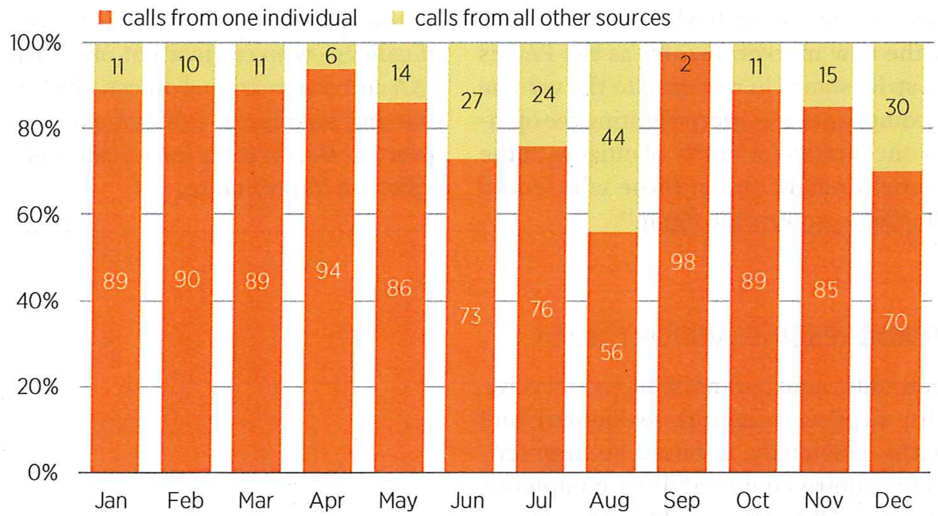
Generally, a very small number of people account for a disproportionately high share of the total number of noise complaints. In 2015, for example, 6,852 of the 8,760 complaints submitted to Ronald Reagan Washington National Airport originated from one residence in the affluent Foxhall neighborhood of northwest Washington, DC.[2] The residents of that particular house called Reagan National to express irritation about aircraft noise an average of almost 19 times per day during 2015. Other major airports report similar trends. In Seattle's detailed call-by-call lists, one individual complains so frequently that her grievances are not transcribed in full but simply tallied at the end of the month. While airport employees provide summaries of other calls, the description of this particular individual's calls is, "Same complaint over and over. Records a/c flying over."[3]

Relative to other large US airports, San Francisco International Airport receives an enormous number of complaints each year. In 2015, it registered 890,376 complaints. Predictably, we find that these complaints were not lodged by a correspondingly large number of people; rather, hundreds of thousands of calls came from just 9,561 callers. Even if calls were uniformly distributed among these callers, each would still have had to place 93 calls. But as with other US airports, San Francisco's complaint records show a high degree of concentration among a very small subset of total callers. In October 2015, 53 Portola Valley, CA, residents placed 25,259 calls to the airport—nearly 477 per person. Similarly, three residents of Daly City placed 1,034 calls in December 2015, and six Woodside callers complained 2,432 times in November.

TABLE 1. SUMMARY OF AIRPORT NOISE COMPLAINTS

Airport	Time period covered	Total number of complaints	Evidence of concentration
Ronald Reagan Washington National Airport (DCA)	2015	8,760	2 individuals at 1 residence in NW DC accounted for 6,852 complaints (78 percent).[4]
Denver International Airport (DEN)	2015	4,870	1 individual in Strasburg, CO, 30 miles from the airport, accounted for 3,555 complaints (73 percent). 4 callers accounted for 4,653 complaints (96 percent). A total of 42 households complained.[5]
Washington Dulles International Airport (IAD)	2015	1,223	1 individual in Poolesville, MD, 13 miles away from the airport, accounted for 1,024 complaints (84 percent).[6]
Las Vegas McCarran International Airport (LAS)	2015	3,963	1 individual accounted for 450 calls in September 2015 (98 percent of monthly total).[7]
Los Angeles International Airport (LAX)	2015	8,862	1 individual in Monterey Park, CA, accounted for 489 complaints during June 2015 (50 percent of monthly total). The top 3 callers accounted for 88 percent of June complaints.[8]
Portland International Airport (PDX)	2015	688	5 individuals accounted for 420 complaints (61 percent).[9]
Phoenix Sky Harbor International Airport (PHX)	2015	24,247	1,338 households in total lodged complaints. While data is not available by household, the airport received 3,814 complaints from 13 households in zip code 85258, for an average of 293 calls per household.[10]
Seattle-Tacoma International Airport (SEA)	2014	1,006	3 individuals accounted for 648 complaints (64 percent). Top caller accounted for 42 percent of total.[11]
San Francisco International Airport (SFO)	2015	890,376	53 Portola Valley, CA, individuals accounted for 25,259 complaints during the month of October 2015, for an average of 477 calls per person in that month.[12]

FIGURE 1. CONCENTRATION OF NOISE COMPLAINTS AT LAS VEGAS MCCARRAN INTERNATIONAL AIRPORT (LAS), 2015



Source: McCarran International Airport, "Noise Complaint Reports."

Table 1 summarizes the concentration of noise complaints registered at several large US airports. Figure 1 shows the monthly concentration of noise complaints over the course of 2015 at McCarran International Airport in Las Vegas.

SMALL NUMBER OF CALLERS HAVE DISPROPORTIONATE IMPACT

Airport noise complaint data paints a startling picture. A handful of individuals are responsible for most of the noise complaints at most airports we examine. Some of these individuals do not appear to live particularly close to the airports to which they are complaining. For example, one individual in Strasburg, CO, 30 miles from Denver International Airport, complained 3,555 times in 2015, an average of 9.7 times per day. One individual in La Selva Beach, CA, about *55 miles* from San Francisco International Airport, complained about airport noise 186 times during October 2015.

There are worrisome signs that this small, frustrated minority of citizens is affecting aviation policy. In recent decades, the Federal Aviation Administration (FAA) has imposed progressively more stringent noise standards on aircraft operating in US airspace.[13] While noise abatement is desirable, it can have significant costs—particularly on the fuel efficiency of aircraft—resulting not only in higher carbon emissions but also in higher ticket prices. It is troubling that a tiny but vocal group is potentially driving policy. While we do not have data on grievances lodged directly to the FAA or to members of Congress, it is probable that those airport noise complaints follow a similar pattern.

AIRPORT NOISE AND FUEL EFFICIENCY

Airport noise is entangled with fuel efficiency in at least two ways. First, the FAA's NextGen airspace modernization program will enable aircraft to travel along denser and more direct routes, particularly on approach for landing. NextGen will remove much of the need for circling above the airport in holding patterns, and it allows aircraft to descend more gradually, saving valuable fuel. However, denser and more gradual approaches also correspond to more noise on the ground under approach paths to the airport. Airports undergoing NextGen implementation have experienced a significant uptick in noise complaints.[14]

Second, airport noise standards are very important for fuel efficiency gains on potential new supersonic aircraft. Aircraft are more fuel efficient when they can take off at full throttle, and these gains in efficiency are of particular importance when aircraft are climbing to the high cruise speeds and altitudes of supersonic planes. Yet in the FAA's most recent policy statement on supersonics, the agency said it "would propose that any future supersonic airplane produce no greater noise impact on a community than a subsonic airplane."[15] Subsonic noise type certification requirements are quite strict, and they will become stricter still in 2018. Holding supersonic aircraft to subsonic noise standards would hamper the viability of the new market. Insofar as the FAA is adopting such a strict stance in response to the volume of airport noise complaints, it is overweighting the opinions of a small, concentrated minority of citizens at the expense of the environment and of those who would benefit from affordable supersonic flight.[16]

OPTIONS FOR ADDRESSING AIRPORT NOISE

Policymakers can address airport noise in several ways. One option is for airports to acquire residential land below flight paths. Obviously, it would be impractical for airports to acquire land to address complaints originating from up to 50 miles away from the airport. Nevertheless, numerous airports have bought up nearby land to reduce the effect of noise on people nearby. A second approach is to make noise standards more severe, creating mandatory retirement of the existing fleet of airplanes. This was done in the 1990s as the Stage 2 noise standard was replaced with Stage 3. Economist Stephen A. Morrison and his coauthors estimate that the benefits of the phaseout, in terms of property values for homeowners, were $5 billion less than the costs to airlines, in terms of the reduced life of their capital.[17]

A third approach is to subsidize and otherwise support the installation of more and better insulation in homes affected by airport noise. Aerospace engineer Philip J. Wolfe and his coauthors estimate that this is more cost-effective than land acquisition or mandatory retirement.[18] There are a number of insulation programs run by airports around the country.[19]

Finally, a noise tax could help to efficiently discourage the production of noise without outright banning it, and revenues could be used to fund insulation programs. This is a better strategy than existing FAA policy of continuing to increase noise standards, perhaps in response to a high volume of complaints.

CONCLUSION

It would be a mistake to allow the preferences of a vocal but minuscule minority of citizens, however sympathetic their circumstances, to impede much-needed improvements in aviation. Airport noise standards are already quite strict, and they create real economic and environmental costs associated with lower aircraft fuel efficiency. While our analysis cannot recommend a precise noise standard, we are concerned that a handful of callers—who contact not only airports but also the FAA and congressional offices—have unduly influenced existing standards. Policymakers should be acutely aware of the distribution of calls before taking further action on airport noise.

NOTES

1. In other words, airport noise complaints could be a classic case of concentrated benefits and diffused costs. Mancur Olson, *The Logic of Collective Action: Public Goods and the Theory of Groups*, 2nd ed. (Cambridge, MA: Harvard University Press, 1971).
2. Metropolitan Washington Airports Authority, "2015 Annual Aircraft Noise Report," accessed August 18, 2016.
3. Port of Seattle, "Public Records Request: Request #16-34," January 27, 2016.
4. Ibid.
5. Denver International Airport, "DEN Noise Report: January 1, 2015–December 31, 2015," accessed August 19, 2016.
6. Metropolitan Washington Airports Authority, "2015 Annual Aircraft Noise Report."
7. McCarran International Airport, "Noise Complaint Reports," July through September 2015 Noise Complaint Reports, October 22, 2015.
8. Los Angeles World Airports, "June 2015 ANCR Report," July 31, 2015.
9. Port of Portland, "2015 Year in Review," accessed August 19, 2016.
10. City of Phoenix Aviation Department, "Annual Noise Report 2015," accessed August 18, 2016.
11. Port of Seattle, "Public Records Request: Request #16-122," April 6, 2016.
12. San Francisco International Airport, "Noise Abatement Data," accessed August 19, 2016.
13. Federal Aviation Administration, "Details on FAA Noise Levels, Stages, and Phaseouts," June 10, 2016.
14. Pia Bergqvist, "NextGen Flight Paths Give Rise to Noise Complaints," *Flying Magazine*, June 23, 2016. Entire websites also exist to coordinate noise complaints against NextGen. See NextGenNoise, accessed September 26, 2016, http://nextgennoise.org/.
15. Federal Aviation Administration, Civil Supersonic Airplane Noise Type Certification Standards and Operating Rules, 73 Fed. Reg. 205 (October 22, 2008).
16. For subsonic aircraft, noise standards have in fact become stricter over time. In 2000, so-called Stage 3 noise requirements became mandatory. In 2006, the FAA stopped certifying aircraft under Stage 3 in favor of the more restrictive Stage 4 standards. In 2018, new Stage 5 standards will be required for certification. This continuous one-way ratchet in noise standards is at least circumstantial evidence that noise complaints are effective.
17. Steven A. Morrison, Clifford Winston, and Tara Watson, "Fundamental Flaws of Social Regulation: The Case of Airplane Noise," *Journal of Law and Economics* 42, no. 2 (1999): 723–44.
18. Philip J. Wolfe et al., "Costs and Benefits of US Aviation Noise Land-Use Policies," *Transportation Research Part D: Transport and Environment* 44 (2016): 147–56.
19. Jon Hilkevitch, "Midway-Area Homes to Get $10 Million More for Soundproofing," *Chicago Tribune*, August 5, 2015; Massachusetts Port Authority, "Sound Insulation Program," accessed August 19, 2016; Community Development Commission of the County of Los Angeles, "Residential Sound Insulation Program (RSIP)," accessed August 19, 2016.

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I

Air Quality/Emissions Reduction

This appendix provides the following detailed information and data tables in support of Chapter 7, *Air Quality/ Emissions Reduction*:

- Fundamentals of Air Quality
  - Table I-1 National Ambient Air Quality Standards
  - Table I-2 Airport-Related Sources of Air Emissions
  - Table I-3 Attainment, Nonattainment, and Maintenance Areas
- Aircraft Fleet and Operational Data Used in EDMS v5.1.4.1
  - Table I-4 2015 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type
- Ground Service Equipment (GSE)/Alternative Fuels Conversion
  - Table I-5 Ground Service Equipment Alternative Fuel Conversion Summary (kg/day)
- Motor Vehicle Emissions
  - Table I-6 MOVES2014a Sample Input File for 2015
  - Table I-7 MOVES2014a Sample Output File for 2015
- Fuel Storage and Handling
  - Table I-8 Fuel Throughput by Fuel Category (gallons)
- Stationary Sources
  - Table I-9 Stationary Source Fuel Throughput by Fuel Category (gallons)
- 1993 – 2010 Emissions Inventories
  - Table I-10 Estimated VOC Emissions (in kg/day) at Logan Airport 1993-2001
  - Table I-11 Estimated VOC Emissions (in kg/day) at Logan Airport 2002-2009
  - Table I-12 Estimated VOC Emissions (in kg/day) at Logan Airport 2010
  - Table I-13 Estimated NO_X Emissions (in kg/day) at Logan Airport 1993-2001

Fundamentals of Air Quality

This section contains a general summary of air quality and air emissions with a particular emphasis on airport-related emissions where appropriate. This material is intended to supplement and provide background information for the materials contained in Chapter 7, *Air Quality/Emissions Reduction*.

Pollutant Types and Standards

The United States (U.S.) Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) for a select group of "criteria air pollutants" designed to protect public health, the environment, and the quality of life from the detrimental effects of air pollution. Listed alphabetically, these pollutants are briefly described below:

- **Carbon monoxide (CO)** is a colorless, odorless, tasteless gas. It may temporarily accumulate, especially in cool, calm weather conditions, when fuel use reaches a peak and CO is chemically most stable due to the low temperatures. CO from natural sources usually dissipates quickly, posing no threat to human health. Transportation sources (e.g., motor vehicles), energy generation, and open burning are among the predominant anthropogenic (i.e., man-made) sources of CO.

- **Lead (Pb)** in the atmosphere is generated from industrial sources including waste oil and solid waste incineration, iron and steel production, lead smelting, and battery and lead manufacturing. The lead content of motor vehicle emissions, which was the major source of lead in the past, has significantly declined with the widespread use of unleaded fuel. Low-lead fuel used in some general aviation (GA) aircraft is still a source of airport-related lead.

- **Nitrogen dioxide (NO_2)**, nitric oxide (NO), and the nitrate radical (NO_3) are collectively called oxides of nitrogen (NO_x). These three compounds are interrelated, often changing from one form to another in chemical reactions, and NO_2 is the compound commonly measured for comparison to the NAAQS. NO_x is generally emitted in the form of NO, which is oxidized to NO_2. The principal man-made source of NO_x is fuel combustion in motor vehicles and power plants – aircraft engines are also a source. Reactions of NO_x with other atmospheric chemicals can lead to formation of ozone (O_3) and acidic precipitation.

- **Ozone (O_3)** is a secondary pollutant, formed from daytime reactions of NO_x and volatile organic compounds (VOCs) in the presence of sunlight. VOCs, which are a subset of hydrocarbons (HC) and have no NAAQS, are released in industrial processes and from evaporation of gasoline and solvents. Sources of NO_x are discussed above.

- **Particulate matter (PM)** comprises very small particles of dirt, dust, soot, or liquid droplets called aerosols. The NAAQS for PM is segregated by sizes (i.e., less than 10 and less than 2.5 microns as PM_{10} and $PM_{2.5}$, respectively). PM is formed as an exhaust product in the internal combustion engine or can be generated from the breakdown and dispersion of other solid materials (e.g., fugitive dust).

- **Sulfur oxides (SO_x)** are primarily composed of sulfur dioxide (SO_2) which is emitted in natural processes and by man-made sources such as combustion of sulfur-containing fuels and sulfuric acid manufacturing.

The NAAQS for these criteria pollutants are subdivided into the Primary Standards (designed to protect human health) and the Secondary Standards (designed to protect the environment and human welfare) and are listed below in **Table I-1**. Exceedances of these values constitute violations of the NAAQS.

Table I-1 National Ambient Air Quality Standards

Pollutants	Averaging Time	Concentration	Condition of Violation
Ozone (O_3)	8-hour	0.070 ppm	3-year average of the fourth-highest daily maximum 8-hour average.
Carbon Monoxide (CO)	8-hour	9 ppm	No more than once per year.
	1-hour	35 ppm	
Nitrogen Dioxide (NO_2)	Annual Average	53 ppb	Annual mean.
	1-hour	100 ppb	3-year average of the 98th percentile of the daily maximum 1-hour average.
Sulfur Dioxide (SO_2)	3-hour	0.5 ppm	No more than once per year.
	1-hour	75 ppb	Three-year average of the 99th percentile of 1-hour daily maximum concentrations.
Particulate Matter (PM_{10})	24-hour	150 $\mu g/m^3$	Not to be exceeded more than once per year on average over 3 years.
Particulate Matter ($PM_{2.5}$)	Annual (primary)	12 $\mu g/m^3$	Annual mean, averaged over 3 years.
	Annual (secondary)	15 $\mu g/m^3$	Annual mean, averaged over 3 years.
	24-hour	35 $\mu g/m^3$	3-year average of the 98th percentile.
Lead (Pb)	Rolling 3 month average	0.15 $\mu g/m^3$	Not to be exceeded.

Source: U.S. EPA, 2016, http://www.epa.gov/air/criteria.html
Note: ppm - parts per million; ppb – parts per billion; µg/m3 - micrograms per cubic meter

Sources of Airport Air Emissions

Almost all large metropolitan airports generate air emissions from the following general source categories: aircraft, ground service equipment (GSE), and motor vehicles traveling to, from, and moving about the airport; fuel storage and transfer facilities; a variety of stationary sources (e.g., steam boilers, back-up generators, snow melters, etc.); an assortment of aircraft maintenance activities (e.g., painting, cleaning, repair, etc.); routine airfield, roadway, and building maintenance activities (e.g., painting, cleaning, repair, etc.); and periodic construction activities for new projects or improvements to existing facilities. **Table I-2** provides a summary listing of these sources of air emissions, the pollutants, and their characteristics.

Table I-2 Airport-related Sources of Air Emissions

Sources	Emissions	Characteristics
Aircraft	CO NO_2 PM SO_2 VOCs	Exhaust products of fuel combustion that vary depending on aircraft engine type, number of engines, power setting, and period of operation. Emissions are also emitted by an aircraft's auxiliary power unit (APU).
Motor vehicles	CO NO_2 PM SO_2 VOCs	Exhaust products of fuel combustion from patron and employee traffic approaching, departing, and moving about the airport site. Emissions vary depending on vehicle type, distance traveled, operating speed, and ambient conditions.
Ground service equipment	CO NO_2 PM SO_2 VOCs	Exhaust products of fuel combustion from service trucks, tow tugs, belt loaders, and other portable equipment.
Fuel storage and transfer	VOCs	Formed from the evaporation and vapor displacement of fuel from storage tanks and fuel transfer facilities. Emissions vary with fuel usage, type of storage tank, refueling method, fuel type, vapor recovery, climate, and ambient temperature.
Stationary sources	CO NO_2 PM SO_2 VOCs	Exhaust products of fossil fuel combustion from boilers dedicated to indoor heating requirements and emissions from incinerators used for waste reduction. Emissions are generally well controlled with operational techniques and post-burn collection methods. Sources include boilers and hot water generators, emergency generators, incinerators, paint booth and surface coating operations, welding operations, and firefighting facilities.
Construction Activities	CO NO_2 PM SO_2 VOCs	Construction projects may have associated emissions from dust generated during excavation and land clearing, exhaust emissions from construction equipment and motor vehicles, and evaporative emissions from asphalt paving and painting. The amount of particulate emissions varies with the material type, the amount of area exposed, and meteorology. The construction of airport and airfield improvement projects at airports represents temporary sources of emissions.

Notes: CO - Carbon monoxide; VOC - Volatile organic compounds; PM - Particulate matter; NO_2 - Nitrogen dioxide; SO_2 - Sulfur dioxide.

The U.S. EPA, state, and local air quality agencies maintain outdoor air monitoring networks to measure air quality conditions and gauge compliance with the NAAQS. Based upon the data collected by these agencies, all areas throughout the country are designated by the U.S. EPA with respect to their compliance with the NAAQS. **Table I-3** provides the definitions of each of these designations.

Table I-3 Attainment, Nonattainment, and Maintenance Areas

Attainment/Nonattainment Designations			
Attainment	**Attainment/Maintenance**	**Nonattainment Area**	**Unclassifiable**
Any area that meets the NAAQS established for all of the criteria air pollutants.	Any area that is in transition from formerly being a nonattainment area to an attainment area (also called Maintenance).	Any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) one or more of the NAAQS.	Any area that cannot be classified on the basis of available information as meeting or not meeting the NAAQS.

Source: U.S. EPA

For O_3, CO, PM_{10}, and $PM_{2.5}$, the nonattainment designations are further classified by the severity, or degree, of the violation of the NAAQS. For example, in the case of O_3, these classifications range from highest to lowest as extreme, severe, serious, marginal, and moderate.

The nonattainment designation of an area has a bearing on the emission control measures required and the time periods allotted by which a State Implementation Plan (SIP) must demonstrate attainment of the NAAQS. It is also important to note that the degree of nonattainment determines the thresholds of emissions that are considered to be "*de minimis,*" or levels below (i.e., within) which a formal General Conformity determination is not required.

Finally, the boundaries of nonattainment areas are generally determined based on Core Based Statistical Areas (CBSA) as defined by U.S. census data (air monitoring station locations and contributing emission sources also play a role). However, nonattainment areas for localized pollutants such as lead and CO typically only comprise a partial CBSA or a local "hot-spot." By comparison, regional pollutants such as O_3 can encompass multiple CBSAs and can extend across state lines.

State Implementation Plans (SIP)

For the purposes of this summary explanation of SIPs, it is sufficient to characterize SIPs as the principal instrument by which a state formulates and implements its strategies for bringing nonattainment or maintenance areas into compliance with the NAAQS. In equally broad terms, the SIP contains the necessary emission limitations, control measures and timetables for achieving this objective. Therefore, the SIP development process is delegated to state air quality agencies that may in turn rely on regional, county, and local agencies to help prepare emission inventories that include airport-related emissions.

Aircraft Fleet and Operational Data used in EDMS Version 5.1.4.1

The Federal Aviation Administration (FAA) Emissions Dispersion System (EDMS) is the EPA-preferred and the FAA-required model for conducting airport air quality analyses. The most recent version of EDMS, Version 5.1.4.1 (EDMS v5.1.4.1), was used in support of the 2015 air quality analysis.

Table I-4 contains the data that were used in EDMS v5.1.4.1 to represent actual conditions at Logan Airport in 2015. These data include aircraft type, engine, landing takeoff cycles (LTOs), and taxi times. The aircraft are divided into four categories: air carrier (AC), cargo (CA), commuter (CO), and GA.

Table I-4 2015 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
Air Carrier Aircraft				
Airbus A319-100 Series	CFM56-5B6/P	4,337	AC AAL	25.89
Airbus A320-200 Series	V2527-A5	1,169	AC AAL	25.89
Airbus A321-100 Series	V2533-A5	2,663	AC AAL	25.89
Boeing 737-800 Series	CFM56-7B26 (8CM051)	8,747	AC AAL	25.89
Boeing 757-200 Series	RB211-535E4B Phase 5	1,760	AC AAL	25.89
Boeing 767-300 Series	CF6-80C2B6 1862M39	38	AC AAL	25.89
Boeing 777-200 Series	Trent 892	14	AC AAL	25.89
Boeing MD-82	JT8D-217	15	AC AAL	25.89
Boeing MD-83	JT8D-219 Environmental Kit (E_Kit)	13	AC AAL	25.89
Embraer ERJ190	CF34-10E6 SAC	5,421	AC AAL	25.89
Airbus A319-100 Series	CFM56-5A5	20	AC ACA	25.89
Embraer ERJ170	CF34-8E5 LEC (8GE108)	839	AC ACA	25.89
Airbus A330-200 Series	CF6-80E1A3	68	AC AFR	25.89
Airbus A340-300 Series	CFM56-5C2	8	AC AFR	25.89
Boeing 747-400 Series	PW4056 Reduced smoke	237	AC AFR	25.89
Boeing 777-200 Series	GE90-90B DAC I	127	AC AFR	25.89
Boeing 777-200 Series	GE90-90B DAC I	15	AC AFR	25.89
Boeing 737-700 Series	CFM56-7B22	159	AC AMX	25.89
Boeing 737-800 Series	CFM56-7B26 (8CM051)	12	AC AMX	25.89
Boeing 787-8 Dreamliner	GEnx-1B64 TAPS (11GE136)	1	AC AMX	25.89
Boeing 737-800 Series	CFM56-7B24	709	AC ASA	25.89
Boeing 737-900 Series	CFM56-7B27	805	AC ASA	25.89

Table I-4 2015 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type (Continued)

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
Air Carrier Aircraft (Cont'd.)				
Airbus A319-100 Series	CFM56-5B6/P	1,516	AC AWE	25.89
Airbus A320-200 Series	CFM56-5B4/P	393	AC AWE	25.89
Airbus A321-100 Series	CFM56-5B3/P	697	AC AWE	25.89
Airbus A330-200 Series	Trent 772 Improved traverse	1	AC AWE	25.89
Boeing 757-200 Series	RB211-535E4 (3RR028)	4	AC AWE	25.89
Embraer ERJ190	CF34-10E6 SAC	1,811	AC AWE	25.89
Boeing 717-200 Series	BR700-715A1-30	9	AC AWI	25.89
Airbus A330-200 Series	CF6-80E1A4 Low emissions	281	AC AZA	25.89
Boeing 747-400 Series	RB211-524H	711	AC BAW	25.89
Boeing 777-200 Series	GE90-90B DAC I	513	AC BAW	25.89
Boeing 777-300 ER	GE90-115B	65	AC BAW	25.89
Boeing 737-400 Series	CFM56-3B-2	11	AC BSK	25.89
Boeing 737-800 Series	CFM56-7B26 (8CM051)	14	AC BSK	25.89
Boeing 787-8 Dreamliner	GEnx-1B64 TAPS (11GE136)	372	AC CHH	25.89
Airbus A320-200 Series	V2527-A5	5	AC CMP	25.89
Boeing 737-700 Series	CFM56-7B24	193	AC CMP	25.89
Boeing 737-800 Series	CFM56-7B26 (8CM051)	125	AC CMP	25.89
Boeing 777-300 ER	GE90-115B	139	AC CPA	25.89
Airbus A319-100 Series	CFM56-5A5	2,349	AC DAL	25.89
Airbus A320-200 Series	CFM56-5A3	2,613	AC DAL	25.89
Airbus A330-300 Series	PW4168A Talon II	379	AC DAL	25.89
Boeing 717-200 Series	BR700-715A1-30	4,451	AC DAL	25.89
Boeing 737-800 Series	CFM56-7B26 (8CM051)	1,486	AC DAL	25.89
Boeing 737-900 Series	CFM56-7B26 (8CM051)	238	AC DAL	25.89
Boeing 757-200 Series	PW2037 (4PW072)	1,957	AC DAL	25.89
Boeing 767-300 Series	CF6-80A2	344	AC DAL	25.89
Boeing 767-400 ER	CF6-80C2B7F 1862M39	285	AC DAL	25.89
Boeing MD-88	JT8D-219 Environmental Kit (E_Kit)	1,012	AC DAL	25.89
Boeing MD-90	V2525-D5	1,842	AC DAL	25.89
Airbus A330-300 Series	PW4168A Talon II	94	AC DLH	25.89

Table I-4 2015 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type (Continued)

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
Air Carrier Aircraft (Cont'd.)				
Airbus A340-300 Series	CFM56-5C4/P	99	AC DLH	25.89
Airbus A340-600 Series	Trent 556-61 Phase5 Tiled (6RR041)	204	AC DLH	25.89
Boeing 747-400 Series	CF6-80C2B1F 1862M39	291	AC DLH	25.89
Boeing 747-8	GEnx-2B67 TAPS (8GENX1)	156	AC DLH	25.89
Airbus A330-200 Series	CF6-80E1A2 1862M39	169	AC EIN	25.89
Airbus A330-300 Series	CF6-80E1A4 Standard	486	AC EIN	25.89
Boeing 757-200 Series	PW2040 (4PW073)	239	AC EIN	25.89
Boeing 767-200 Series	CF6-80A	64	AC EIN	25.89
Boeing 767-300 Series	CF6-80C2B6 1862M39	29	AC EIN	25.89
Boeing 767-300 Series	PW4060 Reduced smoke	76	AC ELY	25.89
Airbus A330-300 Series	CF6-80E1A4 Standard	122	AC IBE	25.89
Airbus A340-300 Series	CFM56-5C4/P	29	AC IBE	25.89
Airbus A340-600 Series	Trent 556-61 Phase5 Tiled (6RR041)	17	AC IBE	25.89
Boeing 757-200 Series	RB211-535E4 (3RR028)	683	AC ICE	25.89
Boeing 787-8 Dreamliner	GEnx-1B64 TAPS (11GE136)	364	AC JAL	25.89
Airbus A320-200 Series	V2527-A5	18,473	AC JBU	25.89
Embraer ERJ190	CF34-10E6 SAC	24,445	AC JBU	25.89
Boeing 737-400 Series	CFM56-3B-2	25	AC NA	25.89
Boeing 777-200 Series	GE90-90B DAC I	27	AC NA	25.89
Boeing 737-800 Series	CFM56-7B26 (8CM051)	18	AC NAX	25.89
Airbus A319-100 Series	V2522-A5	1,498	AC NKS	25.89
Airbus A320-200 Series	V2527-A5	950	AC NKS	25.89
Bombardier Learjet 45	TFE731-2-2B	14	AC RAX	25.89
Airbus A310-200 Series	CF6-80C2A2 1862M39	268	AC RZO	25.89
Boeing 767-300 Series	CF6-80C2B6 1862M39	3	AC RZO	25.89
Boeing 737-700 Series	CFM56-7B22	274	AC SCX	25.89
Boeing 737-800 Series	CFM56-7B27	433	AC SCX	25.89
Boeing 737-300 Series	CFM56-3-B1	2,469	AC SWA	25.89
Boeing 737-700 Series	CFM56-7B24	7,532	AC SWA	25.89
Boeing 737-800 Series	CFM56-7B26 (8CM051)	756	AC SWA	25.89

Table I-4 2015 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type (Continued)

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
Air Carrier Aircraft (Cont'd.)				
Boeing 737-400 Series	CFM56-3B-2	23	AC SWQ	25.89
Airbus A330-300 Series	Trent 772 Improved traverse	230	AC SWR	25.89
Airbus A340-300 Series	CFM56-5C4	125	AC SWR	25.89
Boeing 757-200 Series	PW2037 (4PW072)	30	AC TCV	25.89
Airbus A330-300 Series	Trent 772 Improved traverse	59	AC THY	25.89
Airbus A340-300 Series	CFM56-5C2	305	AC THY	25.89
Boeing 717-200 Series	BR700-715A1-30	14	AC TRS	25.89
Boeing 777-200 Series	GE90-110B1	108	AC UAE	25.89
Boeing 777-300 ER	GE90-115B	350	AC UAE	25.89
Airbus A319-100 Series	V2522-A5	1,171	AC UAL	25.89
Airbus A320-200 Series	V2527-A5	2,313	AC UAL	25.89
Boeing 737-700 Series	CFM56-7B24	961	AC UAL	25.89
Boeing 737-800 Series	CFM56-7B26 (8CM051)	2,734	AC UAL	25.89
Boeing 737-900 Series	CFM56-7B26 (8CM051)	3,523	AC UAL	25.89
Boeing 757-200 Series	PW2037 (4PW072)	765	AC UAL	25.89
Boeing 757-300 Series	RB211-535E4B Phase 5	845	AC UAL	25.89
Boeing 767-300 Series	PW4060 Reduced smoke	3	AC UAL	25.89
Boeing 767-400 ER	CF6-80C2B8FA	1	AC UAL	25.89
Boeing 777-200 Series	PW4077	6	AC UAL	25.89
Airbus A330-300 Series	Trent 772 Improved traverse	47	AC VIR	25.89
Airbus A340-600 Series	Trent 556-61 Phase5 Tiled (6RR041)	128	AC VIR	25.89
Boeing 747-400 Series	CF6-80C2B1F 1862M39	45	AC VIR	25.89
Boeing 787-9 Dreamliner	Trent 1000-A Phase5 Tiled (11RR049)	131	AC VIR	25.89
Airbus A319-100 Series	CFM56-5B6/P	242	AC VRD	25.89
Airbus A320-200 Series	V2527-A5	1471	AC VRD	25.89
Airbus A321-100 Series	V2533-A5	223	AC WOW	25.89
Total Air Carrier Aircraft LTOs		**127,153**		
Cargo Aircraft				
Boeing 767-200 Series	CF6-80A	3	CA ABX	25.89

Table I-4 2015 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type (Continued)

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
Cargo Aircraft (Cont'd.)				
Boeing 757-200 Series	PW2037 (4PW072)	129	CA ATN	25.89
Boeing 767-200 Series	JT9D-7R4D, -7R4D1	22	CA ATN	25.89
Airbus A300F4-600 Series	CF6-80C2A5F	206	CA FDX	25.89
Airbus A310-200 Series	JT9D-7R4E, -7R4E1	22	CA FDX	25.89
Boeing 757-200 Series	RB211-535E4 (3RR028)	242	CA FDX	25.89
Boeing 767-300 Series	CF6-80C2B6 1862M39	711	CA FDX	25.89
Boeing DC-10-10 Series	CF6-6D	517	CA FDX	25.89
Boeing MD-11	CF6-80C2D1F 1862M39	64	CA FDX	25.89
Boeing 767-200 Series	JT9D-7R4D, -7R4D1	109	CA GTI	25.89
Cessna 208 Caravan	PT6A-114	5	CA MTN	25.89
Airbus A300F4-600 Series	PW4158	423	CA UPS	25.89
Boeing 757-200 Series	PW2040 (4PW073)	88	CA UPS	25.89
Boeing 767-300 ER	CF6-80C2B6F	258	CA UPS	25.89
Cessna 208 Caravan	PT6A-114	222	CA WIG	25.89
Total Cargo Aircraft LTOs		**3,021**		
Commuter Aircraft				
Bombardier CRJ-700	CF34-8C1	214	CO ASH	25.89
Embraer ERJ170	CF34-8E5 LEC (8GE108)	5	CO ASH	25.89
Bombardier CRJ-700	CF34-8C1	961	CO ASQ	25.89
Embraer ERJ145	AE3007A1P Type 3 (reduced emissions)	875	CO ASQ	25.89
Embraer ERJ145-XR	AE3007A1E	625	CO ASQ	25.89
Bombardier CRJ-200	CF34-3B	2,490	CO AWI	25.89
Bombardier CRJ-900	CF34-8C5 LEC (8GE110)	3,642	CO FLG	25.89
Bombardier CRJ-700	CF34-8C5 LEC (8GE110)	305	CO GJS	25.89
Bombardier CRJ-900	CF34-8C5 LEC (8GE110)	350	CO GJS	25.89
Bombardier CRJ-700	CF34-8C1	3	CO JIA	25.89
Bombardier CRJ-200	CF34-3B	2,518	CO JZA	25.89
Bombardier de Havilland Dash 8 Q400	PW150A	601	CO JZA	25.89

Table I-4 2015 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type (Continued)

Aircraft Types	Engine	LTOs	Description (Airlines)	Taxi Times
Commuter Aircraft Cont'd.				
Cessna 402	TIO-540-J2B2	17,997	CO KAP	25.89
Bombardier de Havilland Dash 8 Q100	PW120A	390	CO PDT	25.89
Saab 340-B-Plus	CT7-9B	1,874	CO PEN	25.89
Bombardier de Havilland Dash 8 Q400	PW150A	2,046	CO POE	25.89
Bombardier de Havilland Dash 8 Q400	PW150A	167	CO RPA	25.89
Embraer ERJ170	CF34-8E5 LEC (8GE108)	2,314	CO RPA	25.89
Embraer ERJ190	CF34-10E6 SAC	21	CO RPA	25.89
Embraer ERJ170	CF34-8E5 LEC (8GE108)	1,892	CO SKV	25.89
Bombardier CRJ-700	CF34-8C5 LEC (8GE110)	22	CO SKW	25.89
Embraer ERJ170	CF34-8E5 LEC (8GE108)	252	CO SKW	25.89
Embraer ERJ145	AE3007A1E	752	CO TCF	25.89
Embraer ERJ170	CF34-8E5 LEC (8GE108)	1,893	CO TCF	25.89
Total Commuter LTO		**42,209**		
General Aviation Aircraft				
Pilatus PC-12	PT6A-67B	873	GA CNS	25.89
Raytheon Beechjet 400	JT15D-5, -5A, -5B	3	GA CNS	25.89
Cessna 560 Citation XLS	JT15D-5, -5A, -5B	955	GA EJA	25.89
Cessna 680 Citation Sovereign	PW308C	404	GA EJA	25.89
Cessna 750 Citation X	AE3007C Type 2	400	GA EJA	25.89
Dassault Falcon 2000	PW308C	310	GA EJA	
Raytheon Hawker 800	TFE731-3	280	GA EJA	25.89
Bombardier Challenger 300	AE3007A1 Type 2	39	GA EJM	25.89
Bombardier Global Express	BR700-710A2-20	43	GA EJM	25.89
Bombardier Learjet 45	TFE731-2-2B	45	GA EJM	25.89
Gulfstream G400	TAY Mk611-8	73	GA EJM	25.89
Gulfstream G500	BR700-710A1-10 (4BR008)	42	GA EJM	25.89
Cessna 525 CitationJet	JT15D-1 series	5	GA GPD	25.89

Table I-4 2015 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type (Continued)

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
General Aviation Aircraft (Cont'd.)				
Cessna 525 CitationJet	JT15D-1 series	1	GA GPD	25.89
EADS Socata TBM-700	PT6A-64	1	GA GPD	25.89
Pilatus PC-12	PT6A-67B	166	GA GPD	25.89
Bombardier Challenger 300	AE3007A1 Type 2	212	GA LXJ	25.89
Bombardier Challenger 600	CF34-3B	16	GA LXJ	25.89
Bombardier Challenger 600	CF34-3B	15	GA LXJ	25.89
Bombardier Learjet 40	TFE731-2-2B	14	GA LXJ	25.89
Bombardier Learjet 45	TFE731-2-2B	83	GA LXJ	25.89
Bombardier Challenger 300	AE3007A1 Type 2	579	GA NA	25.89
Bombardier Challenger 600	CF34-3B	548	GA NA	25.89
Cessna 560 Citation Excel	JT15D-5, -5A, -5B	721	GA NA	25.89
Cirrus SR22	TIO-540-J2B2	667	GA NA	25.89
Dassault Falcon 2000	PW308C	1,007	GA NA	25.89
Gulfstream G400	TAY Mk611-8	1,210	GA NA	25.89
Gulfstream G500	BR700-710A1-10 (4BR008)	1,093	GA NA	25.89
Raytheon Hawker 800	TFE731-3	961	GA NA	25.89
Raytheon Super King Air 200	PT6A-42	1,082	GA NA	25.89
Raytheon Super King Air 300	PT6A-60A	773	GA NA	25.89
Cessna 172 Skyhawk	TSIO-360C	66	GA NGF	25.89
Mooney M20-K	TSIO-360C	33	GA NGF	25.89
Piper PA-32 Cherokee Six	TIO-540-J2B2	49	GA NGF	25.89
Raytheon Beech Baron 58	TIO-540-J2B2	48	GA NGF	25.89
Raytheon Beech Bonanza 36	TIO-540-J2B2	79	GA NGF	25.89
Cessna 560 Citation V	PW530	106	GA OPT	25.89
Cessna 750 Citation X	AE3007C Type 2	56	GA OPT	25.89
Embraer ERJ135	AE3007A1/3 Type 3 (reduced emissions)	29	GA OPT	25.89
Raytheon Beechjet 400	JT15D-5, -5A, -5B	65	GA OPT	25.89
Bombardier Learjet 60	TFE731-2/2A	7	GA TFF	25.89
Raytheon Beechjet 400	JT15D-5, -5A, -5B	7	GA TFF	25.89

Table I-4 2015 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type (Continued)

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
General Aviation Aircraft (Cont'd.)				
Raytheon Hawker 4000 Horizon	PW308A	160	GA TFF	25.89
Raytheon Hawker 800	TFE731-3	9	GA TFF	25.89
Raytheon Super King Air 300	PT6A-60A	8	GA TFF	25.89
Bombardier Challenger 600	CF34-3B	8	GA TMC	25.89
Bombardier Challenger 600	CF34-3B	9	GA TMC	25.89
Raytheon Beechjet 400	JT15D-5, -5A, -5B	348	GA TMC	25.89
Raytheon Hawker 800	TFE731-3	168	GA TMC	25.89
Bombardier Challenger 300	AE3007A1 Type 2	114	GA XOJ	25.89
Cessna 750 Citation X	AE3007C Type 2	95	GA XOJ	25.89
Total General Aviation Aircraft LTOs		**14,085**		
Total Fleet LTOs		**186,468**		

Ground Service Equipment/Alternative Fuels Conversion

For the 2015 analyses, GSE emissions were calculated using EDMS emission factors which are based on the EPA NONROAD2005 model in combination with the GSE time-in-mode survey and the GSE fuel types obtained from the Logan Airport Vehicle Aerodrome Permit Application as part of the *2011 ESPR*. In this way, the most up-to-date GSE fleet operational, conversion, and emissions characteristics are used.

Table I-5 Ground Service Equipment Alternative Fuel Conversion Summary (kg/day)

Year	Pollutant	Percent Reduction	Calculated Emissions without Reduction	Reduction from AFVs	Calculated Emissions with Reduction
2000	Volatile Organic Compounds (VOCs)	13.72%	178	24	154
	Oxides of Nitrogen (NO_x)	9.87%	369	36	333
	Carbon Monoxide (CO)	12.88%	6,124	789	5,335
2001	VOCs	13.72%	166	23	143

Table I-5 Ground Service Equipment Alternative Fuel Conversion Summary (kg/day) (Continued)

Year	Pollutant	Percent Reduction	Calculated Emissions without Reduction	Reduction from AFVs	Calculated Emission with Reduction
2001 (Cont'd.)	NO_x	9.87%	338	33	305
	CO	12.88%	5,960	768	5,193
2002	VOCs	13.6%	286	39	247
	NO_x	8.0%	350	28	322
	CO	16.3%	6,174	1,004	5,170
2003	VOCs	13.8%	263	36	227
	NO_x	8.0%	316	25	291
	CO	16.4%	5,692	934	4,758
2004	VOCs	11.9%	212	25	187
	NO_x	6.6%	357	24	333
	CO	15.4%	4,236	650	3,586
2005	VOCs	12.2%	203	25	178
	NO_x	6.9%	335	23	312
	CO	15.4%	4,175	643	3,531
	$PM_{10}/PM_{2.5}$	9.9%	11	1	10
2006	VOCs	10.7%	86	9	77
	NO_x	7.5%	324	24	300
	CO	13.8%	1,841	255	1,586
	$PM_{10}/PM_{2.5}$	10.8%	10	1	9
2007	VOCs	8.2%	85	7	78
	NO_x	5.1%	315	16	299
	CO	10.4%	2,124	220	1,904
	$PM_{10}/PM_{2.5}$	5.9%	10	<1	10
2008	VOCs	8.3%	72	6	66
	NO_x	4.8%	270	13	257

Table I-5 Ground Service Equipment Alternative Fuel Conversion Summary (kg/day) (Continued)

Year	Pollutant	Percent Reduction	Calculated Emissions without Reduction	Reduction from AVFs	Calculated Emission with Reduction
2008 (Cont'd)	CO	10.2%	1,792	183	1,609
	$PM_{10}/PM_{2.5}$	5.6%	16	<1	15
2009	VOCs	8.2%	61	5	56
	NO_x	4.8%	230	11	219
	CO	10.0%	1,516	152	1,364
	$PM_{10}/PM_{2.5}$	3.5%	14	<1	14
2010	VOCs	7.5%	53	4	49
	NO_x	3.9%	206	8	198
	CO	8.5%	1,335	113	1,222
	$PM_{10}/PM_{2.5}$	2.5%	13	<1	13
2011	VOCs	13.2%	38	5	33
	NO_x	7.5%	188	14	173
	CO	16.7%	834	139	694
	$PM_{10}/PM_{2.5}$	5.5%	14	1	13
2012	VOCs	11.8%	34	4	30
	NO_x	6.8%	176	12	164
	CO	16.3%	738	120	618
	$PM_{10}/PM_{2.5}$	4.9%	13	<1	13
2013	VOCs	10.3%	29	3	26
	NO_x	6.5%	155	10	145
	CO	15.9%	634	101	533
	$PM_{10}/PM_{2.5}$	5.0%	12	<1	12
2014	VOCs	11.5%	26	3	23
	NO_x	5.6%	142	8	134
	CO	15.4%	572	88	484

Table I-5 Ground Service Equipment Alternative Fuel Conversion Summary (kg/day) (Continued)

Year	Pollutant	Percent Reduction	Calculated Emissions	Reduction from AVFs	Calculated Emissions with Reduction
2014 (Cont'd.)	$PM_{10}/PM_{2.5}$	4.8%	12	<1	12
2015	VOCs	4.5%	22	1	21
	NO_x	5.2%	135	7	128
	CO	15.2%	521	79	442
	$PM_{10}/PM_{2.5}$	14.3%	14	2	12

Source: KBE and Massport.
Notes: 2000 and 2001 analyses used EDMS v4.03. 2002 and 2003 analyses used EDMS v4.11, which used updated emission factors from the NONROAD2002 Model. 2004 analyses used EDMS v4.21, which again used emission factors from the EPA NONROAD2002 Model. 2005 analysis used EDMS v4.5, which used emission factors from the EPA NONROAD2002 Model. 2006 analysis used EDMS v5.0.1, which used emission factors from the EPA NONROAD2005 Model. 2007 analysis used EDMS v5.0.2, which used emission factors from the EPA NONROAD2005 Model. 2008 analysis used EDMS v5.1, which used emission factors from the EPA NONROAD2005 Model. 2009 analysis used EDMS v5.1.2, which used emission factors from the EPA NONROAD2005 Model. 2010, 2011, and 2012 analysis used EDMS v5.1.3, which used emission factors from the EPA NONROAD2005 Model. 2013, 2014, and 2015 used EDMS v5.1.4.1, which used emission factors from the EPA NONROAD2005 Model.

Motor Vehicle Emissions

For the 2015 analysis, the motor vehicle emission factor model MOVES2014a was used. The resultant emission factors were multiplied by average daily vehicle miles to calculate daily emissions. The on-Airport traffic data are summarized in the vehicle miles traveled (VMT) analyses of Appendix G, *Ground Access*. Due to the new roadway configuration of the Ted Williams Tunnel, through-traffic no longer traverses Airport property. Therefore, as of 2003, emissions from these vehicles are no longer included as part of the Logan Airport emissions inventory. Further, MOVES2014a was used to obtain vehicle emissions at idle to estimate parking and curbside motor vehicle emissions. Idling emissions are determined for a unit of time and multiplied by total idling time to reach the associated emissions. The input and output files of MOVES2014a are included as **Tables I-6** and **I-7.**

Table I-6 MOVES2014a Sample Input File for 2015


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at idle 5, 10, 15, 20, 25, 30, 35, 40, 45, 50 mph]]></description>
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    <pmsize value="0"/>
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        <distancefactors selected="true" units="Miles"/>
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Source: KBE and Massport.

Table I-7 MOVES2014a Sample Output File for 2015

MasterKey	MOVESRunID	iterationID	yearID	monthID	dayID	hourID	stateID	countyID	zoneID	linkID	pollutantID	processID	sourceTypeID	regClassId	fuelTypeID	modelYearID	roadTypeID	SCC	emissionQuant	activityTypeID	activity	emissionRate	massUnits	distanceUnits
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"2,1,2015,7,5,16,25,25025,250250,21,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	21	119	NULL	21	0	0	0	0	0	0	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,20,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	20	119	NULL	31	0	0	0	0	0	0	1	1	0	g	mi
"2,1,2015,7,5,16,25,25025,250250,19,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	19	119	NULL	31	0	0	0	0	0	0	1	1	0	g	mi
"2,1,2015,7,5,16,25,25025,250250,18,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	18	119	NULL	31	0	0	0	0	0	0	1	1	0	g	mi
"2,1,2015,7,5,16,25,25025,250250,17,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	17	119	NULL	31	0	0	0	0	0	0	1	1	0	g	mi
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"2,1,2015,7,5,16,25,25025,250250,14,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	14	119	NULL	31	0	0	0	0	0	0	1	1	0	g	mi
"2,1,2015,7,5,16,25,25025,250250,13,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	13	119	NULL	31	0	0	0	0	0	0	1	1	0	g	mi
"2,1,2015,7,5,16,25,25025,250250,12,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	12	119	NULL	31	0	0	0	0	0	0	1	1	0	g	mi
"2,1,2015,7,5,16,25,25025,250250,11,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	11	119	NULL	31	0	0	0	0	0	0	1	1	0	g	mi
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"2,1,2015,7,5,16,25,25025,250250,4,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	4	119	NULL	21	0	0	0	0	0	0	1	1	0	g	mi
"2,1,2015,7,5,16,25,25025,250250,3,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	3	119	NULL	21	0	0	0	0	0	0	1	1	0	g	mi
"2,1,2015,7,5,16,25,25025,250250,2,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	2	119	NULL	21	0	0	0	0	0	0	1	1	0	g	mi
"2,1,2015,7,5,16,25,25025,250250,1,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	1	119	NULL	21	0	0	0	0	0	0	1	1	0	g	mi
"2,1,2015,7,5,16,25,25025,250250,22,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	22	118	NULL	31	0	0	0	0	0	0.035492402	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,21,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	21	118	NULL	21	0	0	0	0	0	0.033338599	1	0	NULL	g	mi

"2,1,2015,7,5,16,25,25025,250250,20,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	20	118	NULL	31	0	0	0	0	0	0.00334407	1	1	0.00334407	g	mi
"2,1,2015,7,5,16,25,25025,250250,19,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	19	118	NULL	31	0	0	0	0	0	0.00339481	1	1	0.00339481	g	mi
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"2,1,2015,7,5,16,25,25025,250250,10,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	10	118	NULL	21	0	0	0	0	0	0.00285559	1	1	0.00285559	g	mi
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"2,1,2015,7,5,16,25,25025,250250,8,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	8	118	NULL	21	0	0	0	0	0	0.00297983	1	1	0.00297983	g	mi
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"2,1,2015,7,5,16,25,25025,250250,21,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	21	117	NULL	21	0	0	0	0	0	0	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,20,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	20	117	NULL	31	0	0	0	0	0	0.00124421	1	1	0.00124421	g	mi
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"2,1,2015,7,5,16,25,25025,250250,17,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	17	117	NULL	31	0	0	0	0	0	0.00155601	1	1	0.00155601	g	mi

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"2,1,2015,7,5,16,25,25025,250250,14,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	14	117	NULL	31	0	0	0	0	0	0.00194579	1	1	0.00194579	g	mi
"2,1,2015,7,5,16,25,25025,250250,13,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	13	117	NULL	31	0	0	0	0	0	0.00209661	1	1	0.00209661	g	mi
"2,1,2015,7,5,16,25,25025,250250,12,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	12	117	NULL	31	0	0	0	0	0	0.00225859	1	1	0.00225859	g	mi
"2,1,2015,7,5,16,25,25025,250250,11,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	11	117	NULL	31	0	0	0	0	0	0.00243373	1	1	0.00243373	g	mi
"2,1,2015,7,5,16,25,25025,250250,10,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	10	117	NULL	21	0	0	0	0	0	0.001229	1	1	0.001229	g	mi
"2,1,2015,7,5,16,25,25025,250250,9,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	9	117	NULL	21	0	0	0	0	0	0.001324	1	1	0.001324	g	mi
"2,1,2015,7,5,16,25,25025,250250,8,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	8	117	NULL	21	0	0	0	0	0	0.001427	1	1	0.001427	g	mi
"2,1,2015,7,5,16,25,25025,250250,7,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	7	117	NULL	21	0	0	0	0	0	0.001537	1	1	0.001537	g	mi
"2,1,2015,7,5,16,25,25025,250250,6,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	6	117	NULL	21	0	0	0	0	0	0.001656	1	1	0.001656	g	mi
"2,1,2015,7,5,16,25,25025,250250,5,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	5	117	NULL	21	0	0	0	0	0	0.001784	1	1	0.001784	g	mi
"2,1,2015,7,5,16,25,25025,250250,4,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	4	117	NULL	21	0	0	0	0	0	0.001922	1	1	0.001922	g	mi
"2,1,2015,7,5,16,25,25025,250250,3,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	3	117	NULL	21	0	0	0	0	0	0.002071	1	1	0.002071	g	mi
"2,1,2015,7,5,16,25,25025,250250,2,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	2	117	NULL	21	0	0	0	0	0	0.002231	1	1	0.002231	g	mi
"2,1,2015,7,5,16,25,25025,250250,1,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	1	117	NULL	21	0	0	0	0	0	0.002404	1	1	0.002404	g	mi
"2,1,2015,7,5,16,25,25025,250250,22,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	22	116	NULL	31	0	0	0	0	0	0	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,21,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	21	116	NULL	21	0	0	0	0	0	0	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,20,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	20	116	NULL	31	0	0	0	0	0	0.0014	1	1	0.0014	g	mi
"2,1,2015,7,5,16,25,25025,250250,19,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	19	116	NULL	31	0	0	0	0	0	0.00219603	1	1	0.00219603	g	mi
"2,1,2015,7,5,16,25,25025,250250,18,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	18	116	NULL	31	0	0	0	0	0	0.00307423	1	1	0.00307423	g	mi
"2,1,2015,7,5,16,25,25025,250250,17,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	17	116	NULL	31	0	0	0	0	0	0.00413246	1	1	0.00413246	g	mi
"2,1,2015,7,5,16,25,25025,250250,16,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	16	116	NULL	31	0	0	0	0	0	0.00553236	1	1	0.00553236	g	mi
"2,1,2015,7,5,16,25,25025,250250,15,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	15	116	NULL	31	0	0	0	0	0	0.00732577	1	1	0.00732577	g	mi
"2,1,2015,7,5,16,25,25025,250250,14,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	14	116	NULL	31	0	0	0	0	0	0.00826577	1	1	0.00826577	g	mi
"2,1,2015,7,5,16,25,25025,250250,13,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	13	116	NULL	31	0	0	0	0	0	0.0098568	1	1	0.0098568	g	mi

"2,1,2015,7,5,16,25,25025,250250,12,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	12	116	NULL	31	0	0	0	0	0	0.0130534	1	1	0.0130534	g	mi
"2,1,2015,7,5,16,25,25025,250250,11,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	11	116	NULL	31	0	0	0	0	0	0.022643	1	1	0.022643	g	mi
"2,1,2015,7,5,16,25,25025,250250,10,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	10	116	NULL	21	0	0	0	0	0	0.00128294	1	1	0.00128294	g	mi
"2,1,2015,7,5,16,25,25025,250250,9,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	9	116	NULL	21	0	0	0	0	0	0.00198081	1	1	0.00198081	g	mi
"2,1,2015,7,5,16,25,25025,250250,8,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	8	116	NULL	21	0	0	0	0	0	0.00275537	1	1	0.00275537	g	mi
"2,1,2015,7,5,16,25,25025,250250,7,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	7	116	NULL	21	0	0	0	0	0	0.00369192	1	1	0.00369192	g	mi
"2,1,2015,7,5,16,25,25025,250250,6,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	6	116	NULL	21	0	0	0	0	0	0.00493551	1	1	0.00493551	g	mi
"2,1,2015,7,5,16,25,25025,250250,5,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	5	116	NULL	21	0	0	0	0	0	0.00655265	1	1	0.00655265	g	mi
"2,1,2015,7,5,16,25,25025,250250,4,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	4	116	NULL	21	0	0	0	0	0	0.00745541	1	1	0.00745541	g	mi
"2,1,2015,7,5,16,25,25025,250250,3,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	3	116	NULL	21	0	0	0	0	0	0.00888721	1	1	0.00888721	g	mi
"2,1,2015,7,5,16,25,25025,250250,2,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	2	116	NULL	21	0	0	0	0	0	0.0117074	1	1	0.0117074	g	mi
"2,1,2015,7,5,16,25,25025,250250,1,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	1	116	NULL	21	0	0	0	0	0	0.0201681	1	1	0.0201681	g	mi
"2,1,2015,7,5,16,25,25025,250250,22,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	22	115	NULL	31	0	0	0	0	0	0.00283361	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,21,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	21	115	NULL	21	0	0	0	0	0	0.00128888	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,20,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	20	115	NULL	31	0	0	0	0	0	0.000164972	1	1	0.000164972	g	mi
"2,1,2015,7,5,16,25,25025,250250,19,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	19	115	NULL	31	0	0	0	0	0	0.000166561	1	1	0.000166561	g	mi
"2,1,2015,7,5,16,25,25025,250250,18,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	18	115	NULL	31	0	0	0	0	0	0.000173325	1	1	0.000173325	g	mi
"2,1,2015,7,5,16,25,25025,250250,17,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	17	115	NULL	31	0	0	0	0	0	0.000184918	1	1	0.000184918	g	mi
"2,1,2015,7,5,16,25,25025,250250,16,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	16	115	NULL	31	0	0	0	0	0	0.000201542	1	1	0.000201542	g	mi
"2,1,2015,7,5,16,25,25025,250250,15,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	15	115	NULL	31	0	0	0	0	0	0.000230983	1	1	0.000230983	g	mi
"2,1,2015,7,5,16,25,25025,250250,14,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	14	115	NULL	31	0	0	0	0	0	0.000286238	1	1	0.000286238	g	mi
"2,1,2015,7,5,16,25,25025,250250,13,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	13	115	NULL	31	0	0	0	0	0	0.000333302	1	1	0.000333302	g	mi
"2,1,2015,7,5,16,25,25025,250250,12,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	12	115	NULL	31	0	0	0	0	0	0.000400591	1	1	0.000400591	g	mi
"2,1,2015,7,5,16,25,25025,250250,11,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	11	115	NULL	31	0	0	0	0	0	0.000602453	1	1	0.000602453	g	mi
"2,1,2015,7,5,16,25,25025,250250,10,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	10	115	NULL	21	0	0	0	0	0	0.000109485	1	1	0.000109485	g	mi
"2,1,2015,7,5,16,25,25025,250250,9,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	9	115	NULL	21	0	0	0	0	0	0.000109651	1	1	0.000109651	g	mi

"2,1,2015,7,5,16,25,25025,250250,8,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	8	115	NULL	21	0	0	0	0	0	0.000114126	1	1	0.000114126	g	mi
"2,1,2015,7,5,16,25,25025,250250,7,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	7	115	NULL	21	0	0	0	0	0	0.000122469	1	1	0.000122469	g	mi
"2,1,2015,7,5,16,25,25025,250250,6,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	6	115	NULL	21	0	0	0	0	0	0.000132612	1	1	0.000132612	g	mi
"2,1,2015,7,5,16,25,25025,250250,5,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	5	115	NULL	21	0	0	0	0	0	0.000143529	1	1	0.000143529	g	mi
"2,1,2015,7,5,16,25,25025,250250,4,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	4	115	NULL	21	0	0	0	0	0	0.00017957	1	1	0.00017957	g	mi
"2,1,2015,7,5,16,25,25025,250250,3,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	3	115	NULL	21	0	0	0	0	0	0.00020633	1	1	0.00020633	g	mi
"2,1,2015,7,5,16,25,25025,250250,2,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	2	115	NULL	21	0	0	0	0	0	0.000239994	1	1	0.000239994	g	mi
"2,1,2015,7,5,16,25,25025,250250,1,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	1	115	NULL	21	0	0	0	0	0	0.000340988	1	1	0.000340988	g	mi
"2,1,2015,7,5,16,25,25025,250250,22,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	22	112	NULL	31	0	0	0	0	0	0.0152367	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,21,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	21	112	NULL	21	0	0	0	0	0	0.00568479	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,20,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	20	112	NULL	31	0	0	0	0	0	0.00134584	1	1	0.00134584	g	mi
"2,1,2015,7,5,16,25,25025,250250,19,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	19	112	NULL	31	0	0	0	0	0	0.00132137	1	1	0.00132137	g	mi
"2,1,2015,7,5,16,25,25025,250250,18,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	18	112	NULL	31	0	0	0	0	0	0.001322	1	1	0.001322	g	mi
"2,1,2015,7,5,16,25,25025,250250,17,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	17	112	NULL	31	0	0	0	0	0	0.00134173	1	1	0.00134173	g	mi
"2,1,2015,7,5,16,25,25025,250250,16,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	16	112	NULL	31	0	0	0	0	0	0.00139631	1	1	0.00139631	g	mi
"2,1,2015,7,5,16,25,25025,250250,15,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	15	112	NULL	31	0	0	0	0	0	0.0016041	1	1	0.0016041	g	mi
"2,1,2015,7,5,16,25,25025,250250,14,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	14	112	NULL	31	0	0	0	0	0	0.00190981	1	1	0.00190981	g	mi
"2,1,2015,7,5,16,25,25025,250250,13,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	13	112	NULL	31	0	0	0	0	0	0.0021524	1	1	0.0021524	g	mi
"2,1,2015,7,5,16,25,25025,250250,12,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	12	112	NULL	31	0	0	0	0	0	0.00247849	1	1	0.00247849	g	mi
"2,1,2015,7,5,16,25,25025,250250,11,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	11	112	NULL	31	0	0	0	0	0	0.00345676	1	1	0.00345676	g	mi
"2,1,2015,7,5,16,25,25025,250250,10,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	10	112	NULL	21	0	0	0	0	0	0.000486863	1	1	0.000486863	g	mi
"2,1,2015,7,5,16,25,25025,250250,9,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	9	112	NULL	21	0	0	0	0	0	0.000487719	1	1	0.000487719	g	mi
"2,1,2015,7,5,16,25,25025,250250,8,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	8	112	NULL	21	0	0	0	0	0	0.000508046	1	1	0.000508046	g	mi
"2,1,2015,7,5,16,25,25025,250250,7,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	7	112	NULL	21	0	0	0	0	0	0.000545864	1	1	0.000545864	g	mi
"2,1,2015,7,5,16,25,25025,250250,6,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	6	112	NULL	21	0	0	0	0	0	0.000591638	1	1	0.000591638	g	mi
"2,1,2015,7,5,16,25,25025,250250,5,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	5	112	NULL	21	0	0	0	0	0	0.00063996	1	1	0.00063996	g	mi

"2,1,2015,7,5,16,25,25025,250250,4,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	4	112	NULL	21	0	0	0	0	0	0.000802691	1	1	0.000802691	g	mi
"2,1,2015,7,5,16,25,25025,250250,3,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	3	112	NULL	21	0	0	0	0	0	0.000921862	1	1	0.000921862	g	mi
"2,1,2015,7,5,16,25,25025,250250,2,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	2	112	NULL	21	0	0	0	0	0	0.00106957	1	1	0.00106957	g	mi
"2,1,2015,7,5,16,25,25025,250250,1,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	1	112	NULL	21	0	0	0	0	0	0.00151268	1	1	0.00151268	g	mi
"2,1,2015,7,5,16,25,25025,250250,22,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	22	110	NULL	31	0	0	0	0	0	0.0507292	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,21,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	21	110	NULL	21	0	0	0	0	0	0.039023399	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,20,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	20	110	NULL	31	0	0	0	0	0	0.00468991	1	1	0.00468991	g	mi
"2,1,2015,7,5,16,25,25025,250250,19,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	19	110	NULL	31	0	0	0	0	0	0.00471618	1	1	0.00471618	g	mi
"2,1,2015,7,5,16,25,25025,250250,18,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	18	110	NULL	31	0	0	0	0	0	0.00487737	1	1	0.00487737	g	mi
"2,1,2015,7,5,16,25,25025,250250,17,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	17	110	NULL	31	0	0	0	0	0	0.00516248	1	1	0.00516248	g	mi
"2,1,2015,7,5,16,25,25025,250250,16,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	16	110	NULL	31	0	0	0	0	0	0.00556934	1	1	0.00556934	g	mi
"2,1,2015,7,5,16,25,25025,250250,15,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	15	110	NULL	31	0	0	0	0	0	0.00628822	1	1	0.00628822	g	mi
"2,1,2015,7,5,16,25,25025,250250,14,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	14	110	NULL	31	0	0	0	0	0	0.00774288	1	1	0.00774288	g	mi
"2,1,2015,7,5,16,25,25025,250250,13,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	13	110	NULL	31	0	0	0	0	0	0.00876401	1	1	0.00876401	g	mi
"2,1,2015,7,5,16,25,25025,250250,12,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	12	110	NULL	31	0	0	0	0	0	0.00996981	1	1	0.00996981	g	mi
"2,1,2015,7,5,16,25,25025,250250,11,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	11	110	NULL	31	0	0	0	0	0	0.0135872	1	1	0.0135872	g	mi
"2,1,2015,7,5,16,25,25025,250250,10,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	10	110	NULL	21	0	0	0	0	0	0.00334246	1	1	0.00334246	g	mi
"2,1,2015,7,5,16,25,25025,250250,9,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	9	110	NULL	21	0	0	0	0	0	0.00334833	1	1	0.00334833	g	mi
"2,1,2015,7,5,16,25,25025,250250,8,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	8	110	NULL	21	0	0	0	0	0	0.00348787	1	1	0.00348787	g	mi
"2,1,2015,7,5,16,25,25025,250250,7,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	7	110	NULL	21	0	0	0	0	0	0.0037475	1	1	0.0037475	g	mi
"2,1,2015,7,5,16,25,25025,250250,6,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	6	110	NULL	21	0	0	0	0	0	0.00406174	1	1	0.00406174	g	mi
"2,1,2015,7,5,16,25,25025,250250,5,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	5	110	NULL	21	0	0	0	0	0	0.00439345	1	1	0.00439345	g	mi
"2,1,2015,7,5,16,25,25025,250250,4,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	4	110	NULL	21	0	0	0	0	0	0.00551061	1	1	0.00551061	g	mi
"2,1,2015,7,5,16,25,25025,250250,3,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	3	110	NULL	21	0	0	0	0	0	0.00632868	1	1	0.00632868	g	mi
"2,1,2015,7,5,16,25,25025,250250,2,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	2	110	NULL	21	0	0	0	0	0	0.00734258	1	1	0.00734258	g	mi
"2,1,2015,7,5,16,25,25025,250250,1,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	1	110	NULL	21	0	0	0	0	0	0.0103843	1	1	0.0103843	g	mi

"2,1,2015,7,5,16,25,25025,250250,22,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	22	107	NULL	31	0	0	0	0	0	0	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,21,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	21	107	NULL	21	0	0	0	0	0	0	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,20,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	20	107	NULL	31	0	0	0	0	0	0.00829476	1	1	0.00829476	g	mi
"2,1,2015,7,5,16,25,25025,250250,19,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	19	107	NULL	31	0	0	0	0	0	0.00893611	1	1	0.00893611	g	mi
"2,1,2015,7,5,16,25,25025,250250,18,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	18	107	NULL	31	0	0	0	0	0	0.00963101	1	1	0.00963101	g	mi
"2,1,2015,7,5,16,25,25025,250250,17,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	17	107	NULL	31	0	0	0	0	0	0.0103735	1	1	0.0103735	g	mi
"2,1,2015,7,5,16,25,25025,250250,16,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	16	107	NULL	31	0	0	0	0	0	0.0111768	1	1	0.0111768	g	mi
"2,1,2015,7,5,16,25,25025,250250,15,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	15	107	NULL	31	0	0	0	0	0	0.0120405	1	1	0.0120405	g	mi
"2,1,2015,7,5,16,25,25025,250250,14,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	14	107	NULL	31	0	0	0	0	0	0.012972	1	1	0.012972	g	mi
"2,1,2015,7,5,16,25,25025,250250,13,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	13	107	NULL	31	0	0	0	0	0	0.0139774	1	1	0.0139774	g	mi
"2,1,2015,7,5,16,25,25025,250250,12,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	12	107	NULL	31	0	0	0	0	0	0.0150573	1	1	0.0150573	g	mi
"2,1,2015,7,5,16,25,25025,250250,11,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	11	107	NULL	31	0	0	0	0	0	0.016225001	1	1	0.016225001	g	mi
"2,1,2015,7,5,16,25,25025,250250,10,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	10	107	NULL	21	0	0	0	0	0	0.00819337	1	1	0.00819337	g	mi
"2,1,2015,7,5,16,25,25025,250250,9,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	9	107	NULL	21	0	0	0	0	0	0.00882671	1	1	0.00882671	g	mi
"2,1,2015,7,5,16,25,25025,250250,8,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	8	107	NULL	21	0	0	0	0	0	0.00951337	1	1	0.00951337	g	mi
"2,1,2015,7,5,16,25,25025,250250,7,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	7	107	NULL	21	0	0	0	0	0	0.0102467	1	1	0.0102467	g	mi
"2,1,2015,7,5,16,25,25025,250250,6,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	6	107	NULL	21	0	0	0	0	0	0.01104	1	1	0.01104	g	mi
"2,1,2015,7,5,16,25,25025,250250,5,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	5	107	NULL	21	0	0	0	0	0	0.0118934	1	1	0.0118934	g	mi
"2,1,2015,7,5,16,25,25025,250250,4,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	4	107	NULL	21	0	0	0	0	0	0.0128134	1	1	0.0128134	g	mi
"2,1,2015,7,5,16,25,25025,250250,3,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	3	107	NULL	21	0	0	0	0	0	0.0138067	1	1	0.0138067	g	mi
"2,1,2015,7,5,16,25,25025,250250,2,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	2	107	NULL	21	0	0	0	0	0	0.0148734	1	1	0.0148734	g	mi
"2,1,2015,7,5,16,25,25025,250250,1,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	1	107	NULL	21	0	0	0	0	0	0.0160267	1	1	0.0160267	g	mi
"2,1,2015,7,5,16,25,25025,250250,22,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	22	106	NULL	31	0	0	0	0	0	0	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,21,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	21	106	NULL	21	0	0	0	0	0	0	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,20,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	20	106	NULL	31	0	0	0	0	0	0.0112	1	1	0.0112	g	mi
"2,1,2015,7,5,16,25,25025,250250,19,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	19	106	NULL	31	0	0	0	0	0	0.017568201	1	1	0.017568201	g	mi

"2,1,2015,7,5,16,25,25025,250250,18,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	18	106	NULL	31	0	0	0	0	0	0.0245938	1	1	0.0245938	g	mi
"2,1,2015,7,5,16,25,25025,250250,17,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	17	106	NULL	31	0	0	0	0	0	0.033059701	1	1	0.033059701	g	mi
"2,1,2015,7,5,16,25,25025,250250,16,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	16	106	NULL	31	0	0	0	0	0	0.0442589	1	1	0.0442589	g	mi
"2,1,2015,7,5,16,25,25025,250250,15,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	15	106	NULL	31	0	0	0	0	0	0.058606099	1	1	0.058606099	g	mi
"2,1,2015,7,5,16,25,25025,250250,14,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	14	106	NULL	31	0	0	0	0	0	0.066126198	1	1	0.066126198	g	mi
"2,1,2015,7,5,16,25,25025,250250,13,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	13	106	NULL	31	0	0	0	0	0	0.078854397	1	1	0.078854397	g	mi
"2,1,2015,7,5,16,25,25025,250250,12,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	12	106	NULL	31	0	0	0	0	0	0.104427002	1	1	0.104427002	g	mi
"2,1,2015,7,5,16,25,25025,250250,11,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	11	106	NULL	31	0	0	0	0	0	0.181143999	1	1	0.181143999	g	mi
"2,1,2015,7,5,16,25,25025,250250,10,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	10	106	NULL	21	0	0	0	0	0	0.0102635	1	1	0.0102635	g	mi
"2,1,2015,7,5,16,25,25025,250250,9,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	9	106	NULL	21	0	0	0	0	0	0.0158465	1	1	0.0158465	g	mi
"2,1,2015,7,5,16,25,25025,250250,8,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	8	106	NULL	21	0	0	0	0	0	0.022043001	1	1	0.022043001	g	mi
"2,1,2015,7,5,16,25,25025,250250,7,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	7	106	NULL	21	0	0	0	0	0	0.029535299	1	1	0.029535299	g	mi
"2,1,2015,7,5,16,25,25025,250250,6,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	6	106	NULL	21	0	0	0	0	0	0.039484099	1	1	0.039484099	g	mi
"2,1,2015,7,5,16,25,25025,250250,5,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	5	106	NULL	21	0	0	0	0	0	0.052421201	1	1	0.052421201	g	mi
"2,1,2015,7,5,16,25,25025,250250,4,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	4	106	NULL	21	0	0	0	0	0	0.059643298	1	1	0.059643298	g	mi
"2,1,2015,7,5,16,25,25025,250250,3,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	3	106	NULL	21	0	0	0	0	0	0.071097702	1	1	0.071097702	g	mi
"2,1,2015,7,5,16,25,25025,250250,2,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	2	106	NULL	21	0	0	0	0	0	0.093659498	1	1	0.093659498	g	mi
"2,1,2015,7,5,16,25,25025,250250,1,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	1	106	NULL	21	0	0	0	0	0	0.161345005	1	1	0.161345005	g	mi
"2,1,2015,7,5,16,25,25025,250250,22,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	22	100	NULL	31	0	0	0	0	0	0.055997901	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,21,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	21	100	NULL	21	0	0	0	0	0	0.0441023	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,20,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	20	100	NULL	31	0	0	0	0	0	0.00525542	1	1	0.00525542	g	mi
"2,1,2015,7,5,16,25,25025,250250,19,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	19	100	NULL	31	0	0	0	0	0	0.00528447	1	1	0.00528447	g	mi
"2,1,2015,7,5,16,25,25025,250250,18,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	18	100	NULL	31	0	0	0	0	0	0.00546541	1	1	0.00546541	g	mi
"2,1,2015,7,5,16,25,25025,250250,17,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	17	100	NULL	31	0	0	0	0	0	0.00578579	1	1	0.00578579	g	mi
"2,1,2015,7,5,16,25,25025,250250,16,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	16	100	NULL	31	0	0	0	0	0	0.00624195	1	1	0.00624195	g	mi
"2,1,2015,7,5,16,25,25025,250250,15,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	15	100	NULL	31	0	0	0	0	0	0.00704379	1	1	0.00704379	g	mi

"2,1,2015,7,5,16,25,25025,250250,14,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	14	100	NULL	31	0	0	0	0	0	0.00867345	1	1	0.00867345	g	mi
"2,1,2015,7,5,16,25,25025,250250,13,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	13	100	NULL	31	0	0	0	0	0	0.00980757	1	1	0.00980757	g	mi
"2,1,2015,7,5,16,25,25025,250250,12,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	12	100	NULL	31	0	0	0	0	0	0.0111328	1	1	0.0111328	g	mi
"2,1,2015,7,5,16,25,25025,250250,11,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	11	100	NULL	31	0	0	0	0	0	0.0151086	1	1	0.0151086	g	mi
"2,1,2015,7,5,16,25,25025,250250,10,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	10	100	NULL	21	0	0	0	0	0	0.00377733	1	1	0.00377733	g	mi
"2,1,2015,7,5,16,25,25025,250250,9,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	9	100	NULL	21	0	0	0	0	0	0.00378396	1	1	0.00378396	g	mi
"2,1,2015,7,5,16,25,25025,250250,8,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	8	100	NULL	21	0	0	0	0	0	0.00394165	1	1	0.00394165	g	mi
"2,1,2015,7,5,16,25,25025,250250,7,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	7	100	NULL	21	0	0	0	0	0	0.00423504	1	1	0.00423504	g	mi
"2,1,2015,7,5,16,25,25025,250250,6,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	6	100	NULL	21	0	0	0	0	0	0.00459016	1	1	0.00459016	g	mi
"2,1,2015,7,5,16,25,25025,250250,5,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	5	100	NULL	21	0	0	0	0	0	0.00496505	1	1	0.00496505	g	mi
"2,1,2015,7,5,16,25,25025,250250,4,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	4	100	NULL	21	0	0	0	0	0	0.00622772	1	1	0.00622772	g	mi
"2,1,2015,7,5,16,25,25025,250250,3,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	3	100	NULL	21	0	0	0	0	0	0.0071523	1	1	0.0071523	g	mi
"2,1,2015,7,5,16,25,25025,250250,2,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	2	100	NULL	21	0	0	0	0	0	0.00829819	1	1	0.00829819	g	mi
"2,1,2015,7,5,16,25,25025,250250,1,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	1	100	NULL	21	0	0	0	0	0	0.0117358	1	1	0.0117358	g	mi
"2,1,2015,7,5,16,25,25025,250250,22,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	22	98	NULL	31	0	0	0	0	0	4848.779785	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,21,21,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	21	98	NULL	21	0	0	0	0	0	3692.48999	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,20,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	20	98	NULL	31	0	0	0	0	0	431.9710083	1	1	431.9710083	g	mi
"2,1,2015,7,5,16,25,25025,250250,19,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	19	98	NULL	31	0	0	0	0	0	441.1530151	1	1	441.1530151	g	mi
"2,1,2015,7,5,16,25,25025,250250,18,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	18	98	NULL	31	0	0	0	0	0	453.0669861	1	1	453.0669861	g	mi
"2,1,2015,7,5,16,25,25025,250250,17,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	17	98	NULL	31	0	0	0	0	0	468.6489868	1	1	468.6489868	g	mi
"2,1,2015,7,5,16,25,25025,250250,16,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	16	98	NULL	31	0	0	0	0	0	494.8770142	1	1	494.8770142	g	mi
"2,1,2015,7,5,16,25,25025,250250,15,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	15	98	NULL	31	0	0	0	0	0	555.3829956	1	1	555.3829956	g	mi
"2,1,2015,7,5,16,25,25025,250250,14,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	14	98	NULL	31	0	0	0	0	0	621.3400269	1	1	621.3400269	g	mi
"2,1,2015,7,5,16,25,25025,250250,13,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	13	98	NULL	31	0	0	0	0	0	722.8280029	1	1	722.8280029	g	mi
"2,1,2015,7,5,16,25,25025,250250,12,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	12	98	NULL	31	0	0	0	0	0	920.7750244	1	1	920.7750244	g	mi
"2,1,2015,7,5,16,25,25025,250250,11,31,0,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	11	98	NULL	31	0	0	0	0	0	1514.609985	1	1	1514.609985	g	mi

"2,1,2015,7,5,16,25,25025,250250,10,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	10	98	NULL	21	0	0	0	0	0	316.6390076	1	1	316.6390076	g	mi
"2,1,2015,7,5,16,25,25025,250250,9,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	9	98	NULL	21	0	0	0	0	0	324.3880005	1	1	324.3880005	g	mi
"2,1,2015,7,5,16,25,25025,250250,8,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	8	98	NULL	21	0	0	0	0	0	335.2009888	1	1	335.2009888	g	mi
"2,1,2015,7,5,16,25,25025,250250,7,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	7	98	NULL	21	0	0	0	0	0	349.7869873	1	1	349.7869873	g	mi
"2,1,2015,7,5,16,25,25025,250250,6,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	6	98	NULL	21	0	0	0	0	0	372.2829895	1	1	372.2829895	g	mi
"2,1,2015,7,5,16,25,25025,250250,5,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	5	98	NULL	21	0	0	0	0	0	417.131012	1	1	417.131012	g	mi
"2,1,2015,7,5,16,25,25025,250250,4,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	4	98	NULL	21	0	0	0	0	0	471.1919861	1	1	471.1919861	g	mi
"2,1,2015,7,5,16,25,25025,250250,3,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	3	98	NULL	21	0	0	0	0	0	551.9030151	1	1	551.9030151	g	mi
"2,1,2015,7,5,16,25,25025,250250,2,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	2	98	NULL	21	0	0	0	0	0	707.7290039	1	1	707.7290039	g	mi
"2,1,2015,7,5,16,25,25025,250250,1,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	1	98	NULL	21	0	0	0	0	0	1175.199951	1	1	1175.199951	g	mi
"2,1,2015,7,5,16,25,25025,250250,22,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	22	91	NULL	31	0	0	0	0	0	0.063898131	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,21,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	21	91	NULL	21	0	0	0	0	0	0.048683487	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,20,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	20	91	NULL	31	0	0	0	0	0	0.005691746	1	1	0.005691746	g	mi
"2,1,2015,7,5,16,25,25025,250250,19,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	19	91	NULL	31	0	0	0	0	0	0.005812716	1	1	0.005812716	g	mi
"2,1,2015,7,5,16,25,25025,250250,18,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	18	91	NULL	31	0	0	0	0	0	0.005969655	1	1	0.005969655	g	mi
"2,1,2015,7,5,16,25,25025,250250,17,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	17	91	NULL	31	0	0	0	0	0	0.006174905	1	1	0.006174905	g	mi
"2,1,2015,7,5,16,25,25025,250250,16,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	16	91	NULL	31	0	0	0	0	0	0.006520423	1	1	0.006520423	g	mi
"2,1,2015,7,5,16,25,25025,250250,15,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	15	91	NULL	31	0	0	0	0	0	0.007317726	1	1	0.007317726	g	mi
"2,1,2015,7,5,16,25,25025,250250,14,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	14	91	NULL	31	0	0	0	0	0	0.008186826	1	1	0.008186826	g	mi
"2,1,2015,7,5,16,25,25025,250250,13,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	13	91	NULL	31	0	0	0	0	0	0.009524235	1	1	0.009524235	g	mi
"2,1,2015,7,5,16,25,25025,250250,12,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	12	91	NULL	31	0	0	0	0	0	0.012133006	1	1	0.012133006	g	mi
"2,1,2015,7,5,16,25,25025,250250,11,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	11	91	NULL	31	0	0	0	0	0	0.019959226	1	1	0.019959226	g	mi
"2,1,2015,7,5,16,25,25025,250250,10,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	10	91	NULL	21	0	0	0	0	0	0.004174423	1	1	0.004174423	g	mi
"2,1,2015,7,5,16,25,25025,250250,9,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	9	91	NULL	21	0	0	0	0	0	0.004276608	1	1	0.004276608	g	mi
"2,1,2015,7,5,16,25,25025,250250,8,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	8	91	NULL	21	0	0	0	0	0	0.00441914	1	1	0.00441914	g	mi
"2,1,2015,7,5,16,25,25025,250250,7,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	7	91	NULL	21	0	0	0	0	0	0.004611405	1	1	0.004611405	g	mi

"2,1,2015,7,5,16,25,25025,250250,6,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	6	91	NULL	21	0	0	0	0	0	0.004907958	1	1	0.004907958	g	mi
"2,1,2015,7,5,16,25,25025,250250,5,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	5	91	NULL	21	0	0	0	0	0	0.005499254	1	1	0.005499254	g	mi
"2,1,2015,7,5,16,25,25025,250250,4,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	4	91	NULL	21	0	0	0	0	0	0.006211955	1	1	0.006211955	g	mi
"2,1,2015,7,5,16,25,25025,250250,3,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	3	91	NULL	21	0	0	0	0	0	0.007276088	1	1	0.007276088	g	mi
"2,1,2015,7,5,16,25,25025,250250,2,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	2	91	NULL	21	0	0	0	0	0	0.009330605	1	1	0.009330605	g	mi
"2,1,2015,7,5,16,25,25025,250250,1,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	1	91	NULL	21	0	0	0	0	0	0.015494156	1	1	0.015494156	g	mi
"2,1,2015,7,5,16,25,25025,250250,22,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	22	90	NULL	31	0	0	0	0	0	4848.029785	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,21,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	21	90	NULL	21	0	0	0	0	0	3691.919922	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,20,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	20	90	NULL	31	0	0	0	0	0	431.848999	1	1	431.848999	g	mi
"2,1,2015,7,5,16,25,25025,250250,19,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	19	90	NULL	31	0	0	0	0	0	441.0280151	1	1	441.0280151	g	mi
"2,1,2015,7,5,16,25,25025,250250,18,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	18	90	NULL	31	0	0	0	0	0	452.9370117	1	1	452.9370117	g	mi
"2,1,2015,7,5,16,25,25025,250250,17,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	17	90	NULL	31	0	0	0	0	0	468.5119934	1	1	468.5119934	g	mi
"2,1,2015,7,5,16,25,25025,250250,16,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	16	90	NULL	31	0	0	0	0	0	494.7309875	1	1	494.7309875	g	mi
"2,1,2015,7,5,16,25,25025,250250,15,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	15	90	NULL	31	0	0	0	0	0	555.2260132	1	1	555.2260132	g	mi
"2,1,2015,7,5,16,25,25025,250250,14,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	14	90	NULL	31	0	0	0	0	0	621.1640015	1	1	621.1640015	g	mi
"2,1,2015,7,5,16,25,25025,250250,13,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	13	90	NULL	31	0	0	0	0	0	722.6329956	1	1	722.6329956	g	mi
"2,1,2015,7,5,16,25,25025,250250,12,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	12	90	NULL	31	0	0	0	0	0	920.552002	1	1	920.552002	g	mi
"2,1,2015,7,5,16,25,25025,250250,11,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	11	90	NULL	31	0	0	0	0	0	1514.300049	1	1	1514.300049	g	mi
"2,1,2015,7,5,16,25,25025,250250,10,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	10	90	NULL	21	0	0	0	0	0	316.572998	1	1	316.572998	g	mi
"2,1,2015,7,5,16,25,25025,250250,9,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	9	90	NULL	21	0	0	0	0	0	324.321991	1	1	324.321991	g	mi
"2,1,2015,7,5,16,25,25025,250250,8,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	8	90	NULL	21	0	0	0	0	0	335.131012	1	1	335.131012	g	mi
"2,1,2015,7,5,16,25,25025,250250,7,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	7	90	NULL	21	0	0	0	0	0	349.7109985	1	1	349.7109985	g	mi
"2,1,2015,7,5,16,25,25025,250250,6,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	6	90	NULL	21	0	0	0	0	0	372.2000122	1	1	372.2000122	g	mi
"2,1,2015,7,5,16,25,25025,250250,5,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	5	90	NULL	21	0	0	0	0	0	417.0419922	1	1	417.0419922	g	mi
"2,1,2015,7,5,16,25,25025,250250,4,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	4	90	NULL	21	0	0	0	0	0	471.0899963	1	1	471.0899963	g	mi
"2,1,2015,7,5,16,25,25025,250250,3,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	3	90	NULL	21	0	0	0	0	0	551.789978	1	1	551.789978	g	mi

"2,1,2015,7,5,16,25,25025,250250,2,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	2	90	NULL	21	0	0	0	0	0	707.5960083	1	1	707.5960083	g	mi
"2,1,2015,7,5,16,25,25025,250250,1,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	1	90	NULL	21	0	0	0	0	0	1175.01001	1	1	1175.01001	g	mi
"2,1,2015,7,5,16,25,25025,250250,22,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	22	87	NULL	31	0	0	0	0	0	0.966842115	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,21,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	21	87	NULL	21	0	0	0	0	0	1.127281189	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,20,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	20	87	NULL	31	0	0	0	0	0	0.122033991	1	1	0.122033991	g	mi
"2,1,2015,7,5,16,25,25025,250250,19,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	19	87	NULL	31	0	0	0	0	0	0.124843739	1	1	0.124843739	g	mi
"2,1,2015,7,5,16,25,25025,250250,18,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	18	87	NULL	31	0	0	0	0	0	0.12878935	1	1	0.12878935	g	mi
"2,1,2015,7,5,16,25,25025,250250,17,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	17	87	NULL	31	0	0	0	0	0	0.134125128	1	1	0.134125128	g	mi
"2,1,2015,7,5,16,25,25025,250250,16,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	16	87	NULL	31	0	0	0	0	0	0.141135737	1	1	0.141135737	g	mi
"2,1,2015,7,5,16,25,25025,250250,15,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	15	87	NULL	31	0	0	0	0	0	0.150427505	1	1	0.150427505	g	mi
"2,1,2015,7,5,16,25,25025,250250,14,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	14	87	NULL	31	0	0	0	0	0	0.163756236	1	1	0.163756236	g	mi
"2,1,2015,7,5,16,25,25025,250250,13,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	13	87	NULL	31	0	0	0	0	0	0.181615949	1	1	0.181615949	g	mi
"2,1,2015,7,5,16,25,25025,250250,12,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	12	87	NULL	31	0	0	0	0	0	0.214739546	1	1	0.214739546	g	mi
"2,1,2015,7,5,16,25,25025,250250,11,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	11	87	NULL	31	0	0	0	0	0	0.314108014	1	1	0.314108014	g	mi
"2,1,2015,7,5,16,25,25025,250250,10,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	10	87	NULL	21	0	0	0	0	0	0.136501253	1	1	0.136501253	g	mi
"2,1,2015,7,5,16,25,25025,250250,9,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	9	87	NULL	21	0	0	0	0	0	0.138646752	1	1	0.138646752	g	mi
"2,1,2015,7,5,16,25,25025,250250,8,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	8	87	NULL	21	0	0	0	0	0	0.142272323	1	1	0.142272323	g	mi
"2,1,2015,7,5,16,25,25025,250250,7,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	7	87	NULL	21	0	0	0	0	0	0.147505865	1	1	0.147505865	g	mi
"2,1,2015,7,5,16,25,25025,250250,6,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	6	87	NULL	21	0	0	0	0	0	0.154280096	1	1	0.154280096	g	mi
"2,1,2015,7,5,16,25,25025,250250,5,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	5	87	NULL	21	0	0	0	0	0	0.162807047	1	1	0.162807047	g	mi
"2,1,2015,7,5,16,25,25025,250250,4,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	4	87	NULL	21	0	0	0	0	0	0.175537661	1	1	0.175537661	g	mi
"2,1,2015,7,5,16,25,25025,250250,3,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	3	87	NULL	21	0	0	0	0	0	0.19367075	1	1	0.19367075	g	mi
"2,1,2015,7,5,16,25,25025,250250,2,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	2	87	NULL	21	0	0	0	0	0	0.22809726	1	1	0.22809726	g	mi
"2,1,2015,7,5,16,25,25025,250250,1,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	1	87	NULL	21	0	0	0	0	0	0.33137688	1	1	0.33137688	g	mi
"2,1,2015,7,5,16,25,25025,250250,22,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	22	79	NULL	31	0	0	0	0	0	0.91345495	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,21,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	21	79	NULL	21	0	0	0	0	0	1.057322145	1	0	NULL	g	mi

"2,1,2015,7,5,16,25,25025,250250,20,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	20	79	NULL	31	0	0	0	0	0	0.114606999	1	1	0.114606999	g	mi
"2,1,2015,7,5,16,25,25025,250250,19,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	19	79	NULL	31	0	0	0	0	0	0.117340498	1	1	0.117340498	g	mi
"2,1,2015,7,5,16,25,25025,250250,18,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	18	79	NULL	31	0	0	0	0	0	0.121218599	1	1	0.121218599	g	mi
"2,1,2015,7,5,16,25,25025,250250,17,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	17	79	NULL	31	0	0	0	0	0	0.126484305	1	1	0.126484305	g	mi
"2,1,2015,7,5,16,25,25025,250250,16,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	16	79	NULL	31	0	0	0	0	0	0.1333808	1	1	0.1333808	g	mi
"2,1,2015,7,5,16,25,25025,250250,15,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	15	79	NULL	31	0	0	0	0	0	0.142417192	1	1	0.142417192	g	mi
"2,1,2015,7,5,16,25,25025,250250,14,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	14	79	NULL	31	0	0	0	0	0	0.155404896	1	1	0.155404896	g	mi
"2,1,2015,7,5,16,25,25025,250250,13,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	13	79	NULL	31	0	0	0	0	0	0.172516599	1	1	0.172516599	g	mi
"2,1,2015,7,5,16,25,25025,250250,12,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	12	79	NULL	31	0	0	0	0	0	0.204036996	1	1	0.204036996	g	mi
"2,1,2015,7,5,16,25,25025,250250,11,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	11	79	NULL	31	0	0	0	0	0	0.298599303	1	1	0.298599303	g	mi
"2,1,2015,7,5,16,25,25025,250250,10,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	10	79	NULL	21	0	0	0	0	0	0.125293702	1	1	0.125293702	g	mi
"2,1,2015,7,5,16,25,25025,250250,9,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	9	79	NULL	21	0	0	0	0	0	0.127287105	1	1	0.127287105	g	mi
"2,1,2015,7,5,16,25,25025,250250,8,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	8	79	NULL	21	0	0	0	0	0	0.130736604	1	1	0.130736604	g	mi
"2,1,2015,7,5,16,25,25025,250250,7,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	7	79	NULL	21	0	0	0	0	0	0.135752201	1	1	0.135752201	g	mi
"2,1,2015,7,5,16,25,25025,250250,6,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	6	79	NULL	21	0	0	0	0	0	0.142226398	1	1	0.142226398	g	mi
"2,1,2015,7,5,16,25,25025,250250,5,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	5	79	NULL	21	0	0	0	0	0	0.150297806	1	1	0.150297806	g	mi
"2,1,2015,7,5,16,25,25025,250250,4,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	4	79	NULL	21	0	0	0	0	0	0.162451804	1	1	0.162451804	g	mi
"2,1,2015,7,5,16,25,25025,250250,3,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	3	79	NULL	21	0	0	0	0	0	0.179591298	1	1	0.179591298	g	mi
"2,1,2015,7,5,16,25,25025,250250,2,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	2	79	NULL	21	0	0	0	0	0	0.212012202	1	1	0.212012202	g	mi
"2,1,2015,7,5,16,25,25025,250250,1,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	1	79	NULL	21	0	0	0	0	0	0.309274495	1	1	0.309274495	g	mi
"2,1,2015,7,5,16,25,25025,250250,22,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	22	31	NULL	31	0	0	0	0	0	0.095086403	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,21,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	21	31	NULL	21	0	0	0	0	0	0.073296003	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,20,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	20	31	NULL	31	0	0	0	0	0	0.0084658	1	1	0.0084658	g	mi
"2,1,2015,7,5,16,25,25025,250250,19,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	19	31	NULL	31	0	0	0	0	0	0.00864562	1	1	0.00864562	g	mi
"2,1,2015,7,5,16,25,25025,250250,18,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	18	31	NULL	31	0	0	0	0	0	0.00887834	1	1	0.00887834	g	mi
"2,1,2015,7,5,16,25,25025,250250,17,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	17	31	NULL	31	0	0	0	0	0	0.00918234	1	1	0.00918234	g	mi

"2,1,2015,7,5,16,25,25025,250250,16,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	16	31	NULL	31	0	0	0	0	0	0.00969481	1	1	0.00969481	g	mi
"2,1,2015,7,5,16,25,25025,250250,15,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	15	31	NULL	31	0	0	0	0	0	0.01088	1	1	0.01088	g	mi
"2,1,2015,7,5,16,25,25025,250250,14,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	14	31	NULL	31	0	0	0	0	0	0.0121742	1	1	0.0121742	g	mi
"2,1,2015,7,5,16,25,25025,250250,13,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	13	31	NULL	31	0	0	0	0	0	0.0141666	1	1	0.0141666	g	mi
"2,1,2015,7,5,16,25,25025,250250,12,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	12	31	NULL	31	0	0	0	0	0	0.018053301	1	1	0.018053301	g	mi
"2,1,2015,7,5,16,25,25025,250250,11,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	11	31	NULL	31	0	0	0	0	0	0.0297135	1	1	0.0297135	g	mi
"2,1,2015,7,5,16,25,25025,250250,10,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	10	31	NULL	21	0	0	0	0	0	0.00628296	1	1	0.00628296	g	mi
"2,1,2015,7,5,16,25,25025,250250,9,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	9	31	NULL	21	0	0	0	0	0	0.00643677	1	1	0.00643677	g	mi
"2,1,2015,7,5,16,25,25025,250250,8,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	8	31	NULL	21	0	0	0	0	0	0.00665134	1	1	0.00665134	g	mi
"2,1,2015,7,5,16,25,25025,250250,7,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	7	31	NULL	21	0	0	0	0	0	0.00694078	1	1	0.00694078	g	mi
"2,1,2015,7,5,16,25,25025,250250,6,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	6	31	NULL	21	0	0	0	0	0	0.0073872	1	1	0.0073872	g	mi
"2,1,2015,7,5,16,25,25025,250250,5,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	5	31	NULL	21	0	0	0	0	0	0.00827727	1	1	0.00827727	g	mi
"2,1,2015,7,5,16,25,25025,250250,4,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	4	31	NULL	21	0	0	0	0	0	0.0093501	1	1	0.0093501	g	mi
"2,1,2015,7,5,16,25,25025,250250,3,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	3	31	NULL	21	0	0	0	0	0	0.010952	1	1	0.010952	g	mi
"2,1,2015,7,5,16,25,25025,250250,2,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	2	31	NULL	21	0	0	0	0	0	0.0140446	1	1	0.0140446	g	mi
"2,1,2015,7,5,16,25,25025,250250,1,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	1	31	NULL	21	0	0	0	0	0	0.0233227	1	1	0.0233227	g	mi
"2,1,2015,7,5,16,25,25025,250250,22,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	22	5	NULL	31	0	0	0	0	0	0.030278549	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,21,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	21	5	NULL	21	0	0	0	0	0	0.023221483	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,20,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	20	5	NULL	31	0	0	0	0	0	0.004959182	1	1	0.004959182	g	mi
"2,1,2015,7,5,16,25,25025,250250,19,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	19	5	NULL	31	0	0	0	0	0	0.005064816	1	1	0.005064816	g	mi
"2,1,2015,7,5,16,25,25025,250250,18,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	18	5	NULL	31	0	0	0	0	0	0.005259523	1	1	0.005259523	g	mi
"2,1,2015,7,5,16,25,25025,250250,17,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	17	5	NULL	31	0	0	0	0	0	0.005547877	1	1	0.005547877	g	mi
"2,1,2015,7,5,16,25,25025,250250,16,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	16	5	NULL	31	0	0	0	0	0	0.005913299	1	1	0.005913299	g	mi
"2,1,2015,7,5,16,25,25025,250250,15,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	15	5	NULL	31	0	0	0	0	0	0.006344683	1	1	0.006344683	g	mi
"2,1,2015,7,5,16,25,25025,250250,14,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	14	5	NULL	31	0	0	0	0	0	0.007124707	1	1	0.007124707	g	mi
"2,1,2015,7,5,16,25,25025,250250,13,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	13	5	NULL	31	0	0	0	0	0	0.007873956	1	1	0.007873956	g	mi

"2,1,2015,7,5,16,25,25025,250250,12,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	12	5	NULL	31	0	0	0	0	0	0.009044121	1	1	0.009044121	g	mi
"2,1,2015,7,5,16,25,25025,250250,11,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	11	5	NULL	31	0	0	0	0	0	0.012554659	1	1	0.012554659	g	mi
"2,1,2015,7,5,16,25,25025,250250,10,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	10	5	NULL	21	0	0	0	0	0	0.002695806	1	1	0.002695806	g	mi
"2,1,2015,7,5,16,25,25025,250250,9,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	9	5	NULL	21	0	0	0	0	0	0.00270092	1	1	0.00270092	g	mi
"2,1,2015,7,5,16,25,25025,250250,8,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	8	5	NULL	21	0	0	0	0	0	0.002830357	1	1	0.002830357	g	mi
"2,1,2015,7,5,16,25,25025,250250,7,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	7	5	NULL	21	0	0	0	0	0	0.003071414	1	1	0.003071414	g	mi
"2,1,2015,7,5,16,25,25025,250250,6,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	6	5	NULL	21	0	0	0	0	0	0.003354953	1	1	0.003354953	g	mi
"2,1,2015,7,5,16,25,25025,250250,5,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	5	5	NULL	21	0	0	0	0	0	0.003587049	1	1	0.003587049	g	mi
"2,1,2015,7,5,16,25,25025,250250,4,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	4	5	NULL	21	0	0	0	0	0	0.004115268	1	1	0.004115268	g	mi
"2,1,2015,7,5,16,25,25025,250250,3,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	3	5	NULL	21	0	0	0	0	0	0.004612972	1	1	0.004612972	g	mi
"2,1,2015,7,5,16,25,25025,250250,2,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	2	5	NULL	21	0	0	0	0	0	0.005380244	1	1	0.005380244	g	mi
"2,1,2015,7,5,16,25,25025,250250,1,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	1	5	NULL	21	0	0	0	0	0	0.007682066	1	1	0.007682066	g	mi
"2,1,2015,7,5,16,25,25025,250250,22,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	22	3	NULL	31	0	0	0	0	0	2.334285498	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,21,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	21	3	NULL	21	0	0	0	0	0	1.471556664	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,20,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	20	3	NULL	31	0	0	0	0	0	0.297543466	1	1	0.297543466	g	mi
"2,1,2015,7,5,16,25,25025,250250,19,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	19	3	NULL	31	0	0	0	0	0	0.29189527	1	1	0.29189527	g	mi
"2,1,2015,7,5,16,25,25025,250250,18,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	18	3	NULL	31	0	0	0	0	0	0.288305283	1	1	0.288305283	g	mi
"2,1,2015,7,5,16,25,25025,250250,17,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	17	3	NULL	31	0	0	0	0	0	0.285791397	1	1	0.285791397	g	mi
"2,1,2015,7,5,16,25,25025,250250,16,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	16	3	NULL	31	0	0	0	0	0	0.287514806	1	1	0.287514806	g	mi
"2,1,2015,7,5,16,25,25025,250250,15,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	15	3	NULL	31	0	0	0	0	0	0.312439442	1	1	0.312439442	g	mi
"2,1,2015,7,5,16,25,25025,250250,14,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	14	3	NULL	31	0	0	0	0	0	0.33231917	1	1	0.33231917	g	mi
"2,1,2015,7,5,16,25,25025,250250,13,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	13	3	NULL	31	0	0	0	0	0	0.360608876	1	1	0.360608876	g	mi
"2,1,2015,7,5,16,25,25025,250250,12,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	12	3	NULL	31	0	0	0	0	0	0.414301038	1	1	0.414301038	g	mi
"2,1,2015,7,5,16,25,25025,250250,11,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	11	3	NULL	31	0	0	0	0	0	0.575376689	1	1	0.575376689	g	mi
"2,1,2015,7,5,16,25,25025,250250,10,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	10	3	NULL	21	0	0	0	0	0	0.192107379	1	1	0.192107379	g	mi
"2,1,2015,7,5,16,25,25025,250250,9,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	9	3	NULL	21	0	0	0	0	0	0.188965231	1	1	0.188965231	g	mi

"2,1,2015,7,5,16,25,25025,250250,8,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	8	3	NULL	21	0	0	0	0	0	0.189977273	1	1	0.189977273	g	mi
"2,1,2015,7,5,16,25,25025,250250,7,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	7	3	NULL	21	0	0	0	0	0	0.194275454	1	1	0.194275454	g	mi
"2,1,2015,7,5,16,25,25025,250250,6,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	6	3	NULL	21	0	0	0	0	0	0.202715814	1	1	0.202715814	g	mi
"2,1,2015,7,5,16,25,25025,250250,5,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	5	3	NULL	21	0	0	0	0	0	0.225827828	1	1	0.225827828	g	mi
"2,1,2015,7,5,16,25,25025,250250,4,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	4	3	NULL	21	0	0	0	0	0	0.239990458	1	1	0.239990458	g	mi
"2,1,2015,7,5,16,25,25025,250250,3,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	3	3	NULL	21	0	0	0	0	0	0.257899255	1	1	0.257899255	g	mi
"2,1,2015,7,5,16,25,25025,250250,2,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	2	3	NULL	21	0	0	0	0	0	0.290321738	1	1	0.290321738	g	mi
"2,1,2015,7,5,16,25,25025,250250,1,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	1	3	NULL	21	0	0	0	0	0	0.38758713	1	1	0.38758713	g	mi
"2,1,2015,7,5,16,25,25025,250250,22,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	22	2	NULL	31	0	0	0	0	0	6.922605038	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,21,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	21	2	NULL	21	0	0	0	0	0	7.144999981	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,20,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	20	2	NULL	31	0	0	0	0	0	2.764748096	1	1	2.764748096	g	mi
"2,1,2015,7,5,16,25,25025,250250,19,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	19	2	NULL	31	0	0	0	0	0	2.80517292	1	1	2.80517292	g	mi
"2,1,2015,7,5,16,25,25025,250250,18,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	18	2	NULL	31	0	0	0	0	0	2.913474798	1	1	2.913474798	g	mi
"2,1,2015,7,5,16,25,25025,250250,17,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	17	2	NULL	31	0	0	0	0	0	3.087763309	1	1	3.087763309	g	mi
"2,1,2015,7,5,16,25,25025,250250,16,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	16	2	NULL	31	0	0	0	0	0	3.289238214	1	1	3.289238214	g	mi
"2,1,2015,7,5,16,25,25025,250250,15,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	15	2	NULL	31	0	0	0	0	0	3.456769228	1	1	3.456769228	g	mi
"2,1,2015,7,5,16,25,25025,250250,14,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	14	2	NULL	31	0	0	0	0	0	4.159496307	1	1	4.159496307	g	mi
"2,1,2015,7,5,16,25,25025,250250,13,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	13	2	NULL	31	0	0	0	0	0	4.661911488	1	1	4.661911488	g	mi
"2,1,2015,7,5,16,25,25025,250250,12,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	12	2	NULL	31	0	0	0	0	0	5.268093586	1	1	5.268093586	g	mi
"2,1,2015,7,5,16,25,25025,250250,11,31,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	11	2	NULL	31	0	0	0	0	0	7.086639881	1	1	7.086639881	g	mi
"2,1,2015,7,5,16,25,25025,250250,10,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	10	2	NULL	21	0	0	0	0	0	2.010581017	1	1	2.010581017	g	mi
"2,1,2015,7,5,16,25,25025,250250,9,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	9	2	NULL	21	0	0	0	0	0	2.056927919	1	1	2.056927919	g	mi
"2,1,2015,7,5,16,25,25025,250250,8,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	8	2	NULL	21	0	0	0	0	0	2.197807789	1	1	2.197807789	g	mi
"2,1,2015,7,5,16,25,25025,250250,7,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	7	2	NULL	21	0	0	0	0	0	2.429258347	1	1	2.429258347	g	mi
"2,1,2015,7,5,16,25,25025,250250,6,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	6	2	NULL	21	0	0	0	0	0	2.686214447	1	1	2.686214447	g	mi
"2,1,2015,7,5,16,25,25025,250250,5,21,0,0,0,0,00"	2	1	2015	7	5	16	25	25025	250250	5	2	NULL	21	0	0	0	0	0	2.828671694	1	1	2.828671694	g	mi

"2,1,2015,7,5,16,25,25025,250250,4,21,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	4	2	NULL	21	0	0	0	0	0	3.40225482	1	1	3.40225482	g	mi
"2,1,2015,7,5,16,25,25025,250250,3,21,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	3	2	NULL	21	0	0	0	0	0	3.83739996	1	1	3.83739996	g	mi
"2,1,2015,7,5,16,25,25025,250250,2,21,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	2	2	NULL	21	0	0	0	0	0	4.39722538	1	1	4.39722538	g	mi
"2,1,2015,7,5,16,25,25025,250250,1,21,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	1	2	NULL	21	0	0	0	0	0	6.076691628	1	1	6.076691628	g	mi
"2,1,2015,7,5,16,25,25025,250250,22,31,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	22	1	NULL	31	0	0	0	0	0	0.943414986	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,21,21,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	21	1	NULL	21	0	0	0	0	0	1.080242157	1	0	NULL	g	mi
"2,1,2015,7,5,16,25,25025,250250,20,31,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	20	1	NULL	31	0	0	0	0	0	0.119505495	1	1	0.119505495	g	mi
"2,1,2015,7,5,16,25,25025,250250,19,31,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	19	1	NULL	31	0	0	0	0	0	0.122343495	1	1	0.122343495	g	mi
"2,1,2015,7,5,16,25,25025,250250,18,31,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	18	1	NULL	31	0	0	0	0	0	0.126414001	1	1	0.126414001	g	mi
"2,1,2015,7,5,16,25,25025,250250,17,31,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	17	1	NULL	31	0	0	0	0	0	0.131964594	1	1	0.131964594	g	mi
"2,1,2015,7,5,16,25,25025,250250,16,31,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	16	1	NULL	31	0	0	0	0	0	0.139222205	1	1	0.139222205	g	mi
"2,1,2015,7,5,16,25,25025,250250,15,31,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	15	1	NULL	31	0	0	0	0	0	0.148684904	1	1	0.148684904	g	mi
"2,1,2015,7,5,16,25,25025,250250,14,31,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	14	1	NULL	31	0	0	0	0	0	0.162443489	1	1	0.162443489	g	mi
"2,1,2015,7,5,16,25,25025,250250,13,31,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	13	1	NULL	31	0	0	0	0	0	0.180296198	1	1	0.180296198	g	mi
"2,1,2015,7,5,16,25,25025,250250,12,31,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	12	1	NULL	31	0	0	0	0	0	0.212974995	1	1	0.212974995	g	mi
"2,1,2015,7,5,16,25,25025,250250,11,31,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	11	1	NULL	31	0	0	0	0	0	0.311011314	1	1	0.311011314	g	mi
"2,1,2015,7,5,16,25,25025,250250,10,21,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	10	1	NULL	21	0	0	0	0	0	0.127954796	1	1	0.127954796	g	mi
"2,1,2015,7,5,16,25,25025,250250,9,21,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	9	1	NULL	21	0	0	0	0	0	0.129953295	1	1	0.129953295	g	mi
"2,1,2015,7,5,16,25,25025,250250,8,21,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	8	1	NULL	21	0	0	0	0	0	0.133530408	1	1	0.133530408	g	mi
"2,1,2015,7,5,16,25,25025,250250,7,21,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	7	1	NULL	21	0	0	0	0	0	0.138784096	1	1	0.138784096	g	mi
"2,1,2015,7,5,16,25,25025,250250,6,21,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	6	1	NULL	21	0	0	0	0	0	0.145538107	1	1	0.145538107	g	mi
"2,1,2015,7,5,16,25,25025,250250,5,21,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	5	1	NULL	21	0	0	0	0	0	0.1538385	1	1	0.1538385	g	mi
"2,1,2015,7,5,16,25,25025,250250,4,21,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	4	1	NULL	21	0	0	0	0	0	0.166514009	1	1	0.166514009	g	mi
"2,1,2015,7,5,16,25,25025,250250,3,21,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	3	1	NULL	21	0	0	0	0	0	0.184144899	1	1	0.184144899	g	mi
"2,1,2015,7,5,16,25,25025,250250,2,21,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	2	1	NULL	21	0	0	0	0	0	0.217322901	1	1	0.217322901	g	mi
"2,1,2015,7,5,16,25,25025,250250,1,21,0,0,0,0,0"	2	1	2015	7	5	16	25	25025	250250	1	1	NULL	21	0	0	0	0	0	0.316857487	1	1	0.316857487	g	mi

Source: KBE and Massport.

Fuel Storage and Handling

As in previous years, VOC emissions from fuel storage and handling were calculated using methods based on EPA's AP-42[1] document. Calculations account for evaporative emissions from breathing losses, working losses, and spillage from aboveground storage tanks, underground storage tanks, and aircraft refueling. In 2003, additional information became available on the fire training fuel, Tek-Flame®. Emissions of VOCs from this fuel were estimated by EDMS. **Table I-8** presents Logan Airport's fuel throughput by category.

Stationary Sources

Stationary sources include the Central Heating and Cooling Plant, emergency generators, snow melters, space heaters, and boilers. Emission factors from EPA's AP-42 or NO_x Reasonably Available Control Technology (RACT) compliance testing were combined with the actual 2015 fuel throughput of the stationary sources to obtain emissions of VOCs, NO_X, CO, and PM with a diameter of less than or equal to 10 micrograms or 2.5 micrograms (PM_{10}/$PM_{2.5}$).

Title V of the 1990 Clean Air Act (CAA) Amendments requires facilities with air emissions to document their emissions and obtain a single permit combining all sources. The permitting program ensures that all emission sources are accounted for, the proper permits have been received, and permit conditions are being followed. A Title V Air Operating Permit covers all of the stationary sources at Logan Airport including boilers, emergency generators, snow melters, fire training, cooling towers, paint booths, deicing facilities, and storage tanks. **Table I-9** presents Logan Airport's stationary source fuel throughput by fuel category.

1 Compilation of Air Pollutant Emission Factors, AP-42, Office of Air Quality Planning and Standards, EPA, Fifth Edition, 1995.

Table I-8 Fuel Throughput by Fuel Category (gallons)

Fuel Category	1999	2000	2001	2002	2003	2004	2005	2006	2007
Jet Fuel	354,095,516	441,901,932	416,748,819	358,190,362	319,439,910	373,996,141	368,645,392	364,450,864	367,585,187
Fire Training Fuel[1]	NA	NA	NA	NA	13,719	12,227	8,105	5,000	8,631
Aviation Gas	99,726	90,922	60,691	35,111	32,515	34,717	52,487	35,098	29,067
Auto Gas	7,200,000	7,569,206	6,181,472	5,754,740	5,436,322	5,803,442	5,903,424	6,028,931	6,022,237
Diesel	768,106	839,751	1,239,904	1,067,847	1,030,185	1,078,665	1,567,688	1,164,493	1,141,335
Heating Oil No.2	480,733	494,500	582,283	340,492	370,903	381,852	367,899	259,768	423,181
Heating Oil No.62	1,600,893	1,555,527	1,641,693	1,079,283	1,122,975	2,940,752	3,098,126	1,396,529	1,073,260

Fuel Category	2008	2009	2010	2011	2012	2013	2014	2015
Jet Fuel	345,631,788	327,358,619	335,693,997	340,421,373	343,731,127	349,397,940	370,222,342	374,985,216
Fire Training Fuel[1]	5,971	3,510	800	3,810	2,587	5,400	3,753	7,619
Aviation Gas	25,037	18,238	15,268	14,064	12,306	14,422	12,514	10,225
Auto Gas	5,693,178	5,736,724	5,696,505	5,487,952	6,694,626	6,800,936	7,007,591	7,432,165
Diesel	1,071,707	1,121,241	1,168,761	1,099,720	878,499	1,094,714	1,178,805	1,473,720
Heating Oil No.2	303,143	409,049	319,727	384,906	210,794	289,665	289,956	294,704
Heating Oil No.6[2]	16,385	368,690	9,010	11,285	6,786	17,721	77,146	0

Source: Massport, 2015.
1 Fire Training Fuel used in 1999-2002 was Jet A Fuel while in 2003 through 2014 it was Tek-Flame®. 2012 includes 100 gallons of avgas, 2013 includes 400 gallons of avgas, 2014 includes 338 gallons of avgas, and 2015 includes 742 gallons of avgas.
2 Effective November 2014, Massport no longer uses No. 6 heating oil at the CHP and was replaced with No. 2 heating oil.
NA Not available.

Table I-9 Stationary Source Fuel Throughput by Fuel Category (gallons)

Fuel Category	1999	2000	2001	2002	2003	2004	2005	2006	2007
Natural Gas (ft^3)	183,943,000	283,720,049	199,500,000	268,359,282	201,714,114	62,610,000	92,460,000	112,390,000	338,430,000
Heating Oil No. 2	480,733	494,500	582,283	340,492	370,903	381,852	367,899	259,768	423,181
Heating Oil No. 6[1]	1,600,893	1,555,527	1,641,693	1,079,283	1,122,975	2,940,752	3,098,126	1,396,529	1,073,260
Diesel Fuel[2]	57,441	NA	NA	NA	NA	67,198	77,848	77,848	258,606
Fire Training Fuel[3]	23,000	NA	NA	NA	13,719	12,227	8,105	5,000	8,631

Fuel Category	2008	2009	2010	2011	2012	2013	2014	2015
Natural Gas (ft^3)	458,680,000	430,810,000	449,640,000	479,830,000	360,523,000	402,496,000	418,805,000	463,170,000
Heating Oil No. 2	303,143	409,050	319,727	384,906	210,794	289,665	289,956	294,704
Heating Oil No. 6[1]	16,385	368,690	9,010	11,285	6,786	17,721	77,146	0
Diesel Fuel[2]	146,718	145,778	116,511	218,081	42,109	231,130	124,480	381,581
Fire Training Fuel[3]	5,971	3,510	800	3,810	2,587	5,400	3,753	7,619

Source: Massport, 2015.
NA Not available.
1 Effective November 2014, Massport no longer uses No. 6 heating oil at the CHP and was replaced with No. 2 heating oil.
2 Diesel fuel was from the stationary snow melter usage. Starting in 2007, portable snow melter usage was also included.
3 Fire Training Fuel used in 1999-2002 was Jet A Fuel while in 2003 through 2015 it was Tek-Flame®. 2012 includes 100 gallons of avgas, 2013 includes 400 gallons of avgas, 2014 includes 338 gallons of avgas, and 2015 includes 742 gallons of avgas.

Tables I-10 through **I-19** contain the 1993 through 2010 Emissions Inventory summary tables for Logan Airport.

1993 Through 2010 Emissions Inventories

Table I-10 Estimated VOC Emissions (in kg/day) at Logan Airport 1993-2001[1]

Aircraft/GSE Model:	**Logan Dispersion Modeling System (LDMS)**					**EDMS v3.22**	**EDMS v4.21**	**EDMS v4.03**	
Motor Vehicle Model:	**MOBILE5a**					**MOB5a_h**	**MOB 6.2.03**	**MOBILE 6.0**	
Year:	1993	1994	1995	1996	1997	1998	1999[2]	2000	2001
Aircraft Sources									
Air carriers	1,958	1,554	1,407	1,390	1,227	736	653	514	374
Commuter aircraft	943	543	531	622	498	154	196	140	113
Cargo aircraft	89	244	236	214	207	43	318	207	149
General aviation	51	48	36	24	27	13	141	42	43
Total aircraft sources	3,041	2,389	2,210	2,250	1,959	946	1,308	903	679
Ground Service Equipment[3]	636	533	521	497	530	145	243	153	143
Motor Vehicles									
Ted Williams Tunnel through-traffic	NA	NA	NA	NA	NA	NA	15	12	10
Parking/curbside	173	148	127	102	102	118	101	89	77
On-airport vehicles[4]	238	215	179	223	205	258	256	206	170
Total motor vehicle sources	411	363	306	325	307	376	372	307	257
Other Sources									
Fuel storage/handling	408	434	318	356	381	372	352	412	372
Miscellaneous sources[5]	5	5	5	6	6	2	16	2	2
Total other sources	413	439	323	362	387	374	368	414	374
Total Airport Sources	4,501	3,724	3,360	3,434	3,183	1,841	2,291	1,777	1,453

Source: KBE and Massport.
kg/day kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy).
NA Not available.
MOB MOBILE model for motor vehicle emissions (MOB5a_h=MOBILE5a_h, MOB6.2.03=MOBILE6.2 version .03)
1 The emissions inventory for 1990 is shown in Chapter 7. Emission inventories for 1991 and 1992 were not prepared.
2 Year 1999 emissions were last re-calculated using EDMS v4.21 in the 2004 ESPR Air Quality Analysis.
3 Beginning in 1996 and later, emissions include vehicles and equipment converted to alternative fuels. APU emissions are also included.
4 1999 emissions inventory include reductions attributable to CNG shuttle buses.
5 Includes the Central Heating and Cooling Plant, emergency electricity generation, and other stationary sources. Fire Training emissions were included in 1999. Diesel snow melter usage was added in 1999.

Table I-11 Estimated VOC Emissions (in kg/day) at Logan Airport 2002-2009

Aircraft/GSE Model:	**EDMS v4.11**		**EDMS v4.21**	**EDMS v4.5**		**EDMS v5.0.1**		**EDMS v5.0.2**		**EDMS v5.1**		**EDMS v5.1.2**
Motor Vehicle Model:	**MOBILE 6.0**	**MOB 6.2.01**	**MOBILE 6.2.03**									
Year:	**2002**	**2003**	**2004**	**2005**	**2006**		**2007**		**2008**		**2009**	
Aircraft Sources												
Air carriers	248	208	292	271	227	511	435	381	324	286	237	235
Commuter aircraft	75	95	127	140	125	371	479	409	253	176	131	133
Cargo aircraft	127	94	110	41	19	46	129	112	107	70	71	71
General aviation	52	61	127	147	147	236	226	206	201	171	78	78
Total aircraft sources	502	458	656	599	518	1,164[1]	1,269	1,108	885	703	517	517
Ground Service Equipment[2]	247	227	187	178	167	77	78	78	66	66	56	56
Motor Vehicles												
Ted Williams Tunnel through-traffic	9	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]
Parking/curbside[4]	51	45	38	37	33	33	31	31	25	25	22	22
On-airport vehicles	152	135	129	118	106	106	104	104	82	82	71	71
Total motor vehicle sources	212	180	167	155	139	139	135	135	107	107	93	93
Other Sources												
Fuel storage/handling	329	297	341	340	336	336	338	338	320	320	307	307
Miscellaneous sources[5]	2	3	9	13	8	8	14	14	13	12	7	7
Total other sources	331	300	350	353	344	344	352	352	333	332	314	314
Total Airport Sources	1,292	1,165	1,360	1,285	1,168	1,724	1,834	1,673	1,391	1,208	980	980

Source: KBE and Massport
Notes: Years 2006 to 2009 were computed with previous years EDMS version to provide for a common basis of comparison.
kg/day kilograms per day. 1 kg/day is equivalent to approximately 0.40234 tons per year (tpy).
1 The 2006 increase in aircraft VOC emissions is largely attributable to the addition of aircraft main engine startup emissions.
2 GSE emissions include aircraft APUs as well as vehicles and equipment converted to alternative fuels.
3 Due to the new roadway configuration and opening of the Ted Williams Tunnel there was no Ted Williams Tunnel through- traffic at Logan Airport beginning in 2003.
4 Parking/curbside is based on VMT analysis.
5 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

Table I-12 Estimated VOC Emissions (in kg/day) at Logan Airport 2010

Aircraft/GSE Model:	**EDMS v5.1.2**	**EDMS v5.1.3**
Motor Vehicle Model:	**MOBILE 6.2.03**	
Year:	**2010**	
Aircraft Sources		
Air carriers	292	292
Commuter aircraft	129	125
Cargo aircraft	70	70
General aviation	81	81
Total aircraft sources	572	568
Ground Service Equipment[1]	49	49
Motor Vehicles		
Ted Williams Tunnel through-traffic	–[2]	–[2]
Parking/curbside[3]	20	20
On-airport vehicles	68	68
Total motor vehicle sources	88	88
Other Sources		
Fuel storage/handling	311	311
Miscellaneous sources[4]	5	5
Total other sources	316	316
Total Airport Sources	1,025	1,021

Source: KBE and Massport
kg/day kilograms per day. 1 kg/day is equivalent to approximately 0.40234 tons per year (tpy).
1 GSE emissions include aircraft APUs as well as vehicles and equipment converted to alternative fuels.
2 Due to the new roadway configuration and opening of the Ted Williams Tunnel there was no Ted Williams Tunnel through-traffic at Logan Airport beginning in 2003.
3 Parking/curbside is based on VMT analysis.
4 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

Table I-13 Estimated NO_X Emissions (in kg/day) at Logan Airport 1993-2001[1]

Aircraft/GSE Model:	**Logan Dispersion Modeling System (LDMS)**					**EDMS v3.22**	**EDMS v4.21**	**EDMS v4.03**	
Motor Vehicle Model:	**MOBILE5a**					**MOB5a_h**	**MOB 6.2.03**	**MOBILE 6.0**	
Year:	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999[2]**	**2000**	**2001**
Aircraft Sources									
Air carriers	4,271	4,317	3,861	3,781	4,150	4,471	4,183	4,202	3,707
Commuter aircraft	202	158	192	137	159	203	166	125	233
Cargo aircraft	213	257	332	363	262	254	286	284	267
General aviation	13	13	17	18	21	5	12	49	34
Total aircraft sources	4,699	4,745	4,402	4,299	4,592	4,933	4,647	4,660	4,241
Ground Service Equipment[3]	722	617	607	588	622	317	444	333	305
Motor Vehicles									
Ted Williams Tunnel through-traffic	NA	NA	NA	NA	NA	NA	28	26	22
Parking/curbside	25	24	24	24	24	37	39	52	46
On-airport vehicles[4]	240	239	229	257	244	372	449	425	369
Total motor vehicle sources	265	263	253	281	268	409	516	503	437
Other Sources									
Fuel storage/handling[5]	0	0	0	0	0	0	0	0	0
Miscellaneous sources[6]	278	330	320	275	244	284	165	211	185
Total other sources	278	330	320	275	244	284	165	211	185
Total Airport Sources	5,964	5,955	5,582	5,443	5,726	5,943	5,772	5,707	5,168

Source: KBE and Massport.
Kg/day kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy).
NA Not available.
MOB MOBILE model for motor vehicle emissions (MOB5a_h=MOBILE5a_h, MOB6.2.03=MOBILE6.2 version .03)
1 The emissions inventory for 1990 is shown in Chapter 7. Emission inventories for 1991 and 1992 were not prepared.
2 Year 1999 emissions were last re-calculated using EDMS v4.21 in the 2004 ESPR Air Quality Analysis.
3 Beginning in 1996 and later, emissions include vehicles and equipment converted to alternative fuels. APU emissions are also included.
4 1999 emissions inventory include reductions attributable to CNG shuttle buses.
5 Fuel storage and handling facilities are not sources of NOx emissions.
6 Includes the Central Heating and Cooling Plant, emergency electricity generation, and other stationary sources. Fire Training emissions were included in 1999. Diesel snow melter usage was added in 1999.

Table I-14 Estimated NO_X Emissions (in kg/day) at Logan Airport 2002-2009

Aircraft/GSE Model:	**EDMS v4.11**		**EDMS v4.21**	**EDMS v4.5**		**EDMS v5.0.1**		**EDMS v5.0.2**		**EDMS v5.1**		**EDMS v5.1.2**
Motor Vehicle Model:	**MOBILE 6.0**	**MOB 6.2.01**	**MOBILE 6.2.03**									
Year:	**2002**	**2003**	**2004**	**2005**	**2006**		**2007**		**2008**		**2009**	
Aircraft Sources												
Air carriers	2,721	2,479	2,949	2,880	2,849	3,044	3,120	3,121	3,031	3,031	2,944	2,952
Commuter aircraft	208	185	245	225	195	256	353	354	319	319	309	234
Cargo aircraft	246	213	215	211	192	125	248	248	233	233	215	204
General aviation	38	45	49	50	49	60	56	56	43	43	27	23
Total aircraft sources	3,213	2,922	3,458	3,366	3,285	3,485	3,777	3,779	3,626	3,626	3,495	3,413
Ground Service Equipment[1]	322	291	333	312	280	300	299	299	257	257	219	219
Motor Vehicles												
Ted Williams Tunnel through-traffic	20	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]
Parking/curbside[3]	32	28	21	22	19	19	18	18	15	15	13	13
On-airport vehicles	341	302	267	269	238	238	233	233	182	182	153	153
Total motor vehicle sources	393	330	288	291	257	257	251	251	197	197	166	166
Other Sources												
Fuel storage/handling[4]	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous sources[5]	175	151	211	218	109	109	128	128	124	124	181	181
Total other sources	175	151	211	218	109	109	128	128	124	124	181	181
Total Airport Sources	4,103	3,694	4,290	4,187	3,931	4,151	4,455	4,457	4,204	4,204	4,061	3,979

Source: KBE and Massport

Notes: Years 2006 to 2009 were computed with previous years EDMS version to provide for a common basis of comparison.

Kg/day kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy).

1 GSE emissions include APUs as well as vehicles and equipment converted to alternative fuels.

2 Due to the new roadway configuration and opening of the Ted Williams Tunnel there was no Ted Williams Tunnel through-traffic at Logan Airport beginning in 2003.

3 Parking/curbside data is based on VMT analysis.

4 Fuel storage/handling facilities are not a source of NOx emissions.

5 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

Table I-15 Estimated NO_X Emissions (in kg/day) at Logan Airport 2010

Aircraft/GSE Model:	**EDMS v5.1.2**	**EDMS v5.1.3**
Motor Vehicle Model:	**MOBILE 6.2.03**	
Year:	**2010**	
Aircraft Sources		
Air carriers	3,031	3,037
Commuter aircraft	203	204
Cargo aircraft	197	197
General aviation	29	26
Total aircraft sources	3,460	3,464
Ground Service Equipment[1]	198	198
Motor Vehicles		
Ted Williams Tunnel through-traffic	–[2]	–[2]
Parking/curbside[3]	12	12
On-airport vehicles	144	144
Total motor vehicle sources	156	156
Other Sources		
Fuel storage/handling[4]	0	0
Miscellaneous sources[5]	166	166
Total other sources	166	166
Total Airport Sources	3,980	3,984

Source: KBE and Massport
Kg/day kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy).
1 GSE emissions include APUs as well as vehicles and equipment converted to alternative fuels.
2 Due to the new roadway configuration and opening of the Ted Williams Tunnel there was no Ted Williams Tunnel through-traffic at Logan Airport beginning in 2003.
3 Parking/curbside data is based on VMT analysis.
4 Fuel storage/handling facilities are not a source of NOx emissions.
5 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

Table I-16 Estimated CO Emissions (in kg/day) at Logan Airport 1993-2001[1]

Aircraft/GSE Model:	**Logan Dispersion Modeling System (LDMS)**					**EDMS v3.22**	**EDMS v4.21**	**EDMS v4.03**	
Motor Vehicle Model:	**MOBILE5a**					**MOB5a_h**	**MOB 6.2.03**	**MOBILE 6.0**	
Year:	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999[2]**	**2000**	**2001**
Aircraft Sources									
Air carriers	5,663	4,660	4,691	4,812	4,698	3,079	3,754	2,994	2,475
Commuter aircraft	1,309	927	934	859	770	482	1,404	1,188	1,072
Cargo aircraft	344	572	598	580	514	218	503	400	323
General aviation	353	356	339	549	654	269	940	295	407
Total aircraft sources	7,669	6,515	6,562	6,800	6,636	4,048	6,601	4,877	4,277
Ground Service Equipment[3]	7,482	6,187	6,029	5,740	6,098	5,113	4,532	5,335	5,193
Motor Vehicles									
Ted Williams Tunnel through-traffic	NA	NA	NA	NA	NA	NA	151	133	121
Parking/curbside	952	820	650	644	586	772	437	495	440
On-airport vehicles[4]	1,575	1,451	1,087	1,514	1,283	1,883	2,547	2,245	2,001
Total motor vehicle sources	2,527	2,271	1,737	2,158	1,869	2,655	3,135	2,873	2,562
Other Sources									
Fuel storage/handling[5]	0	0	0	0	0	0	0	0	0
Miscellaneous sources[6]	26	30	29	39	37	37	168	27	24
Total other sources	26	30	29	39	37	37	168	27	24
Total Airport Sources	17,704	15,003	14,357	14,737	14,640	11,853	14,436	13,112	12,056

Source: KBE and Massport.
Kg/day kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy).
NA Not available.
MOB MOBILE model for motor vehicle emissions (MOB5a_h=MOBILE5a_h, MOB6.2.03=MOBILE6.2 version .03)
1 The emissions inventory for 1990 is shown in Chapter 7. Emission inventories for 1991 and 1992 were not prepared.
2 Year 1999 emissions were last re-calculated using EDMS v4.21 in the 2004 ESPR Air Quality Analysis.
3 Beginning in 1996 and later, emissions include vehicles and equipment converted to alternative fuels. APU emissions are also included.
4 1999 emission inventory include reductions attributable to CNG shuttle buses.
5 Fuel storage and handling facilities are not sources of CO emissions.
6 Includes the Central Heating and Cooling Plant, emergency electricity generation, and other stationary sources. Fire Training emissions were included in 1999. Diesel snow melter usage was added in 1999.

Table I-17 Estimated CO Emissions (in kg/day) at Logan Airport 2002-2009

Aircraft/GSE Model:	**EDMS v4.11**		**EDMS v4.21**	**EDMS v4.5**		**EDMS v5.0.1**		**EDMS v5.0.2**		**EDMS v5.1**		**EDMS v5.1.2**
Motor Vehicle Model:	**MOBILE 6.0**	**MOB 6.2.01**	**MOBILE 6.2.03**									
Year:	**2002**	**2003**	**2004**	**2005**	**2006**		**2007**		**2008**		**2009**	
Aircraft Sources												
Air carriers	2,156	2,128	2,985	2,895	2,828	3,167	2,973	2,973	2,710	2,710	2,460	2,448
Commuter aircraft	783	846	1,010	1,010	950	1,587	2,484	2,484	2,436	2,436	2,364	2,795
Cargo aircraft	285	209	229	174	138	158	241	241	255	255	256	266
General aviation	256	276	416	437	398	442	401	403	345	345	145	150
Total aircraft sources	3,480	3,459	4,640	4,516	4,314	5,354	6,099	6,101	5,746	5,746	5,225	5,659
Ground Service Equipment[1]	5,170	4,758	3,586	3,531	3,409	1,586	1,904	1,904	1,609	1,609	1,364	1,364
Motor Vehicles												
Ted Williams Tunnel through-traffic	112	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]
Parking/curbside[3]	295	253	180	179	144	144	139	139	117	117	107	107
On-airport vehicles	1,872	1,685	1,412	1,290	1,036	1,036	1,038	1,038	834	834	740	740
Total motor vehicle sources	2,279	1,938	1,592	1,469	1,180	1,180	1,177	1,177	951	951	847	847
Other Sources												
Fuel storage/handling[4]	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous sources[5]	23	22	33	40	24	24	51	51	55	55	55	55
Total other sources	23	22	33	40	24	24	51	51	55	55	55	55
Total Airport Sources	10,952	10,177	9,851	9,556	8,927	8,144	9,231	9,233	8,361	8,361	7,491	7,925

Source: KBE and Massport
Notes: Years 2006 to 2009 were computed with previous years EDMS version to provide for a common basis of comparison.
Kg/day kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy).
1 GSE emissions include APUs as well as vehicles and equipment converted to alternative fuels.
2 Due to the new roadway configuration and opening of the Ted Williams Tunnel there was no Ted Williams Tunnel through-traffic at Logan Airport beginning in 2003.
3 Parking/curbside information is based on VMT analysis.
4 Fuel storage/handling facilities are not a source of CO emissions.
5 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

Table I-18 Estimated CO Emissions (in kg/day) at Logan Airport 2010

Aircraft/GSE Model:	**EDMS v5.1.2**	**EDMS v5.1.3**
Motor Vehicle Model:	**MOBILE 6.2.03**	
Year:	**2010**	
Aircraft Sources		
Air carriers	2,531	2,531
Commuter aircraft	2,629	2,086
Cargo aircraft	248	259
General aviation	177	173
Total aircraft sources	5,585	5,049
Ground Service Equipment[1]	1,222	1,222
Motor Vehicles		
Ted Williams Tunnel through-traffic	–[2]	–[2]
Parking/curbside[3]	106	106
On-airport vehicles	726	726
Total motor vehicle sources	832	832
Other Sources		
Fuel storage/handling[4]	0	0
Miscellaneous sources[5]	53	53
Total other sources	53	53
Total Airport Sources	7,692	7,156

Source: KBE and Massport
Kg/day kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy).
1 GSE emissions include APUs as well as vehicles and equipment converted to alternative fuels.
2 Due to the new roadway configuration and opening of the Ted Williams Tunnel there was no Ted Williams Tunnel through-traffic at Logan Airport beginning in 2003.
3 Parking/curbside information is based on VMT analysis.
4 Fuel storage/handling facilities are not a source of CO emissions.
5 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

Table I-19 Estimated $PM_{10}/PM_{2.5}$ Emissions (in kg/day) at Logan Airport, 2005-2010[1,2]

Aircraft/GSE Model:	**EDMS v4.5**		**EDMS v5.0.1**		**EDMS v5.0.2**		**EDMS v5.1**		**EDMS v5.1.2**		**EDMS v5.1.3**
Motor Vehicle Model:	**MOBILE 6.2.03**										
Year:	**2005**	**2006**		**2007**		**2008**		**2009**		**2010**	
Aircraft Sources											
Air carriers	25	25	38	35	67	63	42	43	36	34	34
Commuter aircraft	1	1	2	6	14	11	6	5	5	4	4
Cargo aircraft	2	3	2	3	6	5	4	4	3	3	3
General aviation	2	2	2	2	5	5	4	2	2	2	2
Total aircraft sources	30	31	44	46	92	84	56	54	46	43	43
Ground Service Equipment[3]	11	9	9	10	10	8	15	14	14	13	13
Motor Vehicles											
Parking/curbside[4]	1	1	1	<1	<1	<1	<1	<1	<1	<1	<1
On-airport vehicles	8	8	8	9	9	7	7	6	6	6	6
Total motor vehicle sources	9	9	9	9	9	7	7	6	6	6	6
Other Sources											
Fuel storage/handling[5]	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous sources[6]	34	16	16	17	17	3	3	5	5	2	2
Total other sources	34	16	16	17	17	3	3	5	5	2	2
Total Airport Sources	84	65	78	82	128	102	81	79	71	64	64

Source: KBE and Massport
Notes: Years 2006 to 2010 were computed with previous years EDMS version to provide for a common basis of comparison.
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).
2 2005 is the first year that PM10/PM2.5 emissions were included in the Logan Airport ESPR/EDR emission inventories.
3 GSE emissions include APUs as well as vehicles and equipment converted to alternative fuels.
4 Parking/curbside is based on VTM analysis.
5 Fuel storage and handling facilities are not sources of PM emissions.
6 Includes the Central Heating and Cooling Plant, emergency electricity generation, fire training, snow melters, and other stationary sources.

Greenhouse Gas Emissions Inventory for 2015

The Massachusetts Executive Office of Energy and Environmental Affairs (EEA) has published the *MEPA Greenhouse Gas Emissions Policy and Protocol*.[2] These guidelines require that certain projects undergoing review under the Massachusetts Environmental Policy Act (MEPA) quantify the greenhouse gas (GHG) emissions generated by proposed projects, and identify measures to avoid, minimize, or mitigate such emissions.[3] Even though the *2015 EDR* does not assess any proposed projects and is therefore not subject to the GHG policy, Massport has voluntarily prepared an emission inventory of GHG emissions directly and indirectly associated with Logan Airport.

In April 2009, the Transportation Research Board Airport Cooperative Research Program (ACRP); published the *Guidebook on Preparing Airport Greenhouse Gas Emission Inventories (ACRP Report 11)*, which provides recommended instructions to airport operators on how to prepare an airport-specific GHG emissions inventory.[4] The 2015 GHG emissions estimates include aircraft (within the ground taxi/delay and up to 3,000 feet), GSE, APU, motor vehicles, a variety of stationary sources, and electricity usage. Aircraft cruise emissions over the 3,000-foot level were not included. This work was accomplished following the EEA guidelines and uses widely-accepted emission factors that are considered appropriate for this application, including International Organization for Standardization New England electricity-based values.

Methodology

Airport GHG emissions are calculated in much the same way as criteria pollutants,[5] through the use of input data such as activity levels or material throughput rates (i.e., fuel usage, VMT, electrical consumption) that are applied to appropriate emission factors (i.e., in units of GHG emissions per gallon of fuel).

In this case, the input data were either based on Massport records, or data and information derived from the latest version of the FAA EDMS (EDMS v5.1.4.1). Table I-20 summarizes the data and information used in the 2015 GHG inventory.

Massport will update the GHG Emissions Inventory for Logan Airport annually.

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2 Revised MEPA Greenhouse Gas Emissions Policy and Protocol, Massachusetts Executive Office of Energy and Environmental Affairs, effective May 10, 2010.

3 These GHGs are comprised primarily of carbon dioxide (CO2), methane (CH4), nitrous oxides (N2O), and three groups of fluorinated gases (i.e., sulfur hexafluoride [SF6], hydrofluorocarbons [HFCs], and perfluorocarbons [PFCs]). GHG emission sources associated with airports are generally limited to CO2, CH4, and N2O.

4 Transportation Research Board, Airport Cooperative Research Panel, ACRP Report 11, Project 02-06, Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories (in production). See http://onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_011.pdf for the full report.

5 Criteria pollutants are pollutants for which there are National Ambient Air Quality Standards (i.e., carbon monoxide, sulfur dioxide, nitrogen dioxide, etc.).

Table I-20 Logan Airport Greenhouse Gas (GHG) Inventory Input Data and Information for 2015

Activity	Fuel Type	Usage	Units	Source
Aircraft				
Aircraft Taxi	Jet A[1]	21,219,609	gallons	EDMS v5.1.4
	AvGas[2]	579	gallons	EDMS v5.1.4
Engine Startup	Jet A	220,102	gallons	EDMS v5.1.4
Aircraft Ground up to 3,000 feet	Jet A[1]	18,069,246	gallons	EDMS v5.1.4
	AvGas[2]	493	gallons	EDMS v5.1.4
Aircraft Support Equipment				
GSE	Diesel	791,156	gallons	Massport
	Gasoline	652,773	gallons	Massport
	Propane	1,782	gallons	EDMS v5.1.4
	CNG	428,058	ft^3	EDMS v5.1.4
APU	Jet A	841,860	gallons	EDMS v5.1.4
Motor Vehicles				
On-airport Vehicles	Composite[3]	61,608,547	VMT	Massport
On-airport Parking/Curbsides	Composite[3]	1,429,516	Idle hours	Massport
Massport Shuttle Bus	CNG	259,011	GEG	Massport
	Diesel	Defleeted 2014	gallons	Massport
Massport Express Bus	Diesel	342,328	gallons	Massport
Massport Fire Rescue	Diesel	20,000	gallons	Massport
Agricultural Equipment	Diesel	134,123	gallons	Massport
Massport Fleet Vehicles (Honda Civic)	CNG	3,467	GEG	Massport
Massport Fleet Vehicles (Fueled Onsite)	Gasoline	143,331	gallons	Massport
Massport Fleet Vehicles (Fueled Offsite)	Gasoline	83,683	gallons	Massport
Massport Fleet Vehicles (Fueled Onsite)	Diesel	134,272	gallons	Massport
Off-airport Vehicles (Public)	Composite[3]	165,068,635	VMT	Massport
Off-airport Vehicles (Airport Employees)	Composite[3]	3,785,210	VMT	Massport
Off-airport Vehicles (Tenant Employees)	Composite[3]	51,125,676	VMT	Massport
Stationary and Portable Sources				
Boilers and Space Heaters	No 2 Oil	298,804	gallons	Massport
	No 6 Oil	0	gallons	Massport
	Natural Gas	467	million ft^3	Massport
Generators	Diesel	64,315	gallons	Massport

Table I-20 Logan Airport Greenhouse Gas (GHG) Inventory Input Data and Information for 2015 (Continued)

Activity	Fuel Type	Usage	Units	Source
Aircraft Support Equipment (Cont'd.)				
Snow melters	ULSD	381,581	gallons	Massport
	CNG	4.83	million ft^3	Massport
Fire Training Facility	Tekflame	6,877	gallons	Massport
	AvGas	742	gallons	Massport
Electrical Consumption – Massport	-	18,467,839	kWh	Massport
Electrical Consumption – Tenent/Common Area	-	166,686,391	kWh	Massport

Sources: Massport and KBE.

Notes: APU – Auxiliary power units; CNG – compressed natural gas; GEG – gasoline equivalent gallons; GSE – ground support equipment; kWh – kilowatt hours; VMT – vehicle miles traveled; ULSD – ultra low sulfur diesel.

1 Jet A density of 6.84 pounds per gallon.

2 AvGas density of 6.0 pounds per gallon.

3 Composite means gasoline, diesel, CNG, and liquefied petroleum gas (LPG) fueled motor vehicles.

Emission factors were obtained from the U.S. Energy Information Administration, the International Panel on Climate Change (IPCC), EPA's MOVES, and the most recent version of EPA's GHG Emission Factors Hub (April 2014).[6,7,8,9] **Table I-21** presents emission factors for CO_2, nitrous oxide (N_2O), and methane (CH_4) for 2015.

6 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, 2006, www.ipcc-nggip.iges.or.jp/public/2006gl/index.html.

7 U.S. Energy Information Administration, *Voluntary Reporting of Greenhouse Gases Program. Fuel and Energy Source Codes and Emission Coefficients,* www.eia.doe.gov/oiaf/1605/coefficients.html.

8 U.S. Environmental Protection Agency, GHG Emissions Factors Hub (April 2014), www.epa.gov/climateleadership/inventory/ghg-emissions.html. The most recent version of the Emission Factors Hub includes updates to emission factors for stationary and mobile combustion sources, new electricity emission factors from EPA's Emissions & Generation Resource Integrated Database (eGRID) and the IPCC Fourth and Fifth Assessment Report (AR4/AR5).

9 U.S. Environmental Protection Agency, MOVES Emissions Model, http://www.epa.gov/otaq/models/moves/.

Table I-21 Greenhouse Gas (GHG) Emission Factors for 2015

Sources	Fuel	CO_2	N_2O	CH_4	Units
Aircraft[1]	Jet A	21.5	0.00066	-[5]	lb/gallon
	AvGas	18.3	0.00024	0.01556	lb/gallon
Ground Support Equipment/ Auxiliary Power Units[1]	Diesel	22.5	0.00057	0.00126	lb/gallon
	Gasoline	19.4	0.00049	0.00110	lb/gallon
	CNG	120.0	0.00023	0.00226	lb/1000 ft^3
	Propane	12.6	0.00011	0.00060	lb/gallon
	Jet A	21.5	0.00066	-[5]	lb/gallon
Motor Vehicles[1,2]	Composite	486	0.00010	0.00490	g/mile
	Composite	4,270	0.00030	0.02580	g/hour
	CNG	120.0	0.00023	0.00226	lb/1000 ft^3
	Diesel	22.5	0.00057	0.00126	lb/gallon
	Gasoline	19.4	0.00018	0.0008	lb/gallon
Stationary and Portable[1]	No. 2 Oil	22.5	0.00018	0.00090	lb/gallon
	No. 6 Oil	24.8	0.00020	0.00099	lb/gallon
	Natural Gas	120.0	0.00023	0.00226	lb/1000 ft^3
	ULSD	22.5	0.00018	0.00090	lb/gallon
Fire Training Facility[1]	Tekflame[3]	12.6	0.00011	0.00060	lb/gallon
	AvGas	18.3	0.00024	0.01556	lb/gallon
Electrical Consumption[4]	-	0.72	0.000013	0.00007	lb/kW-hr

Sources: Massport and KBE.

Notes: CH4 – methane; CNG – compressed natural gas; CO2 – carbon dioxide; g- grams; kWh – kilowatt hour; lb – pound; N2O – nitrous oxides; ULSD – Ultra Low Sulfur Diesel.

1 Environmental Protection Agency, GHG Emissions Factors Hub (April 2014), www.epa.gov/climateleadership/inventory/ghg-emissions.html.

2 Environmental Protection Agency, MOVES2014, http://www.epa.gov/otaq/models/moves/.

3 As propane.

4 Environmental Protection Agency, Emissions & Generation Resource Integrated Database (eGRID) 9th edition Version 1.0, February 2014, http://www.epa.gov/climateleadership/documents/emission-factors.pdf.

5 Contributions of CH4 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 CH4 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), the FAA does not calculate CH4 emissions for either the domestic or international bunker commercial aircraft jet fuel emissions inventories. "Methane (CH4) may be emitted by gas turbines during idle and by older technology engines, but recent data suggest that little or no CH4 is emitted by modern engines." "Current scientific understanding does not allow other gases (e.g., N2O and CH4) to be included in calculation of cruise emissions." (IPCC 1999).

Results

Table I-22 presents the results of the 2015 GHG emissions inventory for Logan Airport by emission source (i.e., aircraft, GSE, motor vehicles, and stationary sources) and compound (i.e., CO_2, N_2O, and CH_4), respectively.

Table I-22 Greenhouse Gas (GHG) Emissions (MMT CO2 Eq)[1] for 2015

Activity	CO_2	N_2O	CH_4	Total
Aircraft Sources				
Aircraft Taxi	0.21	<0.01	-[2]	0.21
Engine Startup	<0.01	<0.01	<0.01	<0.01
Aircraft AGL to 3,000 feet	0.18	<0.01	<0.01	0.18
Aircraft Support Equipment				
GSE	0.02	<0.01	<0.01	0.02
APU	0.01	<0.01	-[2]	0.01
Motor Vehicles				
On-airport Vehicles	0.03	<0.01	<0.01	0.03
On-airport Parking/Curbsides	0.01	<0.01	<0.01	0.01
Massport Shuttle Buses	0.01	<0.01	<0.01	0.01
Massport Fleet Vehicles	0.01	<0.01	<0.01	0.01
Off-airport Vehicles (Public)	0.05	<0.01	<0.01	0.05
Off-airport Vehicles (Airport Employees)	<0.01	<0.01	<0.01	<0.01
Off-airport Vehicles (Tenant Employees)	0.02	<0.01	<0.01	0.02
Stationary Sources				
Boilers	0.03	<0.01	<0.01	0.03
Generators, Snow melters, etc.	<0.01	<0.01	<0.01	<0.01
Fire Training Facility	<0.01	<0.01	<0.01	<0.01
Electrical Consumption	0.06	<0.01	<0.01	0.06

Sources: Massport and KBE.

1 Units expressed as million metric tons of CO2 equivalent (MMT CO2 Eq): 1 metric ton = 1.1 short tons.

2 Contributions of CH4 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 CH4 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), the FAA does not calculate CH4 emissions for either the domestic or international bunker commercial aircraft jet fuel emissions inventories. "Methane (CH4) may be emitted by gas turbines during idle and by older technology engines, but recent data suggest that little or no CH4 is emitted by modern engines." "Current scientific understanding does not allow other gases (e.g., N2O and CH4) to be included in calculation of cruise emissions." (IPCC 1999).

Table I-23 compares the total GHG emission from Logan Airport in 2015 to the total GHG emissions for Massachusetts.

Table I-23 Logan Airport Greenhouse Gas (GHG) Emissions Compared to Massachusetts Totals[1]

	CO_2	N_2O	CH_4	Totals
Logan Airport Emissions (2015)[2]	0.63	<0.01	<0.01	0.63
Massachusetts[3]	68.7	0.8	1.1	70.6
Percent of Logan Airport to Massachusetts[4]	<1%	<1%	<1%	<1%

Sources: Massport and KBE.
1 Units expressed as million metric tons of CO_2 equivalents (MMT CO_2 Eq): 1 metric ton = 1.1 short tons.
2 Total from Massport, tenants, and public categories.
3 Climate Analysis Indicators Tool (CAIT US) Version 4.0. (Washington, DC: World Resources Institute, 2012)
4 Percentages represent the relative amount Logan-related emissions compared to the state totals.

Table I-24 provides a comparison between Airport-related GHG emissions from 2007 through 2015. Total GHG emissions in 2015 were slightly higher (13 percent) than 2010 levels. To equally compare to previous years, the 2015 emissions are summarized in a manner similar to previous years.

Table I-24 Comparison of Estimated Total Greenhouse Gas (GHG) Emissions (MMT of CO_2eq) at Logan Airport – 2007 through 2015

Source	2007	2008	2009	2010	2011	2012	2013	2014	2015
Direct Emissions[2]									
Aircraft[3]	0.22	0.21	0.19	0.18	0.19	0.19	0.19	0.20	0.21
GSE/APUs	0.08	0.08	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Motor vehicles[4]	0.03	0.03	0.03	0.03	0.04	0.03	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
Total Direct Emissions	0.37	0.35	0.27	0.27	0.28	0.26	0.29	0.29	0.32
Indirect Emissions[6]									
Aircraft[7]	0.18	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.18
Motor vehicles[8]	0.05	0.05	0.05	0.05	0.06	0.05	0.08	0.07	0.08
Electrical consumption[9]	0.09	0.08	0.07	0.07	0.08	0.08	0.06	0.06	0.06
Total Indirect Emissions	0.32	0.30	0.29	0.29	0.30	0.30	0.31	0.30	0.32
Total Emissions[10]	0.69	0.65	0.56	0.56	0.58	0.57	0.60	0.60	0.63
Percent of State Totals[11]	<1	<1	<1	<1	<1	<1	<1	<1	<1

Sources: Massport and KBE.

1 MMT – million metric tons of CO_2 equivalents (1 MMT = 1.1M Short Tons). CO_2 equivalents (CO_2eq) are bases for reporting the three primary GHGs (e.g., CO_2, N_2O and CH_4) in common units. Quantities are reported as "rounded" and truncated values for ease of addition.

2 Direct emissions are those that occur in areas located within the Airport's geographic boundaries.

3 Direct aircraft emissions based engine start-up, taxi-in, taxi-out and ground-based delay emissions.

4 Direct motor vehicle emissions based on on-site vehicle miles traveled (VMT).

5 Other sources include Central Heating and Cooling Plant, emergency generators, snow melters and live fire training facility.

6 Indirect emissions are those that occur off the Airport site.

7 Indirect aircraft emissions are based on take-off, climb-out and landing emissions which occur up to an altitude of 3,000 ft., the limits of the landing/take-off (LTO) cycle

8 Indirect motor vehicle emissions based on off-site Airport-related VMT and an average round trip distance of approximately 60 miles.

9 Electrical consumption emissions occur off-airport at power generating plants.

10 Total Emissions = Direct +Indirect.

11 Percentage based on relative amount of Airport total of direct emissions to statewide total from World Resources Institute (cait.wri.org).

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Measured NO_2 Concentrations

This section presents the results of Massport's long-term ambient (i.e., outdoor) air quality monitoring program for NO_2 – a pollutant associated with aircraft activity and other fuel combustion sources. Between 1982 and 2011, Massport collected NO_2 concentration data at numerous locations both on the Airport and in neighboring residential communities. The purpose of this monitoring program was to track long-term trends in NO_2 levels and to compare the results to the NAAQS for this pollutant. In 2011, Massport determined that the Logan NO_2 Monitoring Program had achieved its objectives with the significant and stable decrease in NO_2 emissions since 1999 and thus discontinued the program in 2011.

When it was operational, this monitoring program used passive diffusion tube technology for a period of one week each month for 12 months of the year at each of the monitoring stations. The samples of NO_2, along with Quality Assurance/Quality Control (QA/QC) samples, were then analyzed in a laboratory.

Table I-25 presents the final year NO_2 monitoring data (i.e., 2011). For comparative purposes, historical data from 1999 are similarly shown in **Table I-25**. The table also includes NO_2 data collected under a separate effort by MassDEP using continuous monitors at four Boston-area locations.

As shown on **Table I-25**, the 2011 NO_2 levels were somewhat higher than in 2010. However, this occurrence is consistent with the cyclical trend of the average levels over the past several years[10]. Importantly, there remains a long-term trend of decreasing NO_2 concentrations at both the Massport and MassDEP monitoring sites since 1999. Other notable observations of the 2011 data reveal the following:

- Annual NO_2 concentrations at all Massport and MassDEP monitoring locations were below the annual NO_2 NAAQS of 100 micrograms per cubic meter ($\mu g/m^3$) in 2011.
- The Massport-collected data compare relatively closely with data collected by the MassDEP. The average of all Massport monitoring sites was 29.8 $\mu g/m^3$ compared to 32.3 $\mu g/m^3$ for the four MassDEP Boston-area monitors.
- The highest NO_2 concentrations in 2011 from the Massport program occurred in areas characterized by high levels of motor vehicle traffic (i.e., Main Terminal Area [Site 8] and Maverick Square [Site 12]).

10 Spatial and temporal changes in measured NO_2 levels from year to year are typical and should not be used to define short-term results. Rather, NO_2 levels are better assessed by looking at the trends over several years.

Table I-25 Massport and MassDEP Annual NO_2 Concentration Monitoring Results (µg/m^3)

Monitoring Site	Site No.	Year 1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Massport Monitoring Sites														
Runway 9	1	61.0	58.2	41.6	45.8	33.9	30.1	35.0	31.9	17.3	31.3	32.2	32.3	38.7
Runway 4R	2	55.6	44.6	41.4	36.9	32.5	30.9	30.7	29.0	17.2	20.2	19.2	21.9	25.7
Runway 33L	3	47.7	42.6	39.4	33.3	30.8	25.4	24.5	26.3	24.2	21.6	16.9	25.0	29.8
Runway 27	4	42.9	37.8	35.8	30.3	25.5	24.1	22.7	22.3	16.9	18.3	17.6	19.4	23.3
Runaway 22L	5	47.5	39.8	38.2	33.8	27.8	23.7	22.1	24.9	17.1	21.3	20.1	21.9	29.0
Runway 22R	6	60.6	59.2	51.6	45.0	32.3	29.7	32.9	25.1	24.8	29.7	27.8	33.1	30.6
Runway 15R	7	47.0	43.4	44.3	42.6	40.8	28.7	27.7	28.7	20.5	24.2	23.9	26.7	29.7
Main Terminal Area	8	70.8	87.0	80.7	69.3	44.3	44.7	46.2	43.5	29.5	41.7	37.7	43.9	49.0
Webster St., Jeffries Point	11	52.4	45.5	43.4	39.1	32.5	28.3	31.3	31.3	22.7	25.2	23.9	27.0	30.1
Maverick Square, E. Bos	12	81.2	72.2	68.5	61.3	47.9	46.5	41.4	45.6	36.0	41.3	38.2	42.5	43.5
Bremen St., E. Boston	13	59.1	52.6	52.0	46.2	39.1	35.7	37.6	37.1	27.8	30.1	28.6	31.9	35.3
Shore St. E. Boston	14	45.7	38.5	38.8	35.0	27.2	24.0	24.9	22.4	18.1	19.7	18.3	20.7	26.7
Orient Heights Yacht Club	15	45.1	46.9	47.7	43.1	29.4	25.2	25.5	25.1	19.6	21.1	18.3	22.5	26.7
Bayswater St. E. Boston	16	45.2	45.5	48.3	41.2	28.4	22.8	30.4	23.1	18.4	20.2	17.8	21.0	25.9
Annavoy St. E. Boston	17	40.8	39.2	44.4	33.7	24.7	21.4	23.3	21.0	18.2	19.6	17.3	20.9	25.8
Pleasant St. Winthrop	18	42.0	39.3	37.8	32.3	27.9	22.6	23.4	21.4	17.8	20.2	17.7	20.1	24.4
Court Road, Winthrop	19	40.0	36.1	33.8	27.4	24.0	19.2	22.3	21.0	16.3	17.1	16.7	18.4	22.7
Cottage Park Yacht Club	20	37.1	50.9	45.9	36.7	22.5	19.1	27.7	21.4	16.3	18.4	17.8	17.8	22.5
Winthrop, Point Shirley	21	33.1	37.7	38.6	24.4	22.7	17.4	17.2	20.2	15.7	15.6	14.9	17.5	21.6
Deer Island	22	36.3	31.9	33.8	33.1	21.3	17.8	16.9	17.8	13.0	17.0	14.7	16.7	20.7
Runway 4R–9	23	42.2	66.0	42.3	33.4	28.6	24.1	27.1	26.3	19.2	22.4	21.2	21.6	26.5
Runway 33L–4R	24	44.3	41.7	41.8	33.5	28.1	24.3	22.3	25.7	20.9	25.2	20.0	23.6	26.2
Runway 22R–33L	25	62.4	50.3	49.4	42.2	33.8	31.7	29.4	34.5	22.9	25.1	25.3	29.5	34.9

Table I-25 Massport and MassDEP Annual NO2 Concentration Monitoring Results (µg/m3) (Continued)

Monitoring Site	Site No.	Year												
		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Jeffries Point Park/Marginal St.	26	68.6	49.8	45.0	42.0	35.2	30.5	32.5	31.7	24.4	27.0	25.6	28.6	33.1
Harborwalk	27	54.3	48.5	47.4	43.5	35.6	35.5	29.3	34.2	24.2	26.1	24.5	28.3	34.9
Logan Athletic Fields	29	NA	69.1	67.6	54.9	41.9	40.2	37.5	37.0	24.6	28.8	26.8	30.8	37.8
Brophy Park, Jeffries Point	30	NA	48.0	45.2	41.0	36.5	31.2	32.9	31.3	24.8	26.6	24.6	26.8	30.8
Average of all Monitoring Sites		50.5	50.5	47.5	40.0	31.7	28.0	28.7	28.7	21.0	24.3	22.5	25.6	29.8
MassDEP Monitoring Sites[1]														
Long Island Road	A	20.7	24.4	22.6	22.6	16.9	12.6	13.2	13.2	13.2	13.2	11.3	13.6	13.4
Harrison Avenue	B	NA	45.1	47.0	45.1	43.2	37.4	35.8	35.8	37.7	37.7	33.9	32.1	33.1
Kenmore Square	C	56.4	54.5	56.8	47.0	47.0	51.7	43.3	43.3	39.6	41.5	37.7	36.0	38.4
East First Street	D	39.5	37.6	43.2	39.5	39.5	36.8	33.9	39.6	37.7	30.2	28.3	24.0	25.4

Notes: The NAAQS is 100 µg/m^3.
Massport determined that the Logan NO_2 Monitoring Program had achieved its objectives with the significant and stable decrease in NO_2 emissions since 1999 and thus discontinued the program in 2011.
µg/m^3 micrograms/cubic meter.
NA Not available.
1 NO_2 monitoring sites operated by the MassDEP.

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Water Quality/Environmental Compliance and Management

This appendix provides detailed information in support of Chapter 8, *Water Quality/Environmental Compliance and Management*:

- Table J-13 Logan Airport January 2015 Wet Weather Deicing Monitoring Results – North, West, Porter Street, and Runway/Perimeter Stormwater Outfalls
- Table J-14 Logan Airport April 2015 Wet Weather Deicing Monitoring Results – North, West Porter Street, and Runway/Perimeter Stormwater Outfalls
- Table J-15 Logan Airport Stormwater Outfall NPDES Water Quality Monitoring Results – 1993 to 2015
- Table J-16 Logan Airport Oil and Hazardous Material Spills and Jet Fuel Handling – 1990 to 2015
- Table J-17 Type and Quantity of Oil and Hazardous Material Spills at Logan Airport – 1999 to 2015
- Table J-18 MCP Activities Status of Massport Sites at Logan Airport
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Table J-1 Logan Airport NPDES Permit (No. MA0000787) Stormwater Outfall Monitoring Requirements (2007)

Monitoring Event	North Outfall 001		West Outfall 002		Maverick Outfall 003	
	Field Measurement	**Laboratory Analysis**	**Field Measurement**	**Laboratory Analysis**	**Field Measurement**	**Laboratory Analysis**
Monthly Dry Weather	Not Required	Oil and Grease TSS[1] Benzene Surfactant Fecal Coliform *Enterococcus*	Not Required	Oil and Grease TSS[1] Benzene Surfactant Fecal Coliform *Enterococcus*	Not Required	Oil and Grease TSS[1] Benzene Surfactant Fecal Coliform *Enterococcus*
Monthly Wet Weather	pH Flow Rate[6]	Oil and Grease TSS[1] Benzene[2] Surfactant Fecal Coliform *Enterococcus*	pH Flow Rate[6]	Oil and Grease TSS[1] Benzene[2] Surfactant Fecal Coliform *Enterococcus*	pH Flow Rate[6]	Oil and Grease TSS[1] Benzene[2] Surfactant Fecal Coliform *Enterococcus*
Quarterly Wet Weather	pH Flow Rate[6]	PAHs[3]: - Benzo(a)anthracene - Benzo(a)pyrene - Benzo(b)fluoranthene - Benzo(k)fluoranthene - Chrysene -Dibenzo(a,h)anthracene - Indeno(1,2,3-cd)pyrene - Naphthalene	pH Flow Rate[6]	PAHs[3]: - Benzo(a)anthracene - Benzo(a)pyrene - Benzo(b)fluoranthene - Benzo(k)fluoranthene - Chrysene -Dibenzo(a,h)anthracene - Indeno(1,2,3-cd)pyrene - Naphthalene	pH Flow Rate[6]	PAHs[3]: - Benzo(a)anthracene - Benzo(a)pyrene - Benzo(b)fluoranthene - Benzo(k)fluoranthene - Chrysene -Dibenzo(a,h)anthracene - Indeno(1,2,3-cd)pyrene - Naphthalene
Deicing Episode (2/Deicing Season)	Not Required	Ethylene Glycol Propylene Glycol BOD5[4] COD[5] Total Ammonia Nitrogen Nonylphenol Tolyltriazole	Not Required	Ethylene Glycol Propylene Glycol BOD5[4] COD[5] Total Ammonia Nitrogen Nonylphenol Tolyltriazole	Not Required	Not Required
Whole Effluent Toxicity (1st and 3rd Year Deicing Season)	Not Required	Menidia beryllina Arbacia punctulata	Not Required	Menidia beryllina Arbacia punctulata	Not Required	Not Required
Treatment System Sampling (Internal Outfalls)[7]	pH Quantity, Gallons	Oil and Grease TSS[1] Benzene[2]	Not Required	Not Required	Not Required	Not Required

Table J-1 Logan Airport NPDES Permit (No. MA0000787) Stormwater Outfall Monitoring Requirements (2007) (Continued)

Monitoring Event	Northwest Outfall 005		Porter Outfall 003 (3 upstream locations)		Select Runway/Perimeter Outfalls	
	Field Measurement	Laboratory Analysis	Field Measurement	Laboratory Analysis	Field Measurement	Laboratory Analysis
Monthly Dry Weather	Not Required	Not Required	Not Required	Oil and Grease TSS[1] Benzene Surfactant Fecal Coliform *Enterococcus*	Not Required	Not Required
Monthly Wet Weather	Not Required	Not Required	pH Flow Rate	Oil and Grease TSS[1] Benzene[2] Surfactant Fecal Coliform *Enterococcus*	Not Required	Not Required
Quarterly Wet Weather	pH Flow Rate[6]	Oil and Grease TSS[1] Benzene[2]	pH Flow Rate[6]	PAHs[3]: - Benzo(a)anthracene - Benzo(a)pyrene - Benzo(b)fluoranthene - Benzo(k)fluoranthene - Chrysene -Dibenzo(a,h)anthracene - Indeno(1,2,3-cd)pyrene - Naphthalene	pH	Oil and Grease TSS[1] Benzene[2]
Deicing Episode (2/Deicing Season)	Not Required	Not Required	Not Required	Ethylene Glycol Propylene Glycol BOD5[4] COD[5] Total Ammonia Nitrogen Nonylphenol Tolytriazole	Not Required	Ethylene Glycol Propylene Glycol BOD5[4] COD[5] Total Ammonia Nitrogen Nonylphenol Tolytriazole
Whole Effluent Toxicity (1st and 3rd Year Deicing Season)	Not Required	Not Required	Not Required	Menidia beryllina Arbacia punctulata	Not Required	Not Required
Treatment System Sampling (Internal Outfalls)[7]	Not Required	Not Required	Not Required	Not Required	Not Required	Not Required

Source: Massport
Notes: Requirements are from NPDES Permit MA0000787, issued July 31, 2007.
1 TSS - Total Suspended Solids
2 Benzene must be collected with HDPE bailer.
3 PAH - Polycyclic Aromatic Hydrocarbons
4 BOD - Biological Oxygen Demand
5 COD - Chemical Oxygen Demand
6 Flow Rate will be estimated based on measured precipitation and the hydraulic model developed for the Logan Airport drainage system.
7 Outfalls 001D and 001E samples collected by Swissport.

Table J-2 Fire Training Facility NPDES Permit (No. MA0032751) Stormwater Outfall Monitoring Requirements (2006)

Monitoring Event	Outfall Serial Number 001	
	Field Measurement	**Laboratory Analysis**
Each Discharge Event[1]	Flow Rate[2] pH	TSS[3] Oil and Grease[4] Total BTEX[5] Toluene Benzene Ethylbenzene Xylene PAHs[5,6]
Whole Effluent Toxicity (once per year during discharge event)	Not Required	Acute Toxicity[7]

Source: Massport

Notes: Requirements are from NPDES Permit MA0032751, issued November 1, 2006.

All samples, except for wet testing, shall be collected after treatment and prior to discharge from above ground holding tank.

1 Flows from more than one training session may be held in treatment train for several weeks. Treatment and subsequent discharge through Outfall 001 is usually triggered by tank levels. Sampling will be conducted during each discharge event with the sampling point after the GAC unit and prior to discharge from the above ground holding tank. Each sample shall be a composite of three equally weighted (same volume) grab samples taken at the bottom, middle, and top of the above ground tank.

2 Total flow volume shall be reported monthly in gallons and the maximum flow rate in gallons per minute shall be reported for each month.

3 TSS - Total Suspended Solids

4 Oil and grease is measured using EPA Method 1664.

5 BTEX and PAH compounds shall be analyzed using EPA approved methods. Testing method used and method detection level for each parameter will be included in each DMR submittal.

6 PAH - Polycyclic Aromatic Hydrocarbons

7 The permittee shall conduct one acute toxicity test per year. The test results shall be submitted by the last day of the full month following completion of the test in accordance with protocols defined in the permit.

Table J-3 Logan Airport 2015 Monthly Monitoring Results for First Quarter — North, West, and Maverick Street Stormwater Outfalls

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)	*Klebsiella* (cfu/100mL)
001A – North Outfall	1/30/2015	Wet Weather	3.44	0.58	6.04	5.8	23	2.3	0.310	70	350	NA
002A – West Outfall	1/30/2015	Wet Weather	13.53	1.95	6.56	10	32	<1.0	0.240	280	10	NA
004A – Maverick Street Outfall	1/30/2015	Wet Weather	0.90	0.12	NS	NS	NS	NS	NS	NS	NS	NS
001C – North Outfall	1/8/2015	Dry Weather				<4.0	18	<1.0	0.110	<10	10	NA
002C – West Outfall	1/8/2015	Dry Weather				<4.0	28	<1.0	0.110	60	10	NA
004C – Maverick Street Outfall	1/8/2015	Dry Weather				<4.0	23	<1.0	0.090	50	20	NA
001A – North Outfall	-	Wet Weather	1.80	0.77	NS	NS	NS	NS	NS	NS	NS	NS
002A – West Outfall	-	Wet Weather	10.87	2.06	NS	NS	NS	NS	NS	NS	NS	NS
004A – Maverick Street Outfall	-	Wet Weather	0.95	0.13	NS	NS	NS	NS	NS	NS	NS	NS
001C – North Outfall	2/13/2015	Dry Weather				**18**	42	<1.0	0.280	<10	160	NA
002C – West Outfall	2/13/2015	Dry Weather				NS	NS	NS	NS	NS	NS	NS
004C – Maverick Street Outfall	2/13/2015	Dry Weather				NS	NS	NS	NS	NS	NS	NS
001A – North Outfall	3/26/2015	Wet Weather	2.9	0.6	6.60	<4.0	24	<1.0	0.300	10	150	NA
002A – West Outfall	3/26/2015	Wet Weather	10.4	2.1	6.44	<4.0	30	<1.0	0.290	150	<10	NA
004A – Maverick Street Outfall	3/26/2015	Wet Weather	0.7	0.1	6.35	<4.0	32	<1.0	0.170	10	<10	NA
001C – North Outfall	3/11/2015	Dry Weather				<4.0	10	<1.0	0.280	90	100	NA
002C – West Outfall	3/11/2015	Dry Weather				<4.0	32	<1.0	0.250	20	60	NA
004C – Maverick Street Outfall	3/11/2015	Dry Weather				<4.0	25	<1.0	0.150	80	40	NA
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.												
Discharge Limitations												
Maximum Daily			Report	Report	6.0 to 8.5	15 mg/L	100 mg/L	Report	Report	Report	Report	
Average Monthly			Report	Report	6.0 to 8.5	—	Report	Report	Report	Report	Report	

Source: Massport.
Notes: Bold values exceed maximum daily discharge limitation.
Flow rates were estimated for outfalls 001, 002, and 004 by using the SWMM model developed for Logan Airport.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and *Enterococcus*) a value of 1 was employed for those results measured below the laboratory detection limit.
1 *Klebsiella* is an indication of non-fecal coliform bacteria and is tested for at the North Outfall when fecal coliform concentration exceeds 5,000 cfu/100ml.
NA Not Analyzed.
TSS Total Suspended Solids.
NS Not Sampled. A wet weather sampling event was not conducted during the month of February 2015 due to snow cover. In January 2015, a sample could not be collected from the Maverick Street outfalls due to snow cover. In February 2015, a sample could not be collected from the West or Maverick Street Outfalls due to snow cover.

Table J-4 Logan Airport 2015 Monthly Monitoring Results for First Quarter — Porter Street Stormwater Outfall

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (μg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)
003 - Porter Street Outfall 1	1/30/2015	Wet Weather	-	-	6.22	<4.0	63	<1.0	0.210	10	<10
003 - Porter Street Outfall 2	1/30/2015	Wet Weather	-	-	6.53	9.6	28	<1.0	0.170	10	20
003 - Porter Street Outfall 3	1/30/2015	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall Average		Wet Weather	2.33	0.34	6.38	4.8	46	0.0	0.190	10	4.5
003 - Porter Street Outfall 1	1/82015	Dry Weather				9.7	8.6	<1.0	0.160	<10	60
003 - Porter Street Outfall 2	1/8/2015	Dry Weather				<4.0	29	<1.0	<0.050	<10	20
003 - Porter Street Outfall 3	1/8/2015	Dry Weather				<4.0	24	<1.0	0.140	<10	<10
003 - Porter Street Outfall Average		Dry Weather				3.2	20.5	0.0	0.100	1.0	11
003 - Porter Street Outfall 1		Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2		Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 3		Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall Average		Wet Weather	2.19	0.37	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 1	2/13/2015	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	2/13/2015	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 3	2/13/2015	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall Average		Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 1	3/26/2015	Wet Weather	-	-	6.37	13	870	<1.0	0.160	70	320
003 - Porter Street Outfall 2	3/26/2015	Wet Weather	-	-	6.01	20	85	<1.0	0.140	<10	<10
003 - Porter Street Outfall 3	3/26/2015	Wet Weather	-	-	7.45	<4.4	28	<1.0	0.360	80	50
003 - Porter Street Outfall Average		Wet Weather	2.0	0.3	6.61	11.0	328	0.0	0.220	18	25
003 - Porter Street Outfall 1	3/11/2015	Dry Weather				6.7	400	<1.0	0.180	10	10
003 - Porter Street Outfall 2	3/11/2015	Dry Weather				39	90	<5.0	0.420	100	10
003 - Porter Street Outfall 3	3/11/2015	Dry Weather				8.7	48	<1.0	0.140	<10	<10
003 - Porter Street Outfall Average		Dry Weather				18.1	179	0.0	0.247	10	4.6
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily			Report	Report	6.0 to 8.5	Report	Report	Report	Report	Report	Report
Average Monthly			Report	Report	6.0 to 8.5	—	Report	Report	Report	Report	Report

Source: Massport.
Notes: Flow rates were estimated for outfalls 001, 002, 003 and 004 by using the SWMM model developed for Logan Airport.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and Enterococcus) a value of 1 was employed for those results measured below the laboratory detection limit.
TSS Total Suspended Solids.
NA Not Analyzed.
NS Not Sampled. In January 2015, a wet weather sample could not be collected from the Porter Street Outfall 3 due to snow cover. In February 2015, sampling did not occur due to snow cover.

Table J-5 Logan Airport 2015 Monthly Monitoring Results for Second Quarter — North, West, and Maverick Street Stormwater Outfalls

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)	*Klebsiella*[1] (cfu/100mL)
001A – North Outfall	-	Wet Weather	2.28	0.43	NS	NS	NS	NS	NS	NS	NS	NS
002A – West Outfall	-	Wet Weather	8.58	1.84	NS	NS	NS	NS	NS	NS	NS	NS
004A – Maverick Street Outfall	-	Wet Weather	0.58	0.13	NS	NS	NS	NS	NS	NS	NS	NS
001C – North Outfall	4/13/2015	Dry Weather				<4.0	29	<1.0	0.100	20	110	NA
002C – West Outfall	4/13/2015	Dry Weather				<4.0	22	<1.0	0.080	2,800	10	NA
004C – Maverick Street Outfall	4/13/2015	Dry Weather				<4.0	31	<1.0	<0.050	80	20	NA
001A – North Outfall	5/19/2015	Wet Weather	2.34	0.25	6.69	<4.0	27	<1.0	0.130	250	2,600	NA
002A – West Outfall	5/19/2015	Wet Weather	5.40	0.99	6.40	<4.0	11	<1.0	0.130	260	10	NA
004A – Maverick Street Outfall	5/19/2015	Wet Weather	0.58	0.05	6.80	<4.0	36	<1.0	0.070	80	<10	NA
001C – North Outfall	5/8/2015	Dry Weather				<4.0	13	<1.0	0.260	30	2,500	NA
002C – West Outfall	5/8/2015	Dry Weather				<4.0	9.2	<1.0	0.090	780	<10	NA
004C – Maverick Street Outfall	5/8/2015	Dry Weather				<4.0	7.0	<1.0	<0.050	30	<10	NA
001A – North Outfall	-	Wet Weather	5.86	0.58	NS	NS	NS	NS	NS	NS	NS	NS
002A – West Outfall	-	Wet Weather	20.26	2.19	NS	NS	NS	NS	NS	NS	NS	NS
004A – Maverick Street Outfall	-	Wet Weather	1.55	0.15	NS	NS	NS	NS	NS	NS	NS	NS
001C – North Outfall	6/8/2015	Dry Weather				<4.0	6.0	<1.0	0.110	30	900	NA
002C – West Outfall	6/8/2015	Dry Weather				<4.0	14	<1.0	0.090	1,500	10	NA
004C – Maverick Street Outfall	6/8/2015	Dry Weather				<4.0	<5.0	<1.0	<0.050	3,100	10	NA
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.												
Discharge Limitations												
Maximum Daily			Report	Report	6.0 to 8.5	15 mg/L	100 mg/L	Report	Report	Report	Report	
Average Monthly			Report	Report	6.0 to 8.5	—	Report	Report	Report	Report	Report	

Source: Massport.

Notes: Flow rates were estimated for outfalls 001, 002, 003 and 004 by using the SWMM model developed for Logan Airport.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and Enterococcus) a value of 1 was employed for those results measured below the laboratory detection limit.

1 *Klebsiella* is an indication of non-fecal coliform bacteria and is tested for at the North Outfall when fecal coliform concentration exceeds 5,000 cfu/100ml.

TSS Total Suspended Solids.

NA Not Analyzed.

NS Not Sampled. A wet weather event was not conducted in April or in June 2015, due to timing of the rain event (weekend, early morning, or late with respect to low tide).

Table J-6 Logan Airport 2015 Monthly Monitoring Results for Second Quarter — Porter Street Stormwater Outfall

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)
003 - Porter Street Outfall 1	-	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	-	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 3	-	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall Average		Wet Weather	1.63	0.27	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 1	4/13/2015	Dry Weather				<4.0	38	<1.0	0.100	<10	<10
003 - Porter Street Outfall 2	4/13/2015	Dry Weather				6.7	91	<1.0	0.180	<10	10
003 - Porter Street Outfall 3	4/13/2015	Dry Weather				<4.4	8.6	<1.0	0.100	<10	<10
003 - Porter Street Outfall Average		Dry Weather				2.2	46	0.0	0.127	1.0	2.2
003 - Porter Street Outfall 1	5/19/2015	Wet Weather	-	-	7.10	<4.0	30	<1.0	1.54	30	NA
003 - Porter Street Outfall 2	5/19/2015	Wet Weather	-	-	7.57	7.4	25	<1.0	2.69	130	NA
003 - Porter Street Outfall 3	5/19/2015	Wet Weather	-	-	7.41	5.4	280	<1.0	0.620	400	NA
003 - Porter Street Outfall Average		Wet Weather	0.77	0.10	7.36	4.3	112	0.0	1.62	116	NA
003 - Porter Street Outfall 1	5/8/2015	Dry Weather				<4.0	5.3	<1.0	0.140	<10	40
003 - Porter Street Outfall 2	5/8/2015	Dry Weather				<4.0	13	<1.0	0.850	<10	80
003 - Porter Street Outfall 3	5/8/2015	Dry Weather				<4.0	17	<1.0	0.090	<10	<10
003 - Porter Street Outfall Average		Dry Weather				0.0	11.8	0.0	0.360	1.0	14.7
003 - Porter Street Outfall 1	-	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	-	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 3	-	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall Average		Wet Weather	4.06	0.38	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 1	6/8/2015	Dry Weather				<4.0	150	<1.0	0.100	5,400	260
003 - Porter Street Outfall 2	6/8/2015	Dry Weather				<4.0	29	<1.0	0.240	<10	10
003 - Porter Street Outfall 3	6/8/2015	Dry Weather				<4.0	<5.0	<1.0	0.130	10	<10
003 - Porter Street Outfall Average		Dry Weather				0.0	60	0.0	0.157	38	13.8
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily			Report	Report	6.0 to 8.5	Report	Report	Report	Report	Report	Report
Average Monthly			Report	Report	6.0 to 8.5	—	Report	Report	Report	Report	Report

Source: Massport.
Notes: Flow rates were estimated for outfalls 001, 002, 003, and 0034 by using the SWMM model developed for Logan Airport.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and Enterococcus) a value of 1 was employed for those results measured below the laboratory detection limit.
TSS Total Suspended Solids.
NS Not Sampled. A wet weather event was not conducted in April or in June 2015, due to timing of the rain event (weekend, early morning, or late with respect to low tide).

Table J-7 Logan Airport 2015 Monthly Monitoring Results for Third Quarter — North, West, and Maverick Street Stormwater Outfalls

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)	*Klebsiella*[1] (cfu/100mL)
001A – North Outfall	-	Wet Weather	4.38	0.23	NS	NS	NS	NS	NS	NS	NS	NS
002A – West Outfall	-	Wet Weather	15.20	0.84	NS	NS	NS	NS	NS	NS	NS	NS
004A – Maverick Street Outfall	-	Wet Weather	1.06	0.04	NS	NS	NS	NS	NS	NS	NS	NS
001C – North Outfall	7/7/2015	Dry Weather				<4.0	5.8	<1.0	0.120	1,600	510	NA
002C – West Outfall	7/7/2015	Dry Weather				<4.0	23	<1.0	0.080	17,000	90	NA
004C – Maverick Street Outfall	7/7/2015	Dry Weather				<4.0	14	<1.0	0.070	80	20	NA
001A – North Outfall	8/11/2015	Wet Weather	2.13	0.21	6.54	<4.0	<5.0	<1.0	0.230	1,100	18,000	NA
002A – West Outfall	8/11/2015	Wet Weather	6.46	0.79	7.76	<4.0	17	<1.0	0.220	3,400	5,900	NA
004A – Maverick Street Outfall	8/11/2015	Wet Weather	0.51	0.03	6.79	<4.0	13	<1.0	0.410	>80,000	27,000	NA
001C – North Outfall	8/28/2015	Dry Weather				<4.0	19	<1.0	0.170	620	4,200	NA
002C – West Outfall	8/28/2015	Dry Weather				<4.0	22	<1.0	0.130	2,300	10	NA
004C – Maverick Street Outfall	8/28/2015	Dry Weather				<4.0	35	<1.0	0.110	24,000	2,300	NA
001A – North Outfall	9/30/2015	Wet Weather	8.79	0.44	6.25	<4.0	44	<1.0	0.090	2,000	33,000	NA
002A – West Outfall	9/30/2015	Wet Weather	31.0	1.60	7.42	8.4	**120**	<1.0	0.320	2,500	19,000	NA
004A – Maverick Street Outfall	9/30/2015	Wet Weather	2.18	0.10	7.10	<4.0	85	<1.0	0.100	26,000	15,000	NA
001C – North Outfall	9/9/2015	Dry Weather				<4.0	10	<1.0	0.690	4,000	8,700	NA
002C – West Outfall	9/9/2015	Dry Weather				<4.0	12	<1.0	0.370	13,000	>80,000	NA
004C – Maverick Street Outfall	9/9/2015	Dry Weather				<4.0	8.6	<1.0	0.140	56,000	7,600	NA
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.												
Discharge Limitations												
Maximum Daily			Report	Report	6.0 to 8.5	15 mg/L	100 mg/L	Report	Report	Report	Report	Report
Average Monthly			Report	Report	6.0 to 8.5	----	Report	Report	Report	Report	Report	Report

Source: Massport

Notes: Bold values exceed maximum daily discharge limitation.
Flow rates were estimated for outfalls 001, 002, and 004 by using the SWMM model developed for Logan Airport.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and *Enterococcus*) a value of 1 was employed for those results measured below the laboratory detection limit.

1 *Klebsiella* is an indication of non-fecal coliform bacteria and is tested for at the North Outfall when fecal coliform concentration exceeds 5,000 cfu/100ml.

TSS Total Suspended Solids.

NA Not Analyzed.

NS Not Sampled. A wet weather sampling event was not conducted in July 2015, due to timing of the rain event (weekend, early morning, or late with respect to low tide).

Table J-8 Logan Airport 2015 Monthly Monitoring Results for Third Quarter — Porter Street Stormwater Outfall

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)
003 - Porter Street Outfall 1	-	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	-	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 3	-	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall Average		Wet Weather	2.72	0.15	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 1	7/7/2015	Dry Weather				<4.0	59	<1.0	0.110	21,000	4,500
003 - Porter Street Outfall 2	7/7/2015	Dry Weather				<4.0	73	<1.0	0.090	10	<10
003 - Porter Street Outfall 3	7/7/2015	Dry Weather				<4.0	44	<1.0	0.180	<10	<10
003 - Porter Street Outfall Average		Dry Weather				0.0	59	0.0	0.127	59	17
003 - Porter Street Outfall 1	8/11/2015	Wet Weather	-	-	6.80	<4.0	30	<1.0	0.220	3,000	14,000
003 - Porter Street Outfall 2	8/11/2015	Wet Weather	-	-	7.21	<4.0	5.6	<1.0	0.160	60	620
003 - Porter Street Outfall 3	8/11/2015	Wet Weather	-	-	6.81	<4.0	17	<1.0	0.130	30	640
003 - Porter Street Outfall Average		Wet Weather	1.19	0.15	6.94	0.0	18	0.0	0.170	175	1,771
003 - Porter Street Outfall 1	8/28/2015	Dry Weather				<4.0	33	<1.0	0.110	<10	50
003 - Porter Street Outfall 2	8/28/2014	Dry Weather				<4.0	7.3	<1.0	0.420	<10	10
003 - Porter Street Outfall 3	8/28/2014	Dry Weather				<4.0	7.8	<1.0	0.050	<10	<10
003 - Porter Street Outfall Average		Dry Weather				0.0	16	0.0	0.193	1.0	7.9
003 - Porter Street Outfall 1	9/30/2015	Wet Weather	-	-	6.82	<4.0	100	<1.0	0.070	3,900	13,000
003 - Porter Street Outfall 2	9/30/2015	Wet Weather	-	-	6.02	<4.0	10	<1.0	0.050	360	810
003 - Porter Street Outfall 3	9/30/2015	Wet Weather	-	-	**5.63**	<4.0	12	<1.0	0.050	<10	100
003 - Porter Street Outfall Average		Wet Weather	6.24	0.31	6.16	0.0	41	0.0	0.057	112	1,017
003 - Porter Street Outfall 1	9/9/2015	Dry Weather				<4.0	20	<1.0	0.200	10	30
003 - Porter Street Outfall 2	9/9/2015	Dry Weather				<4.0	5.0	<1.0	1.05	40	<10
003 - Porter Street Outfall 3	9/9/2015	Dry Weather				<4.0	7.7	<1.0	<0.250	<10	<10
003 - Porter Street Outfall Average		Dry Weather				0.0	11	0.0	0.417	7.4	3.1
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily			Report	Report	6.0 to 8.5	Report	Report	Report	Report	Report	Report
Average Monthly			Report	Report	6.0 to 8.5	–	Report	Report	Report	Report	Report

Source: Massport.

Notes: Bold values exceed maximum daily discharge limitation.

Flow rates were estimated for outfall 003 by using the SWMM model developed for Logan Airport.

For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and Enterococcus) a value of 1 was employed for those results measured below the laboratory detection limit.

TSS Total Suspended Solids.

NS Not Sampled. A wet weather sampling event was not conducted in July 2015, due to timing of the rain event (weekend, early morning, or late with respect to low tide).

Table J-9 Logan Airport 2015 Monthly Monitoring Results for Fourth Quarter — North, West, and Maverick Street Stormwater Outfalls

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)	*Klebsiella*[1] (cfu/100mL)
001A – North Outfall	10/29/2015	Wet Weather	2.97	0.23	8.22	<4.0	5.1	<1.0	0.090	3,100	9,000	NA
002A – West Outfall	10/29/2015	Wet Weather	12.5	0.76	8.48	<4.4	20	<1.0	0.090	450	5,000	NA
004A – Maverick Street Outfall	10/29/2015	Wet Weather	0.67	0.06	7.54	<4.4	53	<1.0	0.060	26,000	4,400	NA
001C – North Outfall	10/20/2014	Dry Weather				<4.0	9.8	<1.0	0.150	110	4,400	NA
002C – West Outfall	10/20/2014	Dry Weather				<4.0	5.9	<1.0	0.160	5,100	330	NA
004C – Maverick Street Outfall	10/20/2014	Dry Weather				<4.0	16	<1.0	0.110	120	10	NA
001A – North Outfall	11/11/2015	Wet Weather	3.01	0.27	8.14	4.5	<5.0	<1.0	0.140	2,200	1,000	NA
002A – West Outfall	11/11/2015	Wet Weather	10.73	0.90	8.48	<4.0	7.4	<1.0	0.240	350	900	NA
004A – Maverick Street Outfall	11/11/2015	Wet Weather	0.71	-0.04	8.32	<4.0	5.8	<1.0	0.190	11,000	1,700	NA
001C – North Outfall	11/5/2015	Dry Weather				<4.0	10	<1.0	0.150	29,000	420	7,000
002C – West Outfall	11/5/2015	Dry Weather				<4.0	9.4	<1.0	0.180	22,000	520	NA
004C – Maverick Street Outfall	11/5/2015	Dry Weather				<4.0	14	<1.0	0.130	770	60	NA
001A – North Outfall	12/15/2015	Wet Weather	2.47	0.51	8.33	<4.0	6.0	<1.0	0.100	3,500	3,500	NA
002A – West Outfall	12/15/2015	Wet Weather	12.57	1.75	6.25	<4.0	30	<1.0	0.180	3,500	4,300	NA
004A – Maverick Street Outfall	12/15/2015	Wet Weather	1.30	0.08	7.77	<4.0	<5.0	<1.0	0.100	1,200	1,500	NA
001C – North Outfall	12/8/2015	Dry Weather				<4.0	9.0	<1.0	0.150	4,500	2,800	NA
002C – West Outfall	12/8/2015	Dry Weather				<4.0	7.0	<1.0	0.200	>80,000	2,400	NA
004C – Maverick Street Outfall	12/8/2015	Dry Weather				<4.0	30	<1.0	0.250	160	40	NA
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.												
Discharge Limitations												
Maximum Daily			Report	Report	6.0 to 8.5	15 mg/L	100 mg/L	Report	Report	Report	Report	Report
Average Monthly			Report	Report	6.0 to 8.5	–	Report	Report	Report	Report	Report	Report

Source: Massport.
Notes: Flow rates were estimated for outfalls 001, 002, and 004 by using the SWMM model developed for Logan Airport.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and Enterococcus) a value of 1 was employed for those results measured below the laboratory detection limit.
1 *Klebsiella* is an indication of non-fecal coliform bacteria and is tested for at the North Outfall when fecal coliform concentration exceeds 5,000 cfu/100ml.
In November 2015, the modeled average Maverick Street Outfall flow was negative due to tidal effects.
TSS Total Suspended Solids.
NA Not Analyzed.

Table J-10 Logan Airport 2015 Monthly Monitoring Results for Fourth Quarter — Porter Street Stormwater Outfall

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)
003 - Porter Street Outfall 1	10/29/2015	Wet Weather	-	-	**8.51**	<4.0	22	<1.0	0.090	9,000	10,000
003 - Porter Street Outfall 2	10/29/2015	Wet Weather	-	-	7.99	<4.0	5.6	<1.0	0.060	60	340
003 - Porter Street Outfall 3	10/29/2015	Wet Weather	-	-	**8.81**	<4.4	<5.0	<1.0	0.050	2,600	1,700
003 - Porter Street Outfall Average		Wet Weather	2.86	0.15	8.44	0.0	9.2	0.0	0.067	1,120	1,795
003 - Porter Street Outfall 1	10/20/2015	Dry Weather				<4.0	92	<1.0	0.240	40	30
003 - Porter Street Outfall 2	10/20/2015	Dry Weather				<4.0	21	<1.0	0.160	55	520
003 - Porter Street Outfall 3	10/20/2015	Dry Weather				<4.4	9.2	<1.0	0.230	20	250
003 - Porter Street Outfall Average		Dry Weather				0.0	41	0.0	0.210	35.3	157
003 - Porter Street Outfall 1	11/11/2015	Wet Weather	-	-	6.59	<4.0	30	<1.0	0.140	7,900	5,100
003 - Porter Street Outfall 2	11/11/2015	Wet Weather	-	-	6.22	<4.0	7.1	<1.0	0.080	<10	55
003 - Porter Street Outfall 3	11/11/2015	Wet Weather	-	-	6.40	<4.0	6.4	<1.0	0.090	1,600	1,600
003 - Porter Street Outfall Average		Wet Weather	2.19	0.18	6.40	0.0	15	0.0	0.103	233	766
003 - Porter Street Outfall 1	11/5/2015	Dry Weather				<4.0	72	<1.0	0.170	55	170
003 - Porter Street Outfall 2	11/5/2015	Dry Weather				<4.0	20	<1.0	0.170	80	60
003 - Porter Street Outfall 3	11/5/2015	Dry Weather				<4.0	6.5	<1.0	0.130	<10	10
003 - Porter Street Outfall Average		Dry Weather				0.0	33	0.0	0.157	8.9	47
003 - Porter Street Outfall 1	12/15/2015	Wet Weather	-	-	7.52	<4.0	5.0	<1.0	0.100	63,000	6,100
003 - Porter Street Outfall 2	12/15/2015	Wet Weather	-	-	**8.58**	9.0	24	<1.0	0.050	<10	<10
003 - Porter Street Outfall 3	12/15/2015	Wet Weather	-	-	7.20	<4.0	22.0	<1.0	0.110	70	90
003 - Porter Street Outfall Average		Wet Weather	2.74	0.28	7.77	3.0	17	0.0	0.087	164	82
003 - Porter Street Outfall 1	12/8/2014	Dry Weather				9.8	190	<1.0	0.760	>80,000	22,000
003 - Porter Street Outfall 2	12/8/2014	Dry Weather				18	11	<1.0	0.130	<10	110
003 - Porter Street Outfall 3	12/8/2014	Dry Weather				<4.0	<5.0	<1.0	0.140	<10	10
003 - Porter Street Outfall Average		Dry Weather				9.3	67	0.0	0.343	43.1	289
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily			Report	Report	6.0 to 8.5	Report	Report	Report	Report	Report	Report
Average Monthly			Report	Report	6.0 to 8.5	–	Report	Report	Report	Report	Report

Source: Massport.

Notes: Bold values exceed maximum daily discharge limitation.
Flow rates were estimated for outfall 003 using the SWMM model developed for Logan Airport.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and Enterococcus) a value of 1 was employed for those results measured below the laboratory detection limit.
The modeled Maverick Street Outfall on average ended up being negative because of tidal effects.

TSS Total Suspended Solids.

Table J-11 Logan Airport 2015 Quarterly Wet Weather Monitoring Results – North, West, Maverick Street, and Porter Street Stormwater Outfalls

	Date	Wet Weather pH (S.U.)	Benzo(a)-anthracene (µg/L)	Benzo(a)-pyrene (µg/L)	Benzo(b)-fluoranthene (µg/L)	Benzo(k)-fluoranthene (µg/L)	Chrysene (µg/L)	Dibenzo(a,h,)-anthracene (µg/L)	Indeno(1,2,3-cd)-pyrene (µg/L)	Naphthalene (µg/L)	Total PAHs (µg/L)
001 - North Outfall	8/11/2015	6.54	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
002 - West Outfall	8/11/2015	7.76	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
004 - Maverick Street Outfall	8/11/2015	6.79	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 1	8/11/2015	6.80	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 2	8/11/2015	7.21	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 3	8/11/2015	6.81	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall Average		6.94	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ND
001 - North Outfall	12/15/2015	8.33	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
002 - West Outfall	12/15/2015	6.26	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
004 - Maverick Street Outfall	12/15/2015	7.77	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 1	12/15/2015	7.52	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 2	12/15/2015	**8.58**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	3.8	3.8
003 - Porter Street Outfall 3	12/15/2015	7.20	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall Average		7.77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.27	1.3
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily		6.0 to 8.5	Report	Report	Report	Report	Report	Report	Report	Report	Total

Source: Massport

Notes: Quarterly Samples were unable to be collected during the first and second quarters. During the first quarter, the perimeter road was mostly inaccessible because of the historic snowfall events, as were many of the sampling locations. There were few rain opportunities late in the season which were not timed well with the tides. During the second quarter, sampling could not be conducted due to thunderstorms and timing of precipitation versus the low tide.

Bold values exceed maximum daily discharge limitation.

For averaging calculations, a value of zero was employed for those results measures below the laboratory detection limit.

PAHs Polynuclear Aromatic Hydrocarbons

ND Not Detected

Table J-12 Logan Airport 2015 Quarterly Wet Weather Monitoring Results – Northwest and Runway/Perimeter Stormwater Outfalls

	Date	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (SU)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)
005 - Northwest Outfall	8/11/2015	0.29	0.02	6.75	<4.4	7.8	<1.0
006- Runway/ Perimeter Outfall (A9)	8/11/2015	0.12	0.01	7.74	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A18)	8/11/2015	0.02	0.002	7.03	<4.0	65	<1.0
006- Runway/ Perimeter Outfall (A19)	8/11/2015	0.02	0.002	6.87	<4.0	<50	<1.0
006- Runway/ Perimeter Outfall (A21)	8/11/2015	1.06	0.11	6.94	<4.0	5.7	<1.0
006- Runway/ Perimeter Outfall (A23)	8/11/2015	0.10	0.01	7.15	<4.0	54	<1.0
006- Runway/ Perimeter Outfall (A33)	8/11/2015	0.07	0.01	7.04	<4.4	24	<1.0
006- Runway/ Perimeter Outfall (A38)	8/11/2015	0.12	0.01	6.71	<4.4	7.4	<1.0
006- Runway/Perimeter Outfall Average		0.2	0.02	7.07	0.0	22	0.0
005 - Northwest Outfall	12/15/2015	0.30	0.06	7.47	<4.0	11	<1.0
006- Runway/ Perimeter Outfall (A9)	12/15/2015	0.19	0.03	7.49	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A18)	12/15/2015	0.03	0.01	7.82	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A19)	12/15/2015	0.03	0.00	7.48	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A21)	12/15/2015	1.47	0.27	6.94	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A23)	12/15/2015	0.16	0.03	7.39	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A33)	12/15/2015	0.11	0.03	7.42	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A38)	12/15/2015	0.18	0.03	6.58	<4.0	<5.0	<1.0
006- Runway/Perimeter Outfall Average		0.31	0.06	7.30	0.0	0.0	0.0
Discharge Limitations		Report	Report	Report	Report	Report	Report

Source: Massport
Notes: Bold values exceed maximum daily discharge limitation.
For averaging calculations, a value of zero was employed for those results measures below the laboratory detection limit.
Requirements are from NPDES Permit MA 0000787, issued July 31, 2007.
TSS Total Suspended Solids
ND Not Detected

Table J-13 Logan Airport January 2015 Wet Weather Deicing Monitoring Results – North, West, Porter Street, and Runway/Perimeter Stormwater Outfalls

	Date	Ethylene Glycol, Total (mg/L)	Propylene Glycol, Total (mg/L)	BOD5 (mg/L)	COD (mg/L)	Ammonia Nitrogen (mg/L)	Nonylphenol (µg/L)	4-Methyl-1-H-benzotriazole (µg/L)	5-Methyl-1-H-benzotriazole (µg/L)	Tolytriazole (µg/L)
001B - North Outfall	1/30/2015	1,200	8,800	12,000	23,000	0.574	<0.02	5,002.51	5,961.51	10,964.02
002B - West Outfall	1/30/2015	440	4,400	3,000	8,500	0.426	<0.02	69.80	84.74	154.54
003B - Porter Street Outfall 1	1/30/2015	22	17	<200	2,400	2.60	<0.02	15.64	11.82	27.46
003B - Porter Street Outfall 2	1/30/2015	38	180	780	1,800	0.098	<0.02	43.23	28.39	71.62
003B - Porter Street Outfall 3	1/30/2015	NS	NS	NS	NS	NS	NS	NS	NS	NS
003B - Porter Street Outfall Average		30	99	390	2,100	1.3	0.0	29.44	20.11	49.54
006B- Runway/ Perimeter (A7)	1/30/2015	<7.0	<7.0	11	160	4.71	<0.02	14.21	6.04	20.25
006B- Runway/ Perimeter (A9)	1/30/2015	<7.0	<7.0	<2.0	120	0.734	<0.02	7.21	2.76 J	9.97 J
006B- Runway/ Perimeter (A21)	1/30/2015	<7.0	<7.0	23	620	2.14	<0.02	11.33	4.44	15.77
006B- Runway/ Perimeter (A22)	1/30/2015	<7.0	<7.0	20	220	2.95	<0.02	18.09	5.31	23.40
006B- Runway/ Perimeter (A23)	1/30/2015	<7.0	<7.0	9.4	77	2.56	<0.02	18.99	5.40	24.39
006B- Runway/ Perimeter (A35)	1/30/2015	<7.0	<7.0	41	170	4.29	<0.02	27.72	7.53	35.25
006B- Runway/ Perimeter (A38)	1/30/2015	<7.0	<7.0	<5.0	180	0.451	<0.02	<5.0	2.76 J	2.76 J
006B- Runway/Perimeter Outfall Average		0.0	0.0	15	221	2.55	0.00	13.94	4.89	18.83
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.										
Discharge Limitations										
Average Monthly		Report	Report	Report	Report	Report	Report	Report	Report	Report
Maximum Daily		Report	Report	Report	Report	Report	Report	Report	Report	Report

Source: Massport.

Notes: For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit.
J = value is an estimate calculated by the lab from the response factors of the other two triazole compounds.
Tolytriazole concentrations calculated as sum of 4-Methly-1-H-benzotriazole and 5-Methyl-1-H-benzotriazole.

BOD5 Five-day Biochemical Oxygen Demand
COD Chemical Oxygen Demand
NS Not Sampled. Locations were inaccessible due to snow piles.

Table J-14 Logan Airport April 2015 Wet Weather Deicing Monitoring Results – North, West, Porter Street, and Runway/Perimeter Stormwater Outfalls

	Date	Ethylene Glycol, Total (mg/L)	Propylene Glycol, Total (mg/L)	BOD5 (mg/L)	COD (mg/L)	Ammonia Nitrogen (mg/L)	Nonylphenol (µg/L)	4-Methyl-1-H-benzotriazole (µg/L)	5-Methyl-1-H-benzotriazole (µg/L)	Tolytriazole (µg/L)
001B - North Outfall	4/9/2015	20	16	76	86	0.284	0.05 J	<0.10	<0.10	ND
002B - West Outfall	4/9/2015	18	110	150	240	0.362	0.20	5.01	<0.10	5.01
003B - Porter Street Outfall 1	4/9/2015	<7.0	<7.0	7.6	66	0.433	0.03 J	<0.10	<0.10	ND
003B - Porter Street Outfall 2	4/9/2015	<7.0	30	350	670	0.150	<0.02	7.29	<0.10	7.29
003B - Porter Street Outfall 3	4/9/2015	<7.0	1,200	970	2,200	0.224	0.11 J	<0.10	<0.10	ND
003B - Porter Street Outfall Average	4/9/2015	0.0	410	443	979	0.269	0.05	2.43	0.00	2.43
006B- Runway/ Perimeter (A9)	4/9/2015	<7.0	<7.0	30	61	0.638	<0.02	<0.10	<0.10	ND
006B- Runway/ Perimeter (A18)	4/9/2015	<7.0	<7.0	66	100	1.64	<0.02	<0.10	<0.10	ND
006B- Runway/ Perimeter (A20)	4/9/2015	<7.0	<7.0	140	220	4.11	<0.02	3.05	<0.10	3.05
006B- Runway/ Perimeter (A21)	4/9/2015	<7.0	<7.0	9.3	38	0.406	<0.02	<0.10	<0.10	ND
006B- Runway/ Perimeter (A23)	4/9/2015	<7.0	<7.0	14	70	0.404	<0.02	<0.10	<0.10	ND
006B- Runway/ Perimeter (A33)	4/9/2015	<7.0	<7.0	32	110	0.535	<0.02	<0.10	<0.10	ND
006B- Runway/ Perimeter (A38)	4/9/2015	<7.0	<7.0	<2.0	33	0.133	<0.02	<0.10	<0.10	ND
006B- Runway/Perimeter Outfall Average		0.0	0.0	42	90	1.12	0.00	0.44	0.00	0.44
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.										
Discharge Limitations										
Average Monthly		Report	Report	Report	Report	Report	Report	Report	Report	Report
Maximum Daily		Report	Report	Report	Report	Report	Report	Report	Report	Report

Source: Massport.

Notes: For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit.
J = value is an estimate calculated by the lab from the response factors of the other two triazole compounds.
Tolytriazole concentrations calculated as sum of 4-Methly-1-H-benzotriazole and 5-Methyl-1-H-benzotriazole.

BOD5 Five-day Biochemical Oxygen Demand
COD Chemical Oxygen Demand
ND Not Detected

Table J-15 Logan Airport Stormwater Outfall NPDES Water Quality Monitoring Results – 1993 to 2015

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
# / # = Number of samples at or below NPDES limits / Total number of samples taken[1]																							
Oil and Grease (mg/L)																							
North Outfall	30/31	35/36	33/35	29/35	30/35	35/36	29/30	34/36	28/28	36/36	30/32	32/34	33/35	33/33	29/29	23/23	24/24	24/24	24/24	21/21	20/20	21/21	19/20
West Outfall	29/30	36/36	34/34	36/36	34/35	36/36	30/30	35/35	27/28	36/36	31/32	33/34	35/35	32/33	28/28	22/23	24/24	24/24	22/24	21/21	21/21	21/21	19/19
Maverick Street Outfall	29/29	36/36	35/35	36/36	35/35	35/36	30/30	34/34	26/28	35/36	32/32	34/34	35/35	32/33	29/29	22/23	20/21	19/19	23/23	15/15	4/4	20/20	18/18
Settable Solids[2] (mg/L)																							
North Outfall	19/19	34/35	34/35	32/35	31/34	34/36	30/30	34/36	29/29	32/36	32/32	34/34	33/35	32/34	22/22	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
West Outfall	19/19	32/36	34/34	35/36	34/34	35/36	29/30	36/36	27/28	36/36	31/32	34/34	32/35	33/33	22/22	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
TSS (mg/L)																							
North Outfall	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6/6	24/24	24/24	22/23	24/24	21/21	20/21	21/21	20/20
West Outfall	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5/6	24/24	24/24	23/23	22/24	20/22	21/21	20/21	18/19
Maverick Street Outfall	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4/6	22/24	20/21	18/19	20/23	14/15	4/4	19/20	18/18
pH																							
North Outfall	34/35	33/36	35/35	35/35	35/35	36/36	30/30	36/36	29/29	36/36	32/32	34/34	35/35	34/34	26/26	12/12	16/16	11/11	12/12	9/9	8/8	8/8	8/8
West Outfall	34/34	28/36	33/34	35/36	35/35	36/36	30/30	36/36	29/29	36/36	32/32	34/34	35/35	33/33	26/26	12/12	16/16	11/11	12/12	9/9	9/9	8/8	8/8
Porter Street Outfall[2]	35/35	30/36	34/34	36/36	35/35	36/36	30/30	36/36	28/28	36/36	32/32	34/34	35/35	33/33	22/22	21/21	48/48	24/24	23/23	26/27	24/27	24/24	19/23
Maverick Street Outfall	35/35	35/36	35/35	36/36	34/35	36/36	30/30	35/35	28/28	36/36	32/32	34/34	35/35	33/33	26/26	10/10	16/16	10/10	11/11	6/6	2/2	7/7	7/7

Source: Massport

Notes: Sampling requirements changed in 2007 with the issuance of a new NPDES permit. Results through 2007 are based on NPDES Permit MA0000787, issued March 1, 1978. Stormwater outfall water quality monitoring results collected in accordance with the requirements of former NPDES permit. A portion of the Porter Street Drainage Area was incorporated into the West Drainage Area as part of roadway construction projects at Logan Airport.

1 The total number of samples at each outfall varies year to year. In some years, fewer samples are taken due to factors such as construction, weather, and/or tidal conditions.

2 Settleable solids analyses were replaced with TSS in 2008.

Table J-16 Logan Airport Oil and Hazardous Material Spills[1] and Jet Fuel Handling – 1990 to 2015

Year	Total Number of all Spills	Total Number of all Spills >10 gallons	Total Volume of all Spills (Gallons)	Estimated Volume of Jet Fuel Handled (Gallons)	Total Volume of Jet Fuel Spilled (Gallons)
1990	173	NA	NA	438,100,000	3,745
1991	186	NA	NA	NA	2,471
1992	195	NA	NA	NA	4,355
1993	188	NA	NA	451,900,000	3,131
1994	217	NA	NA	476,700,000	4,046
1995	161	NA	NA	309,200,000	21,412[2]
1996	159	NA	NA	346,700,000	1,321
1997	147	NA	NA	377,488,161	2,029[3]
1998	191	NA	NA	387,224,004	10,047[4]
1999	196	43	7,151	425,937,051	7,012[5]
2000	136	20	1,318	441,901,932	1,227
2001	139	37	1,924	416,748,819	1,771
2002	101	16	653	358,190,362	559
2003	128	19	10,364	319,439,910	10,188[6]
2004	126	18	894	373,996,141	574
2005	97	15	2,319	368,645,932	585
2006	92	11	752	364,450,864	644
2007	108	7	604	367,585,187	361
2008	99	20	944	345,631,788	662
2009	95	6	1004	327,358,619	915
2010	87	15	476	335,693,997	360
2011	108	12	572	340,421,373	337
2012	132	5	593	343,731,127	439
2013	94	6	452	349,397,940	351
2014	129	17	2,785	370,222,342	785
2015	196	16	1,278	374,985,216	885

Source: Massport Fire-Rescue Department.
NA Not available.
Notes:
1 Materials include: jet fuel, hydraulic oil, diesel fuel, gasoline, and other materials such as glycol and paint.
2 One tenant spill, which occurred on October 15, 1995, totaled 18,000 gallons (84 percent of the annual spill total). The spill did not enter the Airport's storm drain system.
3 On October 23, 1997, a fuel line on an aircraft failed, resulting in the release of approximately 2,500 gallons, all but 60 gallons of which were recovered in drums before reaching the ground. Only the 60 gallons is included in the 1997 total.
4 Includes a 7,200-gallon spill that was discovered on September 2, 1998, and a 1,300-gallon spill that occurred on June 3, 1998. Neither spill entered the Airport's storm drain system.
5 Includes a 5,000-gallon spill, none of which entered the Airport's storm drainage system.
6 In 2003, one fuel spill comprised 9,460 gallons or 94 percent of the total volume of the MassDEP/MCP reportable spills that year. The fuel spill was contained and did not enter the drainage system.

Table J-17 Type and Quantity of Oil and Hazardous Material Spills at Logan Airport – 1999 to 2015

	Jet Fuel			Hydraulic Oil			Diesel Fuel			Gasoline			Other		
Year	No. of Spills	Quantity (Gallons)	No. of Spills ≥ 10 Gallons	No. of Spills	Quantity (Gallons)	No. of Spills ≥ 10 Gallons	No. of Spills	Quantity (Gallons)	No. of Spills ≥ 10 Gallons	No. of Spills	Quantity (Gallons)	No. of Spills ≥ 10 Gallons	No. of Spills	Quantity (Gallons)	No. of Spills ≥ 10 Gallons
1999	151	7,012	40	24	67	1	13	49	2	5	7	0	3	16	0
2000	115	1,227	18	8	59	2	3	11	0	8	16	0	2	5	0
2001	104	1,771	32	21	92	3	5	30	1	6	26	1	3	5	0
2002	79	559	15	7	38	0	8	37	1	4	8	0	3	11	0
2003	89	10,188	15	15	91	3	15	30	0	7	24	0	2	31	1
2004	82	574	12	17	189	4	14	52	0	7	26	0	6[1]	53[2]	2[3]
2005	66	585	12	14	78	1	7	1,610	2	7	45	0	3[4]	1	0
2006	65	644	9	10	25	0	6	57	1	4	9	0	7	17	1
2007	66	361	4	16	37	0	16	57	1	3	8	0	7	141[5]	2
2008	74	662	19	15	56	2	5	14	0	1	7	0	4	205[6]	1
2009	95	915	6	21	51	0	9	20	0	3	3	0	11	15	0
2010	54	360	12	17	50	1	5	56	2	2	3	0	7	7	0
2011	69	337	10	21	149	1	7	55	1	4	16	0	7	15	0
2012	80	439	4	25	79	1	17	38	0	2	12	0	8	25	0
2013	56	351	5	15	51	0	13	32	0	2	<2	0	7	10	0
2014	81	785	13	24	98	1	17	1,810	2	4	9	0	3	83	1
2015	110	885	10	43	149	3	16	151	2	7	46	1	20	47	0

Source: Massport

Notes:

1 Includes two Unknown spills (14 gallons), plus one spill of each of the following: Ethylene Glycol, Propylene Glycol, AVGAS, and Paint.

2 Ethylene Glycol (25 gallons), Propylene Glycol (10 gallons), AVGAS (1 gallon) and Paint (3 gallons).

3 One spill of Ethylene Glycol; one spill of Propylene Glycol.

4 Includes two spills of an unknown substance and volume.

5 Includes one spill of motor oil (4 gallons); one spill of kerosene (5 gallons); one spill of cooking oil (120 gallons); one spill of fuel oil (10 gallons); one spill from a battery (1 gallon); two spills of an unknown substance (1 gallon).

6 Includes one spill of transformer oil (200 gallons).

Table J-18 MCP Activities Status of Massport Sites at Logan Airport

Location (Release Tracking Number) and MassDEP Reporting Status	Action/Status
1. Fuel Distribution System (3-1287)	
2007	Inspection and Monitoring Status Reports were submitted to the MassDEP detailing monitoring and product recovery efforts along the FDS between September 2006 and September 2007. A Periodic Evaluation Report was submitted in January 2008 which indicated that a Condition of No Substantial Hazard existed at the FDS and a permanent solution was not currently feasible. Massport coordinated with BOSFUEL who prepared construction documents for replacing a portion of the FDS. Construction was conducted under a RAM Plan.
2008	Inspection and monitoring reports were submitted to the MassDEP detailing monitoring and product recovery efforts along the FDS between September 2007 and September 2008. Massport coordinated with BOSFUEL during construction to replace a portion of the FDS. The work was conducted under a RAM Plan that was submitted to the MassDEP in May 2008. A RAM Status Report was submitted in September 2008. Construction of the pipeline replacement was approximately 90 percent complete.
2009	Inspection and monitoring reports were submitted to the MassDEP detailing monitoring and product recovery efforts along the FDS between September 2008 and December 2009. The BOSFUEL project to replace a portion of the FDS continued, with work being completed on pipeline connections, testing of the new fuel line, and abandonment of the old fuel line. RAM Status Reports for the BOSFUEL Project were submitted in February and September 2009.
2010	Inspection and monitoring reports were submitted to the MassDEP detailing monitoring and product recovery efforts along the FDS between September 2009 and September 2010. A RAM Completion Report for the BOSFUEL Project was submitted in February, and the report was revised in March 2010.
2011	A Periodic Review of the Temporary Solution for the FDS was submitted in April 2011. Additionally, three Post-Class C RAO Status Reports were submitted for the FDS in February, June, and December 2011, summarizing the routine inspection and monitoring activities.
2012	Post-Class C RAO Status Reports were submitted in May and November 2012, summarizing the routine inspection and monitoring activities.
2013	Post-Class C RAO Status Reports were submitted in May and November 2013, summarizing the routine inspection and monitoring activities.
2014	Post-Class C RAO Status Reports were submitted in May and November 2014, summarizing the routine inspection and monitoring activities. In addition, a RAM Plan was submitted in April 2014 to address construction in the area of the FDS followed by a RAM Completion Report submitted in August 2014.
2015	Post-Temporary Solution Status Reports were submitted in May and November 2015, summarizing the routine inspection and monitoring activities.
2. North Outfall (3-4837)	
Phase II and Phase III Reports filed in March 1997	Indicated petroleum contamination present at the site was likely the result of decades of airport operation; risk assessment reported no significant risk to human health, or to the aquatic and avian community.
RAO submitted in March 1998	Class C RAO using a Temporary Solution (periodic site monitoring and assessment); remediation steps included (not limited to) installation of a new fuel distribution system and decommissioning of certain fuel lines, and natural biodegradation processes; goal is to have petroleum contamination reduced to an area less than 1,000 square feet. Installation of the new fuel distribution system and decommissioning of sections of the old system were completed. Massport initiated site evaluation to document the reduction of petroleum contamination following the decommissioning of the North Fuel Farm and fuel distribution system.
Post Class C RAO evaluation report submitted in December 2002	Massport has eliminated substantial hazards at this site and submitted a Class C RAO statement. In accordance with applicable regulations, Massport will conduct a periodic evaluation at five-year intervals until a Permanent Solution has been achieved. The next periodic evaluation was scheduled for 2007.
2004	Evaluation report indicated that a "Condition of No Significant Risk" has not been achieved at this site. Massport scheduled another assessment in 2007.
2005	No change in status for 2005.
2006	Massport prepared the five-year review of the Class C RAO for this site, which was due in December 2007.
2007	Massport completed its five-year review of the Class C RAO and transmitted it to MassDEP in December 2007. It was determined that a "Condition of No Significant Risk" has not been achieved at this site at this time. The next five-year re-evaluation will be conducted in 2012.
2008	No change in status.
2009	No change in status.
2010	No change in status.

Table J-18 MCP Activities Status of Massport Sites at Logan Airport (Continued)

2. North Outfall (3-4837) (Continued)	
2011	No change in status. Massport provided updated data for the MassDEP website.
2012	Response Action Outcome submitted to DEP on December 27, 2012. No further MCP response action is required.
3. Former Robie Park (3-10027)	
2005	A Phase I was completed in 2005 with an RAO retraction. The RAO had been completed by the former property owner.
2006	No change in status for 2006.
2007	No change in status for 2007.
2008	A Phase II Scope of Work was prepared on May 9, 2008. A RAM Plan was submitted to MassDEP on September 16, 2008.
2009	A Phase V Remedy Operation Status Plan was submitted on March 31, 2010.
2010	Two Remedy Operation Status Reports were submitted on September 29, 2010 and March 28, 2011. The next status report was scheduled for September 30, 2011.
2011	Phase IV Project Status Reports 2 and 3 were submitted in March and September 2011, respectively.
2012	Phase V Status Reports 4 and 5 were submitted in March and September, 2012, respectively.
2013	Phase V Status Reports 6 and 7 were submitted in March and September, 2013, respectively.
2014	Phase V Status Reports 8 and 9 were submitted in March and September, 2014, respectively.
2015	Phase V Reports 10 and 11 were submitted in March and September, 2015, respectively. A Permanent Solution Statement is currently being prepared.
4. Former Robie Property (3-23493)	
2005	A Phase I was completed in 2005.
2006	No change in status for 2006.
2007	No change in status for 2007.
2008	A Phase II was submitted to MassDEP on October 21, 2008.
2009	An Activity and Use Limitation (AUL) was recorded with the Suffolk County Registry of Deeds for the site on December 16, 2009.
2010	A Class A-3 RAO was submitted on January 4, 2010, corresponding with the recording of an AUL. On May 21, 2010, a RAM Plan for the Economy Parking Structure was submitted. The first RAM Status Report was submitted on September 21, 2010. An AUL Amendment was recorded on December 9, 2010.
2011	A RAM Completion Statement was submitted on March 15, 2011. Regulatory closure has been achieved. No further response actions are required.
5. Tomahawk Drive (3-27068)	
2007	Release notification form submitted in August 2007.
2008	A Class B-1 RAO was submitted to MassDEP on January 9, 2009. No further response actions were required.
2009	No further response actions were required.
6. Fire Training Facility (3-28199)	
2008	Oral notification of release was provided to MassDEP/BWSC on December 10, 2008.
2009	A Phase I/Tier classification was submitted on December 17, 2009.
2010	A RAM Plan was submitted to MassDEP on August 6, 2010. A RAM Status Report was submitted to MassDEP on December 3, 2010.
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.

Table J-18 MCP Activities Status of Massport Sites at Logan Airport (Continued)

6. Fire Training Facility (3-28199) (Continued)	
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.
7. Southwest Service Area (3-28792)	
2009	Release notification form was submitted to MassDEP/BWSC on October 8, 2009.
2010	A Class B-1 RAO was submitted to MassDEP on October 18, 2010. No further response actions required.
2011	No further response actions required.
8. Airfield Duct Bank Site (3-29716)	
2010	Release notification form was submitted on December 22, 2010.
2011	A Class A-1 RAO was submitted on December 23, 2011. No further response actions required.
9. West Outfall Release (3-29792)	
2011	Release notification form was submitted on April 8, 2011. Two IRA Status Reports were submitted to MassDEP on June 9 and December 5, 2011. An RAO was submitted on February 13, 2012. No further response actions required.
10. Hertz Parking Lot Site (3-30260)	
2011	Release notification form was submitted on August 29, 2011. A RAM Plan was submitted to MassDEP on September 1, 2011.
2012	A Class A-2 RAO was submitted on September 10, 2012. No Further response actions required.
11. Former Butler Aviation Hangar (3-30654)	
2012	Verbal notification of a release was provided to MassDEP on February 14, 2012, when Rental Car Center construction encountered an unidentified underground storage, and a Release Notification Form was submitted on April 23, 2012. An IRA Plan was submitted May 21, 2012 and IRA Status Reports were submitted on June 18 and December 26, 2012.
2013	Phase I Report and Tier Classification submitted February 21, 2013 and IRA Completion Report submitted on July 11, 2013.
2014	A Permanent Solution Statement was submitted in October 2014. No further response actions required.
12. Taxi Pool Site (3-32022)	
2014	MassDEP notified of 72-hour Reportable Condition on March 10, 2014
2015	Phase I Report and Tier Classification submitted March 9, 2015.
13. Hangar 16 (3-32351)	
2014	Release Notification Form Submitted August 4, 2014.
2015	A RAM Plan was submitted on January 29, 2015; a Phase I Report and Tier Classification were submitted on August 3, 2015; a RAM Completion Report was submitted November 16, 2015; and a Permanent Solution Statement was submitted on January 21, 2016. No further response actions are required.

Source: Massport

Notes: This list includes Massport MCP sites only. Additional sites are the responsibility of Logan Airport tenants. Refer to Figure 8-2 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	Phase I	Initial Site Investigation
MCP	Massachusetts Contingency Plan	Phase II	Comprehensive Site Assessment
RAM	Release Abatement Measure	Phase III	Identification, Evaluation, and Selection of Comprehensive Remedial Actions
RAO	Response Action Outcome	Phase IV	Implementation of Selected Remediation Action
FDS	Fuel Distribution System	Phase V	Operation, Maintenance and/or Monitoring
IRA	Immediate Response Action		

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Capital Programs and Environmental Affairs

EnviroNews

A Massport Newsletter

Volume 41, Issue 1
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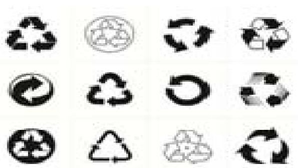

EnviroNews is a newsletter published quarterly for Massport and its tenants. Your comments and suggestions are welcome. Please contact Brenda Enos (benos@massport.com) at 617-568-5963.

SUSTAINABLE MASSPORT

Many of you have already received the 2015 Sustainable Massport calendar. The program is a year-long initiative to roll our sustainability program across the Authority.

Massport was selected to receive a FAA grant to prepare a Sustainability Management Plan (SMP) for Logan Airport as part of a nationally recognized pilot program. Massport was selected due to our exemplary track record in implementing sustainability initiatives and commitment to stewardship. When completed, the SMP will provide a baseline assessment of all Massport's activities and major accomplishments to date as well as support and promote sustainability at the Airport.

Massport has a very broad view of sustainability, which goes beyond environmental considerations to also include economic/financial benefits, social/community aspects, and the operational efficiency of facilities. This broad outlook of sustainability necessitates the involvement of all Airport employees.

The calendar has monthly programming on Hot Sustainability Topics. You will learn what Massport is doing; what you can do in the office and at home; and where to get more information.

The following is the summary of topics for the year:

January 2015 – Sustainability Awareness
February 2015 – Recycling
March 2015 – Energy/Electricity
April 2015 – Passenger Experience
May 2015 – Parks and Open Space
June 2015 – Sustainable Transportation
July 2015 – Water Conservation
August 2015 – Community Outreach and Support
September 2015 – Waste Management/Reduction
October 2015 – Climate Change Adaptation/Resiliency
November 2015 – Employee Wellness
December 2015 – Air Quality/Greenhouse Gas Reduction

For a copy of the calendar contact Jacob Glickel at jglickel@massport.com or (617) 568-3558

Jacob Glickel, Sustainability Project Manager

Jacob joined the Massport Staff in September 2014. The following is an interview with him.

What brought you to Massport?

Massport is an important economic engine in the region and a leader in incorporating sustainability throughout its organization. For example, the new Consolidated Rental Car Center has applied for a green building certification of LEED Gold and is served by buses using clean natural gas. Yet, there is always opportunity for Massport to continue to raise the bar on sustainability and be at the forefront among airports nationally. While airplane travel and port operations require high energy use and release of greenhouse gas emissions, the opportunity is enormous for Massport to make significant impact. Whether it be increasing recycling, reducing our energy use, or preparing for rising seas, Massport is primed to continue to be a leader.

What interests you most about expanding sustainability programs at Massport?

I have always been interested in bringing proven technologies and successful sustainable programs to a wider audience. There is often reporting of the next big technology or new product that will solve many of our climate and energy issues. Science and industry have already made great strides, and by just using existing technology, Massport could make drastic reductions in our energy use and greenhouse gas emissions. Of course, the key is to incorporate these sustainability programs and technology into how business is done today without a significant impact on our customers. I know it can be done and I will work with my colleagues across Massport to reach our goals. I encourage everyone to provide your ideas, give us feedback, and keep an open mind to new programs and technologies.

Can you give us an example of a project you are working on?

I know I have been talking a lot about energy use, but I am really excited to work on improving the amount of material recycled in the terminals and across Massport. I believe we can increase the recycling rate by 25% by the end of the year. Not only will this save Massport money but it will reduce our greenhouse gas emissions.

Where did you work prior to joining Massport?

For the past seven years, I worked for the City of Boston's Office of Environment, Energy and Open Space. I was able to take part in a number of firsts and big changes at the City of Boston around sustainability. I helped craft the first Climate Action Plan, which lays out a blueprint for how Boston is going to meet its sustainability goals. I engaged residents and businesses about reducing their energy use through Renew Boston. In just a two-year span, Renew Boston completed over 13,000 home energy assessments.

One of my biggest takeaways from working at the City of Boston was Mayor Thomas M. Menino's focus on relating sustainability to people's everyday lives. Mayor Menino constantly pushed our department to show the benefits to residents and businesses (our customers!) of being sustainable.

Where did you grow up?

I grew up and live in the Boston neighborhood of Jamaica Plain. When Boston first started offering monthly recycling drop offs, I remember separating the household trash and organizing my parents to drive me there. I love working and living in Boston. I take the T to work every day and know that I am adding one less car to traffic, as well saving money on my commute.

Service Station Safety Tips

An estimated 5,020 fires and explosions occurred at public service stations per year from 2004-2008. That means that, on average, one in every 13 service stations experienced a fire. These 7,400 fires caused an annual average of 2 deaths, 48 injuries and $20 million in property damage. Almost two-thirds of those fires involved vehicles. These statistics show that pumping gas is a hazardous operation. It is necessary to pay attention to what you're doing.

Check out this video clip of a fire started by static electricity as a young lady was refueling her SUV.

https://www.youtube.com/watch?v=tuZxFL9cGkI

If you search for "gas station fire videos", there are many more like this one. Some other tips are:

- Turn off your vehicle's engine when refueling.
- Keep gasoline and other fuels out of children's sight and reach. Gasoline is highly toxic in addition to being a fire hazard. Never allow a child to pump gas.
- Don't smoke, light matches or use lighters while refueling.
- Don't engage in other activities.
- If you must use any electronic device, such as cell phones, computers or portable radios while refueling, follow manufacturer's instructions. Again, play attention to what you are doing.
- Do not jam the latch with an object to hold it open.
- To avoid spills, do not top off or overfill your vehicle.
- After pumping gasoline, leave the nozzle in the tank opening for a few seconds to avoid drips when you remove it.
- If a fire starts while you're refueling, don't remove the nozzle from the vehicle or try to stop the flow of gasoline. Leave the area immediately and call for help.
- Don't get in and out of your vehicle while refueling. A static electric charge can develop on your body as you slide across the seat, and when you reach for the pump, a spark can ignite gasoline vapor.
- If you must get into the vehicle during refueling, discharge any static electricity by touching metal on the outside of the vehicle, away from the filling point, before removing the nozzle from your vehicle.
- Use only approved portable containers for transporting or storing gasoline. Make sure the container is in a stable position.
- Never fill a portable container when it is in or on the vehicle. Always place the container on the ground first. Fires caused by static charges have occurred when people filled portable containers in the back of pick-up trucks, particularly those with plastic bed liners. Removing the container will also prevent a dangerous spill of gasoline.
- When filling a portable container, keep the nozzle in direct contact with the container. Fill it only about 95 percent full to leave room for expansion.

Ground Service Equipment, Did You Know …?

Did you know that there are over 1200 pieces of Ground Service Equipment (also known as GSE) on the ramp at Logan? That is a lot of equipment in a small footprint of the terminal and cargo areas where GSE operate! This is in addition to the more than 200 on-road vehicles, such as trucks and vans, and 80 pieces of snow removal equipment that also operate on the ramp. Why bring up GSE equipment? Because GSE typically accounts for 25% of the fire alarm calls for fuel spills each year. In 2014, there were 32 notifications to fire alarm for GSE equipment leaking fuel on the ramp. In June and July of 2014 when ambient temperatures on the ramp began to rise, GSE spills increased to 30% with most spills attributed to thermal expansion. Equipment should not be topped off when refueling which is specifically prohibited under Logan's stormwater permit. In addition, given the age of many of the GSEs at Logan, implementation of routine inspections and maintenance to ensure equipment is in good operating condition is strongly encouraged. As you know, all fuel spills regardless of quantity require notification to Fire Alarm.

Provided below is a summary of fuel spills that occurred in 2014

Total number of spills: 129

Total fuel spilled: 2,785 gallons

Total reportable spills: 17

MA DEP and National Response Center
(10 gallons or more or impact to storm drainage system)

Spill sources:

49	Aircraft
32	GSE
8	Aircraft fueling system
29	Aircraft fueling system/GSE
2	Operator Error
1	Snowmelter
8	Other (gas station pump dispenser; transformer; jet bridge; construction truck; private auto)

Fuel types:

Jet Fuel:

Diesel Fuel:

Hydraulic oil:

Transmission oil:

Other: (gasoline; transmission fluid; unknown)

Brain Teaser

If you topped off a 20 gallon tank with diesel fuel with a beginning temperature of 75^{o} F and the tank warmed up to 95^{o} as it sat on the ramp in July, how much would the diesel fuel expand to overflow the tank?

Formula:

amount fueled **x** thermal expansion coefficient of diesel fuel (0.00046/^{o}F) **x** the increase in temperature = number of gallons spilled

Answer to Brain Teaser:

Answer: 0.2 gallons

Solution:

20 gallons (amount fueled) x 0.00046 (thermal expansion coefficient) x 20 (increase in temperature) = 0.2 gallons

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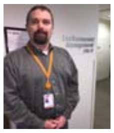
Questions about Environmental/Safety Issues

Who should you contact?

Contact	Phone Number	Email Address
 **Auditing/General**		
Brenda Enos	(617) 568-5963	benos@massport.com
Universal Waste		
Glenn Adams	(617) 568-3542	gadams@massport.com
Safety		
Brian Dinneen	(617) 568-7427	bdinneen@massport.com
Michael McAveeney	(617) 561-3390	mmcaveeney@massport.com
Karisa Morin	(617) 568-7434	kmorin@massport.com
Spill Follow-Up		
James Stolecki	(617) 568-3552	jstolecki@massport.com
NPDES Permitting		
Rosanne Joyce	(617) 568-3516	rjoyce@massport.com
Underground/Aboveground Storage Tanks		
Erik Bankey	(617) 568-3514	ebankey@massport.com
 **Air Quality/Hazardous Waste**		
Ian Campbell	(617) 568-3508	icampbell@massport.com
 **EMS/Sustainability/Recycling**		
Jacob Glickel	(617) 568-3558	jglickel@massport.com

Capital Programs and Environmental Affairs

EnviroNews

A Massport Newsletter

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INSIDE THIS ISSUE:

EnviroNews is a newsletter published quarterly for Massport and its tenants. Your comments and suggestions are welcome. Please contact Brenda Enos (benos@massport.com) at 617-568-5963.

Sustainability Management Plan Release

Two years ago, Massport embarked on a comprehensive effort to prepare a Sustainability Management Plan (SMP) for Logan International Airport. This plan serves as a roadmap for prioritizing initiatives and moving goals forward along our path towards a more “Sustainable Massport”. This plan will guide our sustainability practices over the next decade and will support the Authority’s continued commitment to sustainability.

The report represents the combined efforts of over 125 employees and tenants who came together to establish our baseline sustainability performance, shape our goals, and identify new initiatives. Massport is focused on a holistic approach with an emphasis on economic viability, operational efficiency, natural resource conservation, and social responsibility.

Massport’s commitment to sustainability has a long history, with recent accomplishments including the consolidation of the rental car shuttle bus fleet into a unified, alternative fuel busing system; the implementation of innovative applications of solar and wind energy technology; and the opening of the East Boston Greenway Connector. Additionally, the SMP has included several ground-breaking elements including the launch of an Authority-wide sustainability engagement calendar, distributed in January 2015, and the development of Sustainability Planning Optimization Tools (SPOT™) for use to manage Massport’s sustainability efforts.

Logan Airport experienced record-breaking passenger levels in 2013, with 30.2 million passengers. The Airport achieved another milestone in 2014 with 31.6 million annual passengers. With passenger levels projected to reach 35 million by the end of 2022, the sustainable operation of Logan Airport is more important than ever before. As an increasing number of people pass through our gates, we will aim to engage our passengers, employees, and the community in a sustainable manner.

The SMP outlines the following:

- A summary of Logan Airport’s current sustainability performance, with specific focus areas of energy and greenhouse gas emissions; resiliency; waste management, and recycling; water conservation; and community well-being.
- Sets sustainability goals to improve performance at Logan Airport, and established metrics for ongoing tracking of progress toward achieving those goals.
- Develops a well laid out and organized framework as a key to the successful implementation.

To view the Sustainability Management Plan Highlights Report go to:

www.Massport.com/Environment

WIPERS ON; LIGHTS ON!

Massachusetts joins a number of other states that specifically require headlights to be on when windshield wipers are on. A new state law went into effect on April 7, 2015, requiring motorists to turn on their headlights and tail-lights whenever their vehicle's windshield wipers are needed.

The new law also states that headlights and tail-lights should be turned on a half-hour after sunset and a half-hour before sunrise or when visibility is less than 500 feet. Relying on daytime running lights for these conditions is not sufficient under the law.

The fine for violating the new headlight law is only $5. However, a driver who gets ticketed for a headlights offense will face increased vehicle insurance premiums as it is a surchargeable offense (there are talks to have this portion removed from the law).

Here's the text of the new law, as it appears in Section 15, Chapter 85, of Massachusetts General Laws:

> A vehicle, whether stationary or in motion, on a public way, shall have attached to it headlights and tail-lights which shall be turned on by the vehicle operator and so displayed as to be visible from the front and rear during the period of 1/2 hour after sunset to 1/2 hour before sunrise; provided, however, that such headlights and tail-lights shall be turned on by the vehicle operator at all other times when, due to insufficient light or unfavorable atmospheric conditions, visibility is reduced such that persons or vehicles on the roadway are not clearly discernible at a distance of 500 feet or when the vehicle's windshield wipers are needed; provided further, that this section shall not apply to a vehicle which is designed to be propelled by hand; and provided further, that a vehicle carrying hay or straw for the purpose of transporting persons on a hayride shall display only electrically operated lights which shall be 2 flashing amber lights to the front and 2 flashing red lights to the rear, each of which shall be at least 6 inches in diameter and mounted 6 feet from the ground.

Baggage Conveyor Safety

Every day at the airport, numerous people work with automatic baggage conveyors. These can be stationary such as a stripping belt, mobile ramp trucks with conveyors, or back-of-house units transporting luggage across the terminal or across the airport. Baggage conveyors can start and stop without warning, even though most are equipped with audible warning signals. The Bureau of Labor and Standards – Occupational Safety and Health Administration, from 1998-2014, identifies many unfortunate incidents across a variety of occupations. Injuries related to conveyors identified 524 investigated injuries. Airport related injuries or fatalities were 50. Finally, “baggage conveyor” exhibits 21 documented injuries with 5 being fatal. Victims range from children being placed on baggage claim belts, to technicians absentmindedly forgoing Lock-Out/Tag-Out procedures. When servicing conveyor equipment or working around them, Please do not forget, the controls and operators of conveyors may be 100’s of feet away, in remote offices.

The acute and prolonged risks of baggage handling are unique to airport workers. In an effort to communicate these inherent challenges, OSHA offers education specific to baggage handlers.

https://www.osha.gov/SLTC/etools/baggagehandling/baggage_makeup.html

2015 Regulatory Changes for Massachusetts Underground Storage Tanks

The Massachusetts Department of Environmental Protection (MADEP) recently enacted some changes to the underground storage tank (UST) regulations. These Regulations (310 CMR 80.00) address the registration, installation, operation, maintenance, closure and inspection of UST systems used to store petroleum fuels and hazardous substances. MADEP has also incorporated recent federal requirements and added new provisions to ensure that UST systems are properly installed, operated and maintained; that leaks and spills are prevented and contained; that UST systems and components found to be leaking or not working properly are repaired or replaced; and any resulting environmental damage is limited, assessed and cleaned up.

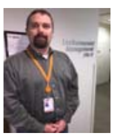
Below are some of the more significant changes in these regulations. This list however is not meant to be all inclusive. Tank owners and operators should read these regulations to make sure they are in compliance.

- Monthly inventory reconciliation is no longer required for double wall USTs/piping with continuous interstitial monitoring;
- Signs must be posted (and updated as necessary) at each UST indicating what steps should be followed in the event of a UST system or UST component emergency;
- Owners/operators must develop (and update when necessary) written procedures for how UST facility employees and contractors should respond in the event of an UST sys tem or UST component emergency;
- UST Leak Detection Systems must be tested on an annual basis;
- Piping sumps, intermediate sumps and dispenser sumps must be inspected annually, and must pass an integrity test by January 2, 2017;
- Inspections of USTs and associated systems must be conducted monthly under the direction of Class A or B Operator (interval not previously defined);
- The regulation identifies and clarifies specific timelines for responding to alarms/leaks/etc. to more closely match requirements in the Massachusetts Contingency Plan. Alarms must be investigated and resolved within 72 hours;
- Compliance Certifications must be submitted to MADEP by owner/operator 18 months after each third-party inspection (which are still due every 3 years);
- Spill buckets must be inspected monthly;
- New or replacement spill buckets must be double walled and have a minimum 5-gallon capacity and must pass a tightness test at installation;
- Existing spills buckets must pass an integrity testing by January 2, 2017, and at 5 year intervals thereafter;
- Double-walled tanks can be temporarily taken out of service for up to 5 years provided certain conditions are met (previous limit was 2 years); and
- Financial responsibility language in the regulations has been expanded/clarified to address exemptions. Specifically, the regulation indicates that financial responsibility is not required for “State and Federal government entities whose debts and liabilities are the debts and liabilities of a state or the United States government”

Please refer to http://www.mass.gov/eea/agencies/massdep/toxics/ust for detailed information.

Questions about Environmental/Safety Issues

Who should you contact?

Contact	Phone Number	Email Address
 **Auditing/General**		
Brenda Enos	(617) 568-5963	benos@massport.com
Universal Waste		
Glenn Adams	(617) 568-3542	gadams@massport.com
Safety		
Brian Dinneen	(617) 568-7427	bdinneen@massport.com
Michael McAveeney	(617) 561-3390	mmcaveeney@massport.com
Karisa Morin	(617) 568-7434	kmorin@massport.com
Spill Follow-Up		
James Stolecki	(617) 568-3552	jstolecki@massport.com
NPDES Permitting		
Rosanne Joyce	(617) 568-3516	rjoyce@massport.com
Underground/Aboveground Storage Tanks		
Erik Bankey	(617) 568-3514	ebankey@massport.com
 **Air Quality/Hazardous Waste**		
Ian Campbell	(617) 568-3508	icampbell@massport.com
 **EMS/Sustainability/Recycling**		
Jacob Glickel	(617) 568-3558	jglickel@massport.com

Capital Programs and Environmental Affairs

ENVIRONEWS

A Massport Newsletter

Volume 41, Issue 3
October 2015

INSIDE THIS ISSUE:

EnviroNews is a newsletter published quarterly for Massport and its tenants. Your comments and suggestions are welcome. Please contact Brenda Enos (benos@massport.com) at 617-568-5963.

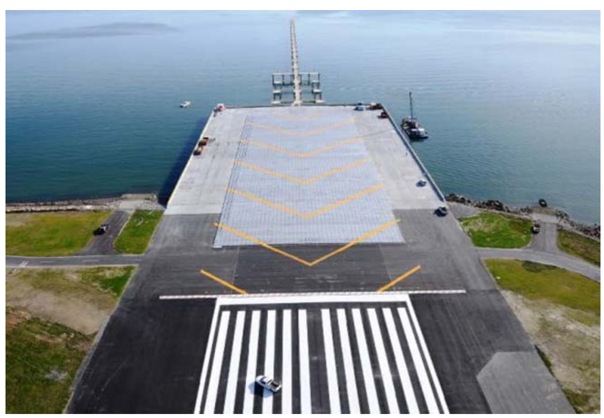
Massport's Conservation Mooring Program - An Eelgrass Alternative Mitigation Strategy

Why are eelgrass habitats important?

Eelgrass habitats are among the most productive and biologically diverse ecosystems on the planet. Living and dead plant material, including leaves, roots and rhizomes, has many valuable ecological functions such as stabilizing seafloor sediments and shorelines, cleaning coastal waters, providing habitat for a diversity of flora and fauna, and supporting the foundation of the detrital food web. The economic value of eelgrass habitat is demonstrated by the abundance and diversity of commercially and recreationally important species such as flounder, weakfish, blue crabs, bay scallops, lobsters, striped bass, and blue mussels (http://seagrant.mit.edu/eelgrass/eelgrassscience).

What is Massport's Conservation Mooring Program?

Massport's Conservation Mooring Program was developed as an alternative innovative strategy to mitigate for the unavoidable loss of 1.5 acres of eelgrass habitat when Runway 33L Safety Area (RSA) Improvements project was constructed.



Logan International Airport Runway 33L Safety Area

The initial eelgrass mitigation effort consisted of harvesting and transplanting more than 100,000 eelgrass shoots from the Runway 33L RSA project footprint prior to construction in June, 2011. The eelgrass shoots were relocated to two areas in Boston Harbor to re-establish eelgrass in those areas and encompassed a 4.6 acre footprint to meet the 3:1 regulatory mitigation ratio.

As early as October 2011, field surveys indicated that the Old Harbor Boston site had no surviving transplanted eelgrass and the White Head Flat sites showed only limited survival. At the Interagency Working Group (IWG), which comprised of the MA

Continued on next page

Compliance Corner

Hazardous Waste Compliance

Do you know your hazardous waste generator status?

Many Massport tenants generate regulated hazardous waste during the course of their operation. In Massachusetts, all businesses generating hazardous waste need to submit notification to MassDEP. Generator status is based on the amount of hazardous waste generated per month. Massachusetts regulates waste oil as a hazardous waste. This designation triggers requirements for proper storage, labeling, handling, transportation, disposal and record keeping. Very Small Quantity Generators (VSQG), those generating less than 220 lbs. / 27 gallons of federally regulated hazardous waste and up to 2200 lbs. / 270 gallons per month of Massachusetts regulated hazardous waste must fill out and submit a MassDEP Hazardous waste Generator Registration form. VSQG status allows on-site storage of up to 2200 gallons (5 – 55 gallon drums) at one time and has no time limit for duration of storage as long as it is below the storage limit. Generation of waste(s) above VSQG thresholds triggers other reporting and compliance requirements. More information is available at the MassDEP web site at **http://www.mass.gov/eea/agencies/massdep/recycle/hazardous/**

If you have any questions or concerns about hazardous waste compliance, contact the Massport Environmental Department.

Massport's Conservation Mooring Program - An Eelgrass Alternative Mitigation Strategy

DEP, US EPA, NOAA, MA Coastal Zone Management, Army Corps of Engineers, and Boston Conservation Commission, it was agreed that, given the limited transplanting success and the potential for long-term temporal loss of replacing eelgrass functions, Massport needed to pursue an alternative mitigation strategy to fulfill its eelgrass mitigations goals for the construction project. Massport elected to pursue conservation moorings, which would provide for the funding of traditional boat moorings in eelgrass with conservation moorings.

What are conservation moorings?

Conservation boat moorings utilized for Massport's Conservation Mooring Program consist of helical anchors and flexible mooring rodes. The helical anchor is an embedment anchor fabricated with high grade steel and designed to penetrate cohesive soils. Helix anchor installation has minimal environmental impact as it is hydraulically driven to a specified depth (~15 – 20 feet) using a specialized hydraulic anchor driver. Unlike traditional boat moorings which may have a concrete block and large footprint (i.e., 4 feet by 4 feet), the helix anchor footprint is typically no more than six inches in diameter at the substrate/water interface. Upon installation, the elastic mooring rode has several immediate benefits to the aquatic environment including the elimination of scour within the eelgrass meadow; reduction and/or elimination of suspended sediments in the water column; and reduction in water column turbidity which concomitantly improves water column clarity and enhances sunlight availability for the eelgrass shoots.

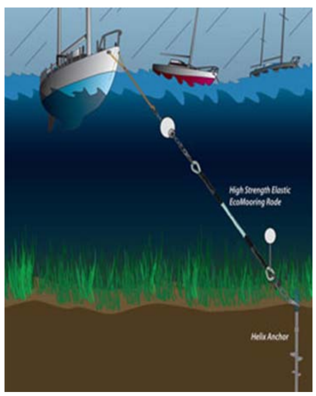
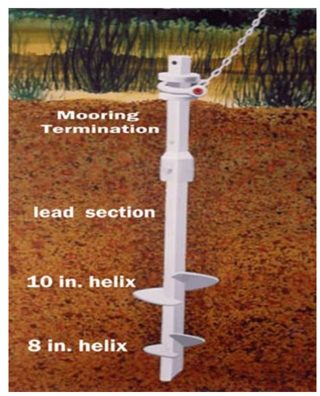


Figure 3. Ecomooring system
www.boatmoorings.com.



The Helix Anchor
www.helixanchors.com

Conservation Mooring Site Selection

The expansiveness of the eelgrass meadows in the selected harbors selected was one of Massport's important criteria for selection: the meadow had to be expansive with at least 25 boat moorings within the meadow footprint. The basis for the criteria was to maximize environmental benefit; the greater number of mooring replacements with conservation moorings within a defined eelgrass bed, the greater realization of the environmental benefits.

Under this program, Massport funded individual towns and entities for the purchase and installation of conservation boat mooring equipment to replace a total of 225 conventional chain moorings in harbors where extensive eelgrass meadows were co-located. Funding recipients included Manchester-by-the-Sea, Gloucester, West Falmouth, Wareham, and Camp Harbor View Foundation.

Expected benefits: With the replacement of conventional, substrate disturbing boat moorings, a multitude of environmental benefits are expected to be realized over time. With the rise and fall of the tides in the harbor environments and movement of the boats driven by the wind, it is expected that suspended solids will be measurably reduced and result in the overall improvement of water quality. Reduction in suspended solids in the water column is not only beneficial to the eelgrass habitat but is a more favorable environment for the aquatic organisms, such as fish and shellfish that seek shelter in the eelgrass meadow. Though the damaged eelgrass meadow may take some time to recover, the scars formed from the conventional moorings may fill in with eelgrass which will enhance the stability of the harbor bottom to further reduce sediment suspension in the water column.

Massport's Conservation Mooring Program was multifaceted that involved a diverse group of stakeholders who worked together to realize the collective goal of implementing the Conservation Mooring Program; the program strengthened Massport's commitment and those of the participants in the implementation of this significant environmental initiative; and ultimately, the citizens of the Commonwealth of Massachusetts benefit from the Conservation Mooring Program because eelgrass restoration and preservation is not just a local issue, it is regionally beneficial to enhancing the aquatic habitat.

2015 Airports Going Green Award

Massport has been chosen as a recipient of the 2015 Airports Going Green award for the Eelgrass Habitat/ Conservation Mooring Program which complements Massport's long-standing industry leadership and overall demonstrated commitment to sustainability. This prestigious award recognizes the value of this program as as well as Massport's outstanding leadership in pursuit of sustainability within the aviation industry. The award will be presented at the 8th Annual Airports Going Green Conference in Chicago on October 27th.

The Massport Safety Alliance Fair 2015

The Logan Airport Safety Alliance is a working group that promotes Ramp and Apron Safety. The group is chaired by Aviation Operations and Massport Safety and works closely with Massport Fire Rescue, Massport State Police, Massport Facilities, FAA, airline and ground service company partners to keep the ramp operation working safety and efficiently. The group meets monthly to discuss operational concerns and learn from each other. Typically, the meeting is held at the Massport Briefing Room the third Tuesday of each month. All are invited.

Each year, the Alliance sponsors a Safety Fair to support the effort. 2015 marked the 11th Massport Safety Fair. It was held on September 16th in the JetBlue Hangar with great success. There were 35 vendor tables showing the latest safety gear to over 1000 attendees. Jet Blue staff cooked up a delicious lunch of sausages, hamburgers and hotdogs for the hungry bunch. The Red Cross was also on-site collecting Blood Donations with 18 attendee's volunteering.

The Safety Alliance also manages the Logan Airport Safety Hotline. This is a voluntary, confidential reporting system which was created to provide a means for people to report unsafe practices or conditions on the Logan Apron without fear of retaliation. It can be reached by calling 617-568-3600. Each item will be logged and discussed at the next monthly Alliance meeting. As always, emergency conditions should be immediately reported to:

Massport Fire-Rescue at 617-567-2020,
Massport State Police at 617-568-7300 or
Massport Operations Department at 617-561-1919.

Thank you for putting *SAFETY FIRST* at Logan International Airport!

Questions about Environmental/Safety Issues

Who should you contact?

Contact	Phone Number	Email Address
 **Auditing/General**		
Brenda Enos	(617) 568-5963	benos@massport.com
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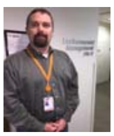 **Air Quality/Hazardous Waste**		
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2015 and 2016 Peak Period Pricing Monitoring Report

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BOSTON-LOGAN INTERNATIONAL AIRPORT MONITORING REPORT ON SCHEDULED AND NON-SCHEDULED FLIGHT ACTIVITY

Peak Period Surcharge Regulation
740 CMR 27:00: Massachusetts Port Authority

Report Number:	**012**
Monitoring Period:	**Through Sept. 2015**
Report Issue Date:	**May 2015**

Note: This report reflects the Boston-Logan Airport flight activity monitoring under 740 CMR 27.03 Peak Period Surcharge Regulation on Aircraft Operations at Boston-Logan International Airport.

Findings: This report includes actual and projected activity data **through September 2015**. Current and projected near-term flight levels at Boston Logan are well below Logan's good weather (VFR) throughput of approximately 120 flights per hour. **As a result, average VFR delays are projected to be minimal and well below the 15 minutes threshold through the analysis period.**

In the event demand conditions at the airport change significantly from the current projection, Massport will issue updates to this report.

Attachments

Table 1: Summary Overview of Peak Period Surcharge Program

Table 2: Summary Overview of Forecast Methodology

Table 3: Projected Aircraft Operations at Logan Airport Projected

Table 4: Projected Hourly Operations, Average Weekday

Table 5: Forecast Logan Average Weekday Operations

Massport Contact:

Mr. Flavio Leo
Deputy Director, Aviation Planning and Strategy
617-568-3528
fleo@massport.com

Table 1: Summary Overview of Peak Period Surcharge Program

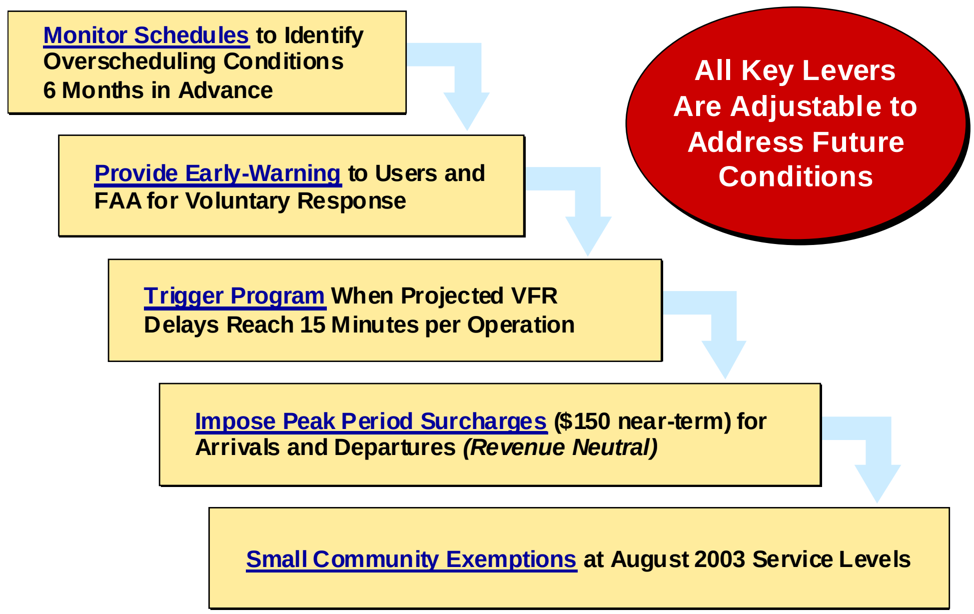
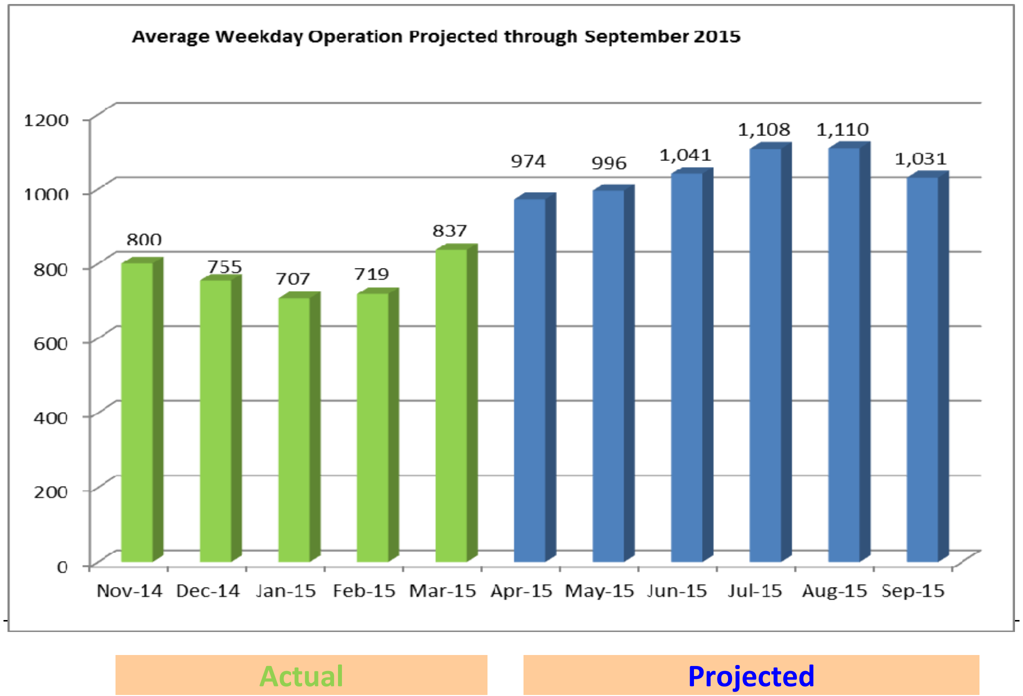


Table 2: Summary Overview of Forecast Methodology

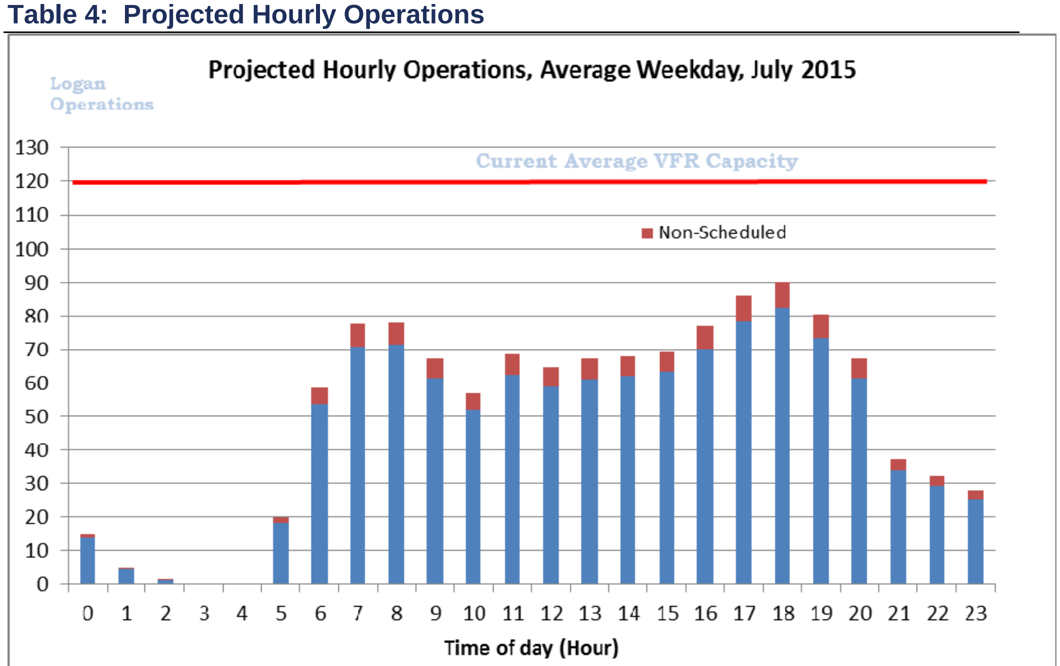
- Scheduled passenger airline flights represent more than 93 percent of total aircraft operations. Passenger airline activity for the Spring and Summer periods were projected based on published advance airline schedules
- Forecasts of monthly activity for other segments (GA, Cargo, Charter) are based on the past three months of actual flight volume and historic patterns of monthly seasonality
- Day-of-week and time of day distributions for non-scheduled segments are based on analysis of Logan radar data
- Projections for each segment were combined to produce the forecast pattern of hourly flight activity for an average weekday, Saturday, and Sunday for the period from February through September

Table 3: Aircraft Operations at Logan Airport



Note: Actual Operations are based on Massport data/air carrier reports and reflect flight cancellations due to weather and other operational impacts.

Table 4: Projected Hourly Operations



Note: Includes projected services by scheduled airlines plus non-scheduled activity including general aviation, charters etc.

Table 5: Forecast Logan Average Weekday Operations, *Feb. – Sep.*

	Average Daily Operations							
Hour Range	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15
0	12	14	11	12	13	14	14	13
1	3	4	3	3	4	4	3	3
2	1	1	0	0	1	1	1	0
3	0	0	0	0	0	0	0	0
4	1	1	0	0	0	0	0	0
5	6	11	17	17	20	18	18	16
6	32	45	49	46	47	54	53	49
7	37	47	55	65	67	71	68	60
8	39	50	73	66	67	71	71	65
9	44	52	60	57	57	61	63	56
10	38	41	43	48	49	52	54	52
11	35	42	48	51	58	62	62	58
12	34	40	50	56	56	59	59	59
13	36	41	51	53	56	61	62	53
14	37	42	52	51	55	62	64	62
15	41	48	56	51	57	63	66	56
16	45	55	63	64	67	70	71	70
17	46	56	75	72	75	78	76	75
18	50	55	71	74	75	82	84	81
19	48	53	61	67	71	73	70	61
20	44	47	50	56	57	61	61	56
21	33	37	33	32	34	34	34	33
22	29	28	24	27	28	29	30	28
23	26	25	28	28	26	25	27	24
Total	**719**	**837**	**974**	**996**	**1,041**	**1,108**	**1,110**	**1,031**

February – March, actual data

April – September, forecast data

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BOSTON-LOGAN INTERNATIONAL AIRPORT MONITORING REPORT ON SCHEDULED AND NON-SCHEDULED FLIGHT ACTIVITY

Peak Period Surcharge Regulation
740 CMR 27:00: Massachusetts Port Authority

Report Number:	**013**
Monitoring Period:	**Through Sept. 2016**
Report Issue Date:	**May 2016**

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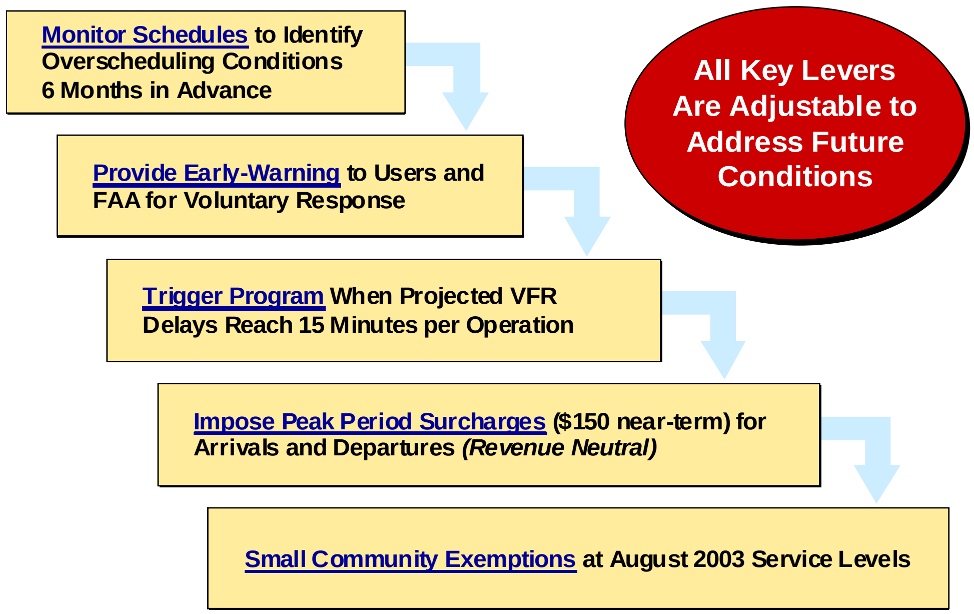

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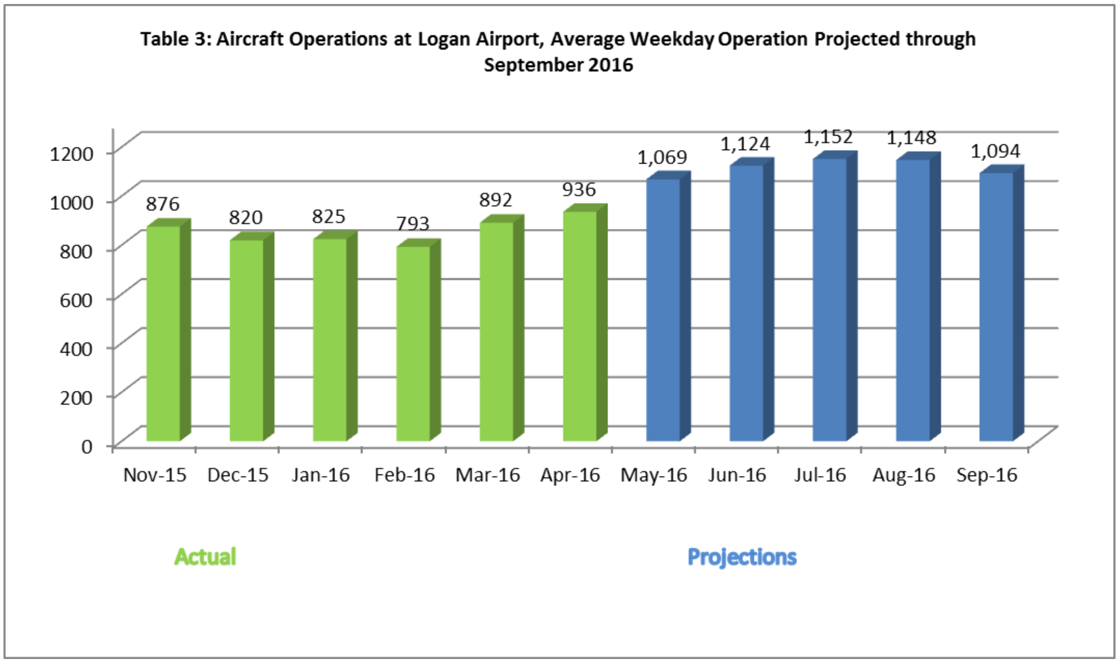

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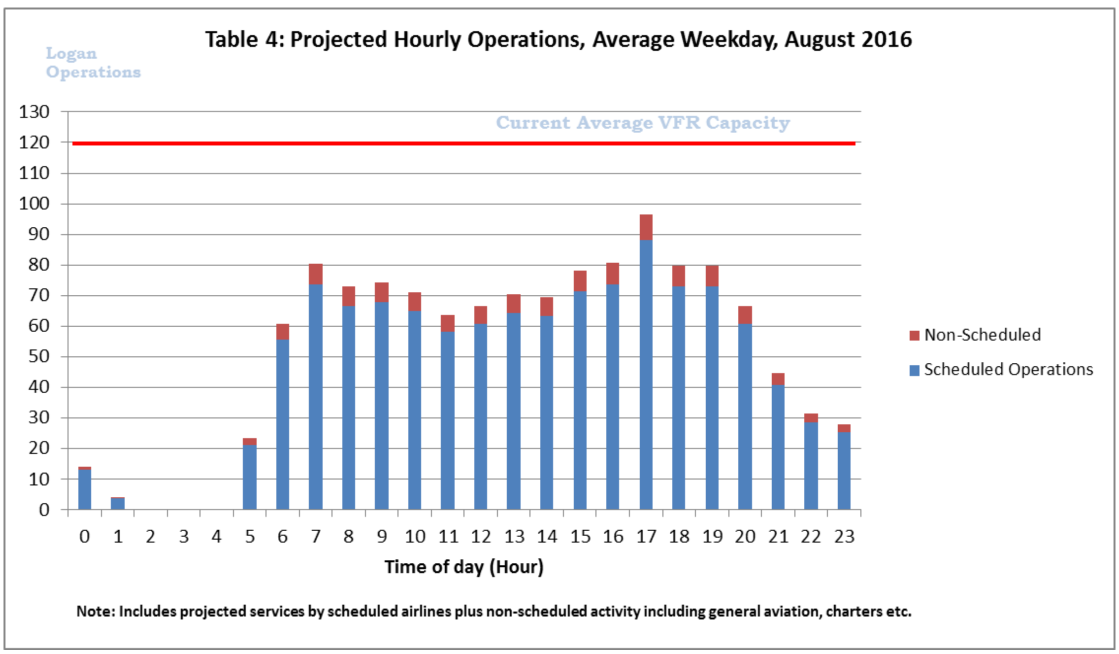
Table 4: Projected Hourly Operations



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Forecast Daily Operations								
Hour Range	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16
0	14	14	12	16	16	16	13	11
1	3	4	3	2	3	4	4	3
2	2	1	0	1	0	0	0	0
3	1	0	0	0	0	0	0	0
4	1	1	0	0	0	0	0	0
5	14	19	17	18	23	26	21	16
6	38	45	51	54	54	58	56	53
7	45	50	58	68	71	66	73	69
8	49	54	76	65	63	66	67	65
9	48	56	63	68	68	71	68	67
10	43	45	45	58	63	66	65	57
11	42	49	50	48	55	57	58	57
12	39	45	52	50	57	61	61	57
13	41	47	53	60	63	61	64	62
14	37	42	55	58	63	66	63	65
15	42	51	59	61	68	70	71	66
16	50	55	66	73	80	81	74	70
17	54	61	79	82	84	87	88	85
18	50	57	75	70	70	71	73	73
19	47	54	64	74	73	75	73	70
20	46	49	52	49	55	58	61	58
21	36	38	35	39	40	38	41	36
22	27	31	25	28	28	31	29	30
23	25	24	30	25	27	24	25	23
Total	**793**	**892**	**1,020**	**1,069**	**1,124**	**1,152**	**1,148**	**1,094**

February – April, actual data

May – September, forecast data

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Reduced/Single Engine Taxiing at Logan Airport Memoranda

This Appendix provides detailed information in support of Chapter 7, *Air Quality/ Emissions Reduction:*

- Memorandum from Edward C. Freni, Massport Director of Aviation, to the Boston Logan Airline Committee, Regarding Single/Reduced-Engine Taxiing and the Use of Idle Reverse Thrust as Strategies to Reduce Aircraft-Generated Emissions and Noise at Boston Logan, Dated May 4, 2015
- Memorandum from Edward C. Freni, Massport Director of Aviation, to the Boston Logan Airline Committee, Regarding Single/Reduced-Engine Taxiing and Other Strategies to Reduce Aircraft-Generated Emissions and Noise at Boston Logan, Dated May 18, 2016
- Simaiakis, I, Khadilkar, H., Balakrishnan, H., Reynolds, T.G., Hansman, R.J., Reilly, B., and Urlass, S. "Demonstration of Reduced Airport Congestion Through Pushback Rate Control." *Ninth USA/Europe Air Traffic Management Research and Development Seminar (ATM2011)*.

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

TO: Boston Logan Air Carriers, Chief Pilots

FROM: Edward C. Freni
Director of Aviation

DATE: May 4, 2015

RE: Single/Reduced-Engine Taxiing and the Use of Idle Reverse Thrust as Strategies to Reduce Aircraft-Generated Emissions and Noise at Boston Logan

As an important user of Boston-Logan International Airport ("Boston Logan"), you are an essential partner in our efforts to ensure that Boston Logan operates in the safest, most dependable and environmentally responsible manner possible. Working together, we have successfully implemented many safety technologies and airfield improvements at Boston Logan and we look forward to continuing these collaborative relationships.

Our success in implementing physical and technological improvements and conducting cutting-edge safety research at Boston Logan is based, in part, on continuing to evaluate and promote operational measures with the potential to reduce environmental impacts from various landside and airside operations. Two important operational measures that have been identified are single/reduced-engine taxiing and the use of idle-reverse thrust.

Based on our outreach to the air carrier community serving Boston Logan and survey information, it is clear that single- or reduced-engine taxiing is being voluntarily utilized by the vast majority of air carriers at Boston Logan. I write to you again to encourage your continued use of this fuel saving and emissions reduction strategy subject to pilot discretion and consistent with air carrier operating safety procedures.

I also encourage your use of idle reverse thrust (or minimize the use of reverse thrust) on landing, as a second operational measure, again, only at the discretion of the pilot and when consistent with air carrier operational safety procedures. This measure provides noise relief to our closest neighbors and, at the same time, provides companion benefits to you, such as reducing fuel burn and engine wear. Clearly, the use of this procedure must be consistent with operational conditions at Boston Logan, including runway surface conditions and whether LAHSO is in use.

On a related note, I want to share with you information regarding recent industry efforts to retrofit A320 aircraft with "vortex generators" to reduce aircraft noise. Although the A320 is a fully compliant/modern aircraft, this is an excellent example of additional, incremental actions we can take as an industry to reduce operational impacts on the environment. Attached please find more information related to this technology.

I encourage you to share this letter with your flight crews and thank you for your continued work to enhance Boston Logan's operational safety and efficiency, while improving its environmental footprint. If you have any questions or would like to discuss any aspect of this letter, please feel free to contact me or Mr. Flavio Leo, Deputy Director of Planning and Strategy, at 617-568-3528.

Edward C. Freni
Director of Aviation

Deutsch Contact Imprint Mobile Version

Lufthansa Group

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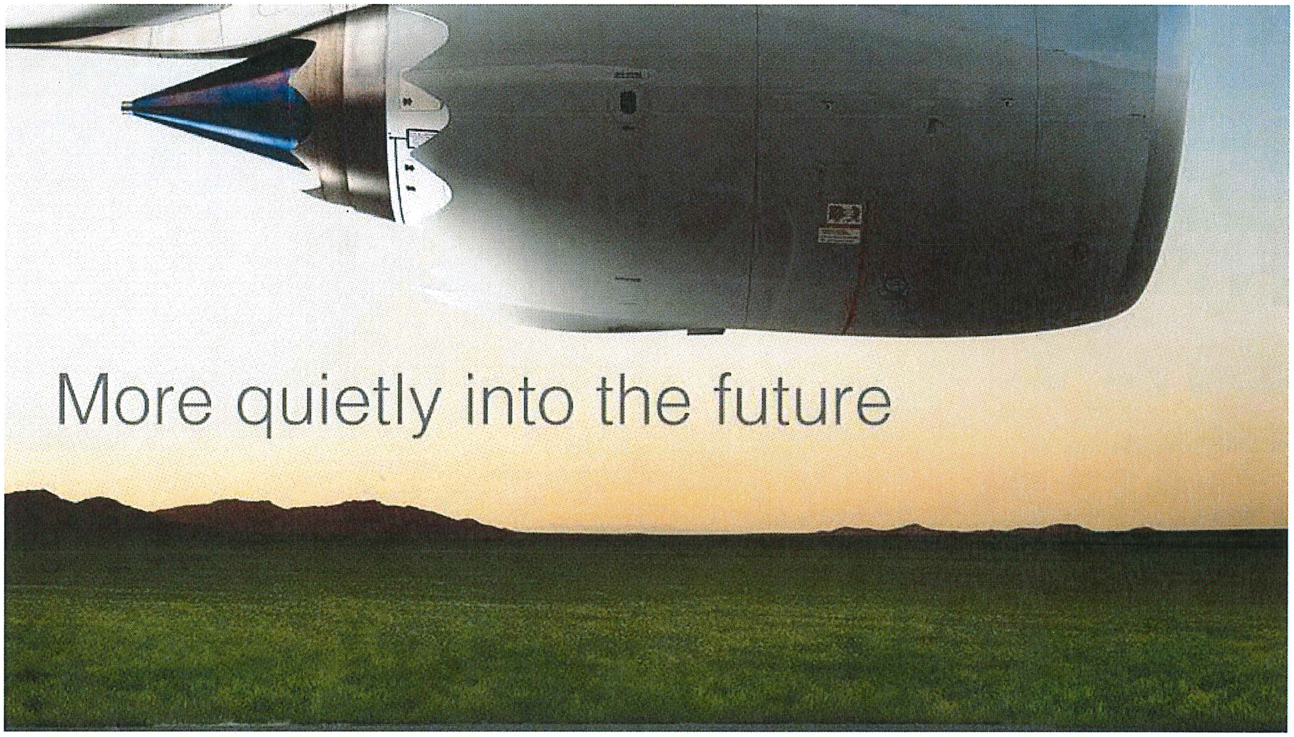


Flight Noise Reduction Investment **Technical Upgrades** Noise Research Noise-Reducing Procedures Dialogue

Retrofitting the existing fleet

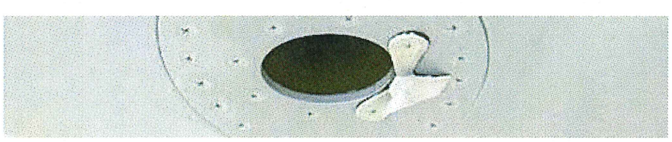
The Lufthansa Group is also retrofitting older aircraft in its fleet with noise-reducing technologies. In this connection the Group is working closely with the German Aerospace Center (DLR) and the various aircraft manufacturers.

Lufthansa is retrofitting more than 200 aircraft with vortex generators so that they will fly more quietly in the future.

In February 2014 Lufthansa became the first airline in the world to take delivery of an Airbus A320 equipped with vortex generators. A total of 157 aircraft in the existing fleet will be equipped with the new noise-reducing component, so that, when the expected new deliveries are added in, more than 200 A320 aircraft in total will be flying more quietly. As result, every second Lufthansa landing in Frankfurt and one in three in Munich will become audibly quieter. Overfly measurements revealed that the vortex generators are able to eliminate two unpleasant tones and thereby lower the aircraft's total noise level on approach by up to four decibels at distances between 17 and 10 kilometers from the runway. Thus the Lufthansa Group has realized a key objective of the "Alliance for More Noise Protection", a joint initiative of the Lufthansa Group, Fraport, the airline association BARIG, DFS, the Airport and Region Forum (FFR), and the government of the State of Hesse.

A320 audio tests

A320 audio tests with and without vortex generators on the **final approach at Frankfurt Airport** from the Offenbach-Lauterborn monitoring point



Further information

Refitting existing aircraft

→ Active noise protection – More than 200 Lufthansa Airbus A320 aircraft will become quieter from February 2014

Video: Active noise protection at Frankfurt Airport

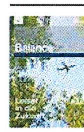
→ Retrofitting of the Boeing 737 fleet

Press Releases

29.10.13

→ Lufthansa to make majority of short-haul aircraft quieter

Sustainability Report



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Without vortex generators **With vortex generators**

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

To: Boston Airline Committee

From: Edward C. Freni
Director of Aviation

Date: May 18, 2016

RE: Single/Reduced-Engine Taxiing and Other Strategies to Reduce Aircraft- Generated Emissions and Noise at Boston Logan

As an important user of Boston-Logan International Airport ("Boston Logan"), you are an essential partner in our efforts to ensure that Boston Logan operates in the safest, most dependable and environmentally responsible manner feasible. Our success in implementing physical and technological improvements and piloting cutting-edge safety enhancements at Boston Logan is based, in part, on continuing to evaluate and promote operational measures with the potential to reduce environmental impacts from various landside and airside operations.

Important measures that have been identified are:

1.) Single/reduced-engine taxiing,
2.) Use of idle-reverse thrust, and
3.) Retrofitting older A320 aircraft with "vortex generators" to reduce aircraft noise.

Based on outreach to the Logan air carrier community, it is clear that single- or reduced-engine taxiing is being voluntarily implemented by the vast majority of air carriers at Boston Logan. I write to you again to encourage your continued use of this fuel-saving emissions reduction strategy, subject to pilot discretion and to the extent consistent with your established operating safety procedures.

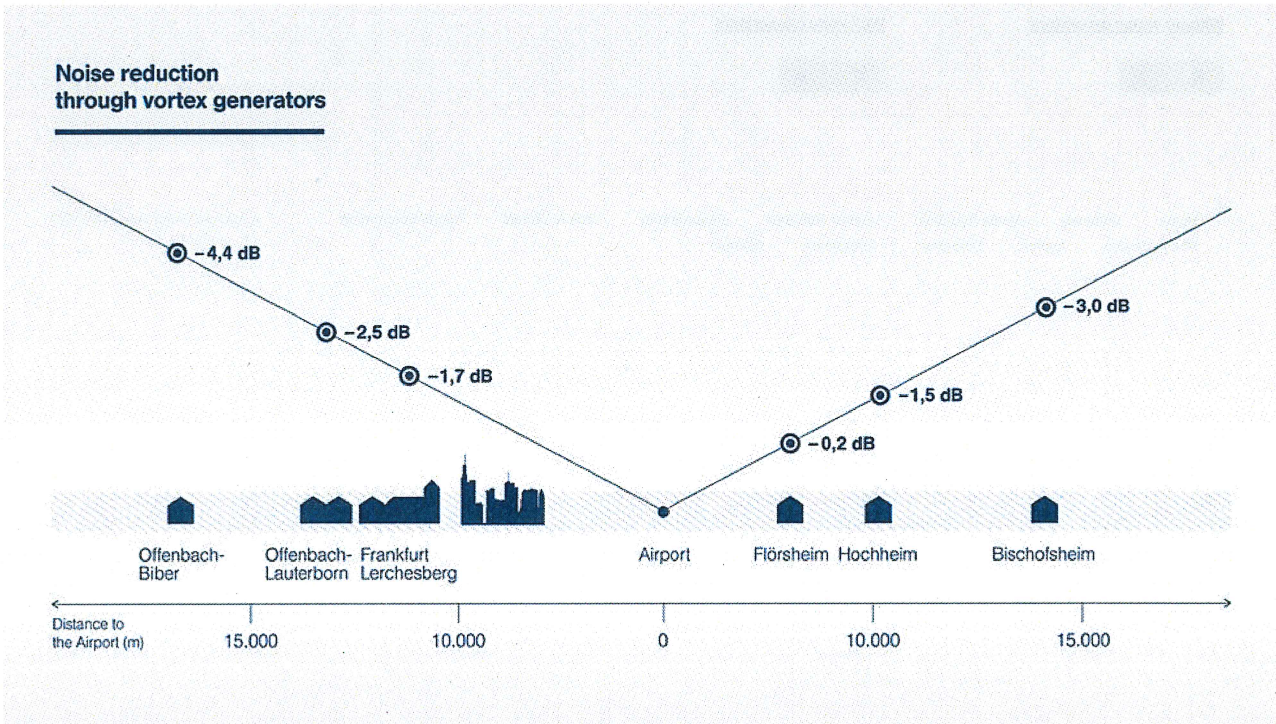
I also encourage your use of idle reverse thrust (or minimize the use of reverse thrust) on landing, as a second operational measure, again, only at the discretion of the pilot and only to the extent consistent with your established operational safety procedures. This measure provides noise relief to our nearest neighbors and, at the same time, provides companion benefits to you, such as reducing fuel burn and engine wear. Clearly, the use of this procedure must be consistent with operational conditions at Boston Logan, including runway surface conditions and whether LAHSO is in use.

Finally, I again want to share with you information regarding recent industry efforts to retrofit A320 aircraft with "vortex generators" to reduce airframe noise. Although the A320 is a fully noise-compliant/modern aircraft, this is an excellent example of additional, incremental actions we can take as an industry to reduce operational impacts on the environment. Attached please find more information related to this technology.

Thank you for your continued work to enhance Boston Logan's operational safety and efficiency, while improving its environmental footprint. If you have any questions or would like to discuss any aspect of this letter, please feel free to contact me or Mr. Flavio Leo, Director of Planning and Strategy, at 617-568-3528.

Edward C. Freni
Director of Aviation

Attachments



Retrofitting the existing fleet

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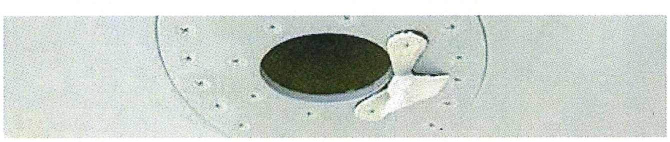

Press Releases

25.06.2015
Lufthansa now flying much quieter
12.02.14
Lufthansa takes delivery of world's first aircraft with vortex generators
29.10.13
Lufthansa to make majority of short-haul aircraft quieter

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Without vortex generators **With vortex generators**

Demonstration of Reduced Airport Congestion Through Pushback Rate Control

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***Abstract*—Airport surface congestion results in significant increases in taxi times, fuel burn and emissions at major airports. This paper describes the field tests of a congestion control strategy at Boston Logan International Airport. The approach determines a suggested rate to meter pushbacks from the gate, in order to prevent the airport surface from entering congested states and to reduce the time that flights spend with engines on while taxiing to the runway. The field trials demonstrated that significant benefits were achievable through such a strategy: during eight four-hour tests conducted during August and September 2010, fuel use was reduced by an estimated 12,000-15,000 kg (3,900-4,900 US gallons), while aircraft gate pushback times were increased by an average of only 4.3 minutes for the 247 flights that were held at the gate.**

Keywords- departure management, pushback rate control, airport congestion control, field tests

I. Introduction

Aircraft taxiing on the surface contribute significantly to the fuel burn and emissions at airports. The quantities of fuel burned, as well as different pollutants such as Carbon Dioxide, Hydrocarbons, Nitrogen Oxides, Sulfur Oxides and Particulate Matter, are proportional to the taxi times of aircraft, as well as other factors such as the throttle settings, number of engines that are powered, and pilot and airline decisions regarding engine shutdowns during delays.

Airport surface congestion at major airports in the United States is responsible for increased taxi-out times, fuel burn and emissions [1]. Similar trends have been noted in Europe, where it is estimated that aircraft spend 10-30% of their flight time taxiing, and that a short/medium range A320 expends as much as 5-10% of its fuel on the ground [2]. Domestic flights in the United States emit about 6 million metric tonnes of CO_2, 45,000 tonnes of CO, 8,000 tonnes of NOx, and 4,000 tonnes of HC taxiing out for takeoff; almost half of these emissions are at the 20 most congested airports in the country. The purpose of the Pushback Rate Control Demonstration at Boston Logan International Airport (BOS) was to show that a significant portion of these impacts could be reduced through measures to limit surface congestion.

This work was supported by the Federal Aviation Administration's Office of Environment and Energy through MIT Lincoln Laboratory and the Partnership for AiR Transportation Noise and Emissions Reduction (PARTNER).

A simple airport congestion control strategy would be a state-dependent pushback policy aimed at reducing congestion on the ground. The *N-control* strategy is one such approach, and was first considered in the Departure Planner project [3]. Several variants of this policy have been studied in prior literature [4, 5, 6, 7]. The policy, as studied in these papers, is effectively a simple threshold heuristic: if the total number of departing aircraft on the ground exceeds a certain threshold, further pushbacks are stopped until the number of aircraft on the ground drops below the threshold. By contrast, the *pushback rate control* strategy presented in this paper does not stop pushbacks once the surface is in a congested state; instead it regulates the rate at which aircraft pushback from their gates during high departure demand periods so that the airport does not reach undesirable highly congested states.

A. Motivation: Departure throughput analysis

The main motivation for our proposed approach to reduce taxi times is an observation of the performance of the departure throughput of airports. As more aircraft pushback from their gates onto the taxiway system, the throughput of the departure runway initially increases because more aircraft are available in the departure queue. However, as this number, denoted N, exceeds a threshold, the departure runway capacity becomes the limiting factor, and there is no additional increase in throughput. We denote this threshold as N^*. This behavior can be further parameterized by the number of arrivals. The dependence of the departure throughput on the number of aircraft taxiing out and the arrival rate is illustrated for one runway configuration in Figure 1 using 2007 data from FAA's Aviation System Performance Metrics (ASPM) database. Beyond the threshold N^*, any additional aircraft that pushback simply increase their taxi-out times [8]. The value of N^* depends on the airport, arrival demand, runway configuration, and meteorological conditions. During periods of high demand, the pushback rate control protocol regulates pushbacks from the gates so that the number of aircraft taxiing out stays close to a specified value, N_{ctrl}, where $N_{\text{ctrl}} > N^*$, thereby ensuring that the airport does not reach highly-congested states. While the choice of N_{ctrl} must be large enough to maintain runway utilization, too large a value will be overly conservative, and result in a loss of benefit from the control strategy.

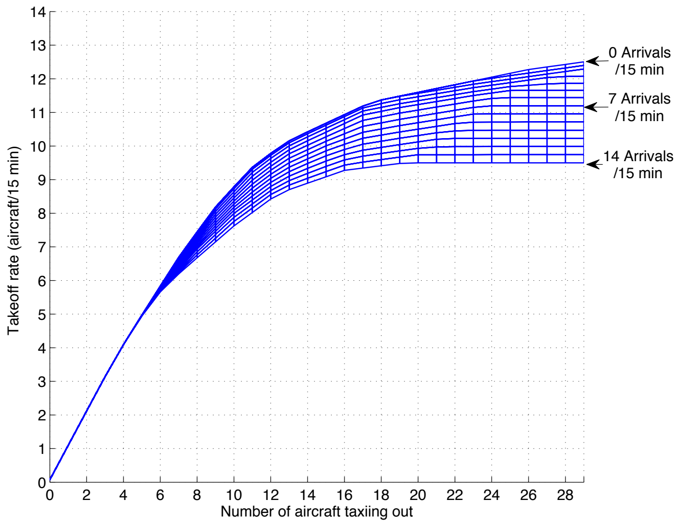

Fig. 1: Regression of the departure throughput as a function of the number of aircraft taxiing out, parameterized by the arrival rate for 22L, 27 | 22L, 22R configuration, under VMC [9].

II. Design of the pushback rate control protocol

The main design consideration in developing the pushback rate control protocol was to incorporate effective control techniques into current operational procedures with minimal additional controller workload and procedural modifications. After discussions with the BOS facility, it was decided that suggesting a rate of pushbacks (to the BOS Gate controller) for each 15-min period was an effective strategy that was amenable to current procedures.

The two important parameters that need to be estimated in order to determine a robust control strategy are the N^* threshold and the departure throughput of the airport for different values of N. These parameters can potentially vary depending on meteorological conditions, runway configuration and arrival demand (as seen in Figure 1), but also on the fleet mix and the data sources we use.

A. Runway configurations

BOS experiences Visual Meteorological Conditions (VMC) most of the time (over 83% of the time in 2007). It has a complicated runway layout consisting of six runways, five of which intersect with at least one other runway, as shown in Figure 2. As a result, there are numerous possible runway configurations: in 2007, 61 different configurations were reported. The most frequently-used configurations under VMC are 22L, 27 | 22L, 22R; 4L, 4R | 4L, 4R, 9; and 27, 32 | 33L, where the notation 'R1, R2 | R3, R4' denotes arrivals on runways R1 and R2, and departures on R3 and R4. The above configurations accounted for about 70% of times under VMC.

We note that, of these frequently used configurations, 27, 32 | 33L involves taxiing out aircraft across active runways. Due to construction on taxiway "November" between runways 15L and 22R throughout the duration of the demo, departures headed to 22R used 15L to cross runway 22R onto taxiway

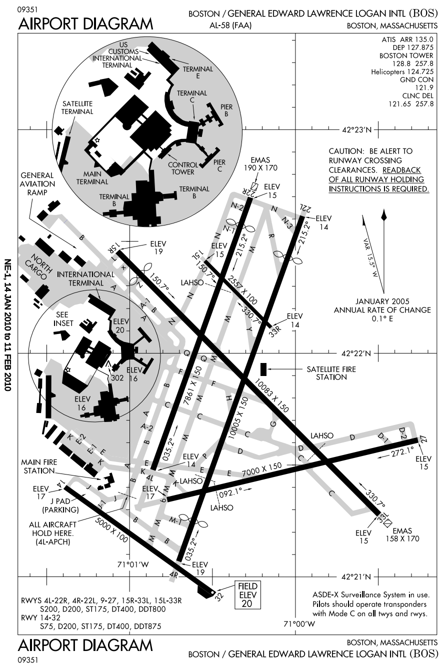

Fig. 2: BOS airport diagram, showing alignment of runways.

"Mike". This resulted in departing aircraft crossing active runways in the 27, 22L | 22L, 22R configuration as well.

During our observations prior to the field tests as well as during the demo periods, we found that under Instrument Meteorological Conditions (IMC), arrivals into BOS are typically metered at the rate of 8 aircraft per 15 minutes by the TRACON. This results in a rather small departure demand, and there was rarely congestion under IMC at Boston during the evening departure push. For this reason, we focus on configurations most frequently used during VMC operations for the control policy design.

B. Fleet mix

Qualitative observations at BOS suggest that the departure throughput is significantly affected by the number of propeller-powered aircraft (props) in the departure fleet mix. In order to determine the effect of props, we analyze the tradeoff between takeoff and landing rates at BOS, parameterized by the number of props during periods of high departure demand.

Figure 3 shows that under Visual Meteorological Conditions (VMC), the number of props has a significant impact on the departure throughput, resulting in an increase at a rate of nearly one per 15 minutes for each additional prop departure. This observation is consistent with procedures at BOS, since air traffic controllers fan out props in between jet departures, and therefore the departure of a prop does not significantly interfere with jet departures. The main implication of this observation for the control strategy design at BOS was that props could be exempt from both the pushback control as well as the counts of aircraft taxiing out (N). Similar analysis also shows that heavy departures at BOS do not have a significant

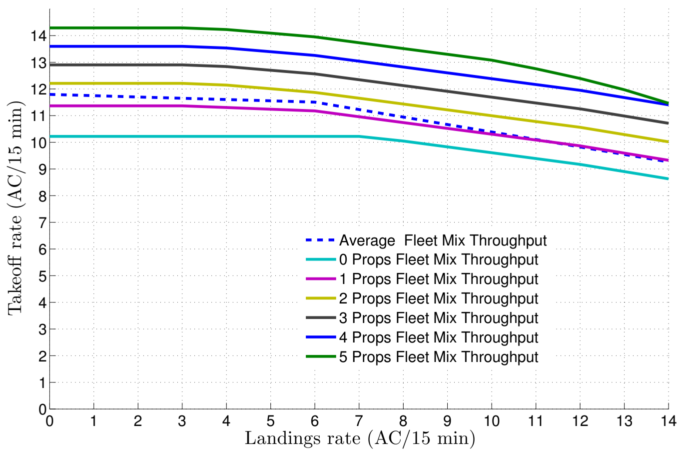

Fig. 3: Regression of the takeoff rate as a function of the landing rate, parameterized by the number of props in a 15-minute interval for 22L, 27 | 22L, 22R configuration, under VMC [9].

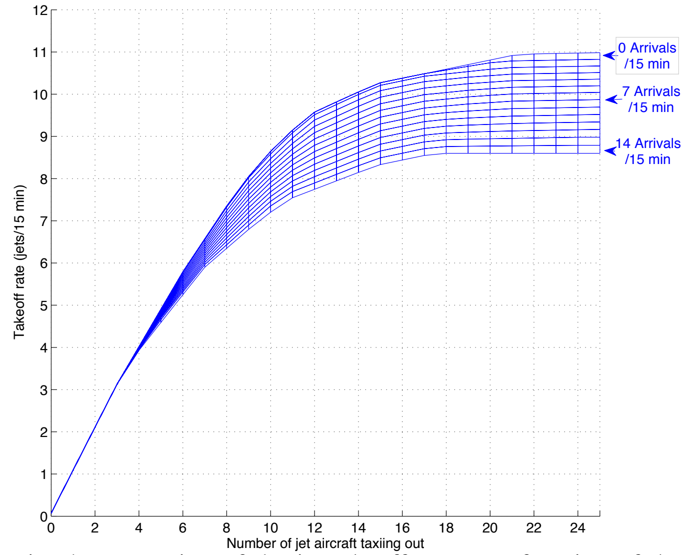

Fig. 4: Regression of the jet takeoff rate as a function of the number of departing jets on the ground, parameterized by the number of arrivals for 22L, 27 | 22L, 22R configuration, under VMC [9].

impact on departure throughput, in spite of the increased wake-vortex separation that is required behind heavy weight category aircraft. This can be explained by the observation that air traffic controllers at BOS use the high wake vortex separation requirement between a heavy and a subsequent departure to conduct runway crossings, thereby mitigating the adverse impact of heavy weight category departures [9].

Motivated by this finding, we can determine the dependence of the jet (i.e., non-prop) departure throughput as a function of the number of jet aircraft taxiing out, parameterized by the number of arrivals, as illustrated in Figure 4. This figure illustrates that during periods in which arrival demand is high, the jet departure throughput saturates when the number of jets taxiing out exceeds 17 (based on ASPM data).

C. Data sources

It is important to note that Figure 1, Figure 3 and Figure 4 are determined using ASPM data. Pushback times in ASPM are determined from the brake release times reported through the ACARS system, and are prone to error because about 40% of the flights departing from BOS do not automatically report these times [10]. Another potential source of pushback and takeoff times is the Airport Surface Detection Equipment Model X (or ASDE-X) system, which combines data from airport surface radars, multilateration sensors, ADS-B, and aircraft transponders [11]. While the ASDE-X data is likely to be more accurate than the ASPM data, it is still noisy, due to factors such as late transponder capture (the ASDE-X tracks only begin after the pilot has turned on the transponder, which may be before or after the actual pushback time), aborted takeoffs (which have multiple departure times detected), flights cancelled after pushback, etc. A comparison of both ASDE-X and ASPM records with live observations made in the tower on August 26, 2010 revealed that the average difference between the number of pushbacks per 15-minutes as recorded by ASDE-X and by visual means is 0.42, while it is -3.25 for ASPM and visual observations, showing that the ASPM records differ considerably from ASDE-X and live observations. The above comparison motivates the recalibration of airport performance curves and parameters using ASDE-X data in addition to ASPM data. This is because ASPM data is not available in real-time and will therefore not be available for use in real-time deployments, and the ASDE-X data is in much closer agreement to the visual observations than ASPM.

We therefore conduct similar analysis to that shown in Figure 4, using ASDE-X data. The results are shown in Figure 5. We note that the qualitative behavior of the system is similar to what was seen with ASPM data, namely, the jet throughput of the departure runway initially increases because more jet aircraft are available in the departure queue, but as this number exceeds a threshold, the departure runway capacity becomes the limiting factor, and there is no additional increase in throughput. By statistically analyzing three months of ASDE-X data from Boston Logan airport using the methodology outlined in [9], we determine that the average number of active jet departures on the ground at which the surface saturates is 12 jet aircraft for the 22L, 27 | 22L, 22R configuration, during periods of moderate arrival demand. This value is close to that deduced from Figure 5, using visual means.

D. Estimates of N^*

Table I shows the values of N^* for the three main runway configurations under VMC, that were used during the field tests based on the ASDE-X data analysis. For each runway configuration, we use plots similar to Figure 5 to determine the expected throughput. For example, if the runway configuration is 22L, 27 | 22L, 22R, 11 jets are taxiing out, and the expected arrival rate is 9 aircraft in the next 15 minutes, the expected departure throughput is 10 aircraft in the next 15 minutes.

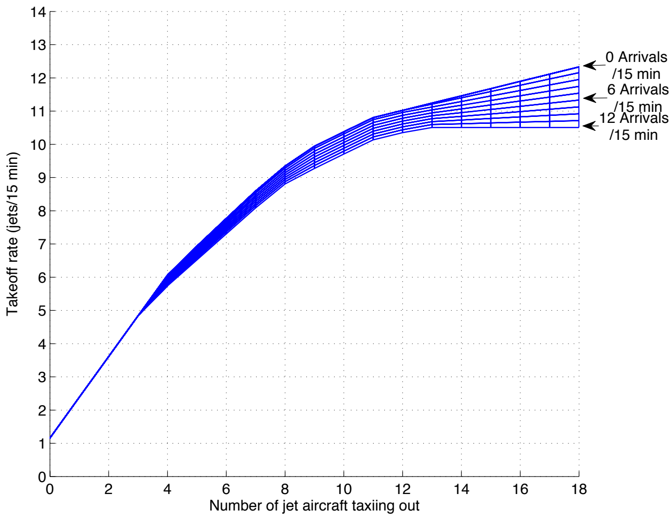

Fig. 5: Regression of the takeoff rate as a function of the number of jets taxiing out, parameterized by the number of arrivals, using ASDE-X data, for the 22L, 27 | 22L, 22R configuration.

III. Implementation of Pushback Rate Control

The pushback rate was determined so as to keep the number of jets taxiing out near a suitable value (N_{ctrl}), where N_{ctrl} is greater than N^*, in order to mitigate risks such as under-utilizing the runway, facing many gate conflicts, or being unable to meet target departure times. Off-nominal events such as gate-use conflicts and target departure times were carefully monitored and addressed. Figure 6 shows a schematic of the decision process to determine the suggested pushback rate.

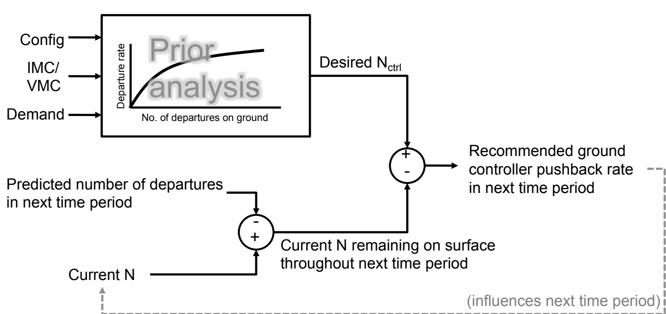

Fig. 6: A schematic of the pushback rate calculation.

The determination of the pushback rate is conducted as follows. Prior to the start of each 15-minute period, we:

1) Observe the operating configuration, VMC/IMC, and the predicted number of arrivals in the next 15 minutes (from ETMS) and using these as inputs into the appropriate departure throughput saturation curves (such as Figure 5), determine the expected jet departure throughput.
2) Using visual observations, count the number of departing jets currently active on the surface. We counted a departure as active once the pushback tug was attached to the aircraft and it was in the process of pushing back.
3) Calculate the difference between the current number of active jet departures and the expected jet departure throughput. This difference is the number of currently active jets that are expected to remain on the ground through the next 15 min.
4) The difference between N_{ctrl} and the result of the previous step provides us with the additional number of pushbacks to recommend in next 15 minutes.
5) Translate the suggested number of pushbacks in the next 15 minutes to an approximate pushback rate in a shorter time interval more appropriate for operational implementation (for example, 10 aircraft in the next 15 minutes would translate to a rate of "2 per 3 minutes.").

TABLE I
Values of N^* estimated from the analysis of ASDE-X data.

Configuration	N^*
22L, 27 | 22L, 22R	12
27, 32 | 33L	12
4L, 4R | 4L, 4R, 9	15

A. Communication of recommended pushback rates and gate-hold times

During the demo, we used color-coded cards to communicate suggested pushback rates to the air traffic controllers, thereby eliminating the need for verbal communications. We used one of eight 5 in × 7.5 in cards, with pushback rate suggestions that ranged from "1 per 3 minutes" (5 in 15 minutes) to "1 aircraft per minute" (15 in 15 minutes), in addition to "Stop" (zero rate) and "No restriction" cards, as shown in Figure 7 (left). The setup of the suggested rate card in the Boston Gate controllers position is shown in Figure 7 (right).

Fig. 7: (Left) Color-coded cards that were used to communicate the suggested pushback rates. (Right) Display of the color-coded card in the Boston Gate controller's position.

The standard format of the gate-hold instruction communicated by the Boston Gate controller to the pilots included both the current time, the length of the gate-hold, and the time at which the pilot could expect to be cleared. For example:
Boston Gate: "AAL123, please hold push for 3 min. Time is now 2332, expect clearance at 2335. Remain on my frequency, I will contact you."

In this manner, pilots were made aware of the expected gate-holds, and could inform the controller of constraints such as gate conflicts due to incoming aircraft. In addition, ground crews could be informed of the expected gate-hold time, so that they could be ready when push clearance was given. The post-analysis of the tapes of controller-pilot communications showed that the controllers cleared aircraft for push at the times they had initially stated (i.e., an aircraft told to expect to push at 2335 would indeed be cleared to push at 2335), and that they also accurately implemented the push rates suggested by the cards.

B. Handling of off-nominal events

The implementation plan also called for careful monitoring of off-nominal events and system constraints. Of particular concern were gate conflicts (for example, an arriving aircraft is assigned a gate at which a departure is being held), and the ability to meet controlled departure times (Expected Departure Clearance Times or EDCTs) and other constraints from Traffic Management Initiatives. After discussions with the Tower and airlines prior to the field tests, the following decisions were made:

1) Flights with EDCTs would be handled as usual and released First-Come-First-Served. Long delays would continue to be absorbed in the standard holding areas. Flights with EDCTs did not count toward the count of active jets when they pushed back; they counted toward the 15-minute interval in which their departure time fell. An analysis of EDCTs from flight strips showed that the ability to meet the EDCTs was not impacted during the field tests.
2) Pushbacks would be expedited to allow arrivals to use the gate if needed. Simulations conducted prior to the field tests predicted that gate-conflicts would be relatively infrequent at BOS; there were only two reported cases of potential gate-conflicts during the field tests, and in both cases, the departures were immediately released from the gate-hold and allowed to pushback.

C. Determination of the time period for the field trials

The pushback rate control protocol was tested in select evening departure push periods (4-8PM) at BOS between August 23 and September 24, 2010. Figure 8 shows the average number of departures on the ground in each 15-minute interval using ASPM data. There are two main departure pushes each day. The evening departure push differs from the morning one because of the larger arrival demand in the evenings. The morning departure push presents different challenges, such as a large number of flights with controlled departure times, and a large number of tow-ins for the first flights of the day.

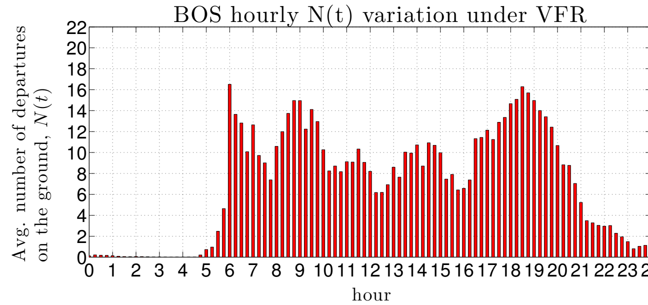

Fig. 8: Variation of departure demand (average number of active departures on the ground) as a function of the time of day.

IV. RESULTS OF FIELD TESTS

Although the pushback rate control strategy was tested at BOS during 16 demo periods, there was very little need to control pushbacks when the airport operated in its most efficient configuration (4L, 4R | 4L, 4R, 9), and in only eight of the demo periods was there enough congestion for gate-holds to be experienced. There was insufficient congestion for recommending restricted pushback rates on August 23, September 16, 19, 23, and 24. In addition, on September 3 and 12, there were no gate-holds (although departure demand was high, traffic did not build up, and no aircraft needed to be held at the gate). For the same reason, only one aircraft received a gate-hold of 2 min on September 17. The airport operated in the 4L, 4R | 4L, 4R, 9 configuration on all three of these days. In total, pushback rate control was in effect during the field tests for over 37 hours, with about 24 hours of test periods with significant gate-holds.

A. Data analysis examples

In this section, we examine three days with significant gate-holds (August 26, September 2 and 10) in order to describe the basic features of the pushback rate control strategy.

Figure 9 shows taxi-out times from one of the test periods, September 2. Each green bar in Figure 9 represents the actual taxi-out time of a flight (measured using ASDE-X as the duration between the time when the transponder was turned on and the wheels-off time). The red bar represents the gate-hold time of the flight (shown as a negative number). In practice, there is a delay between the time the tug pushes them from the gate and the time their transponder is turned on, but statistical analysis showed that this delay was random, similarly distributed for flights with and without gate-holds, and typically about 4 minutes. We note in Figure 9 that as flights start incurring gate-holds (corresponding to flights departing at around 1900 hours), there is a corresponding decrease in the active taxi-out times, i.e., the green lines. Visually, we notice that as the length of the gate-hold (red bar) increases, the length of the taxi-out time (green bar) proportionately decreases. There are still a few flights with large taxi-out times, but these typically correspond to flights with EDCTs. These delays were handled as in normal operations (i.e., their gate-hold times were not increased), as was agreed with the tower and airlines. Finally, there are also a few flights with no gate-holds and very short taxi-out times, typically corresponding to props.

The impact of the pushback rate control strategy can be further visualized by using ASDE-X data, as can be seen in

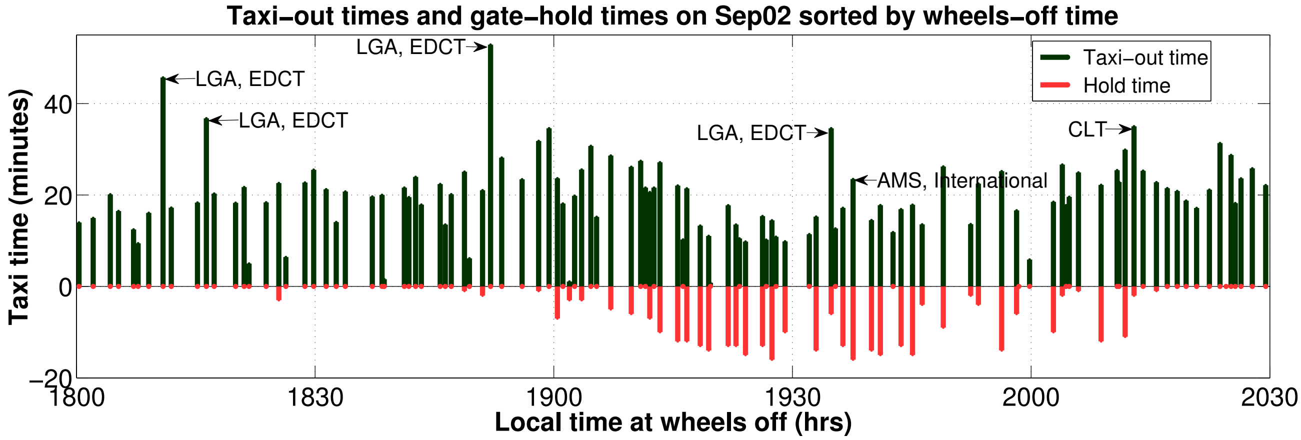

Fig. 9: Taxi-out and gate-hold times from the field test on September 2, 2010.

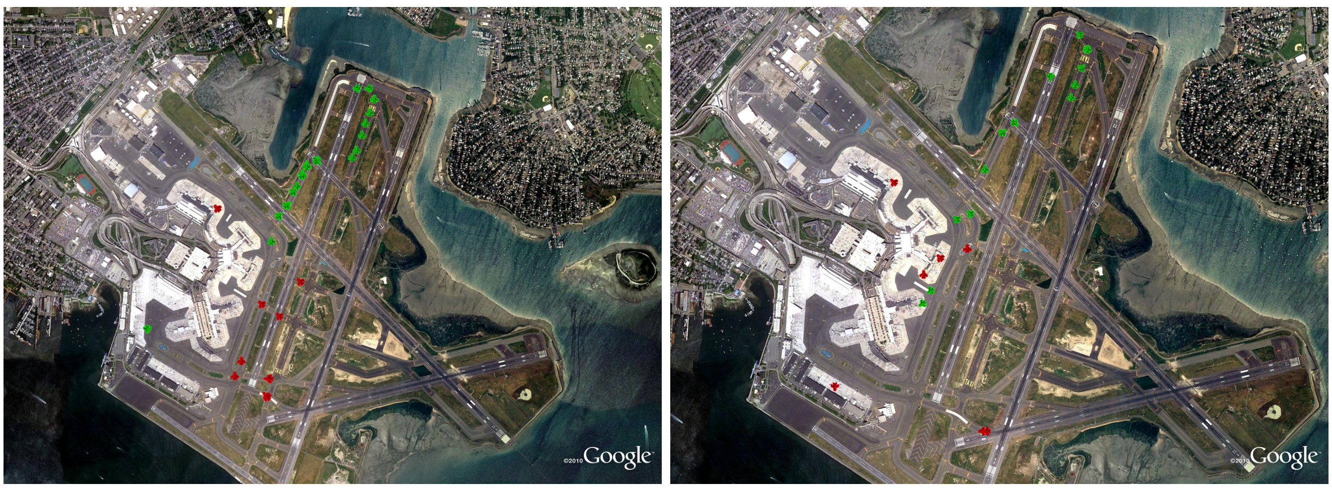

Fig. 10: Snapshots of the airport surface, (left) before gate-holds started, and (right) during gate-holding. Departing aircraft are shown in green, and arrivals in red. We note that the line of 15 departures between the ramp area and the departure runway prior to commencement of pushback rate control reduces to 8 departures with gate-holds. The white area on the taxiway near the top of the images indicates the closed portion of taxiway "November".

the Figure 10, which shows snapshots of the airport surface at two instants of time, the first before the gate-holds started, and the second during the gate-holds. We notice the significant decrease in taxiway congestion, in particular the long line of aircraft between the ramp area and the departure runway, due to the activation of the pushback rate control strategy.

Looking at another day of trials with a different runway configuration, Figure 11 shows taxi-out times from the test period of September 10. In this plot, the flights are sorted by pushback time. We note that as flights start incurring gate-holds, their taxi time stabilizes at around 20 minutes. This is especially evident during the primary departure push between 1830 and 1930 hours. The gate-hold times fluctuate from 1-2 minutes up to 9 minutes, but the taxi-times stabilize as the number of aircraft on the ground stabilizes to the specified N_{ctrl} value. Finally, the flights that pushback between 1930 and 2000 hours are at the end of the departure push and derive the most benefit from the pushback rate control strategy: they have longer gate holds, waiting for the queue to drain and then taxi to the runway facing a gradually diminishing queue.

Figure 12 further illustrates the benefits of the pushback rate control protocol, by comparing operations from a day with pushback rate control (shown in blue) and a day without it (shown in red), under similar demand and configuration. The upper plot shows the average number of jets taxiing-out, and the lower plot the corresponding average taxi-out time, per 15-minute interval. We note that after 1815 hours on September 10, the number of jets taxiing out stabilized at around 15. As a result, the taxi-out times stabilized at about 16 minutes. Pushback rate control smooths the rate of the pushbacks so as to bring the airport state to the specified state, N_{ctrl}, in a controlled manner. Both features of pushback rate control, namely, smoothing of demand and prevention of congestion can be observed by comparing the evenings of September 10 and September 15. We see that on September 15, in the absence of pushback rate control, as traffic started accumulating at 1745 hours, the average taxi-out time grew to over 20 minutes. During the main departure push (1830 to

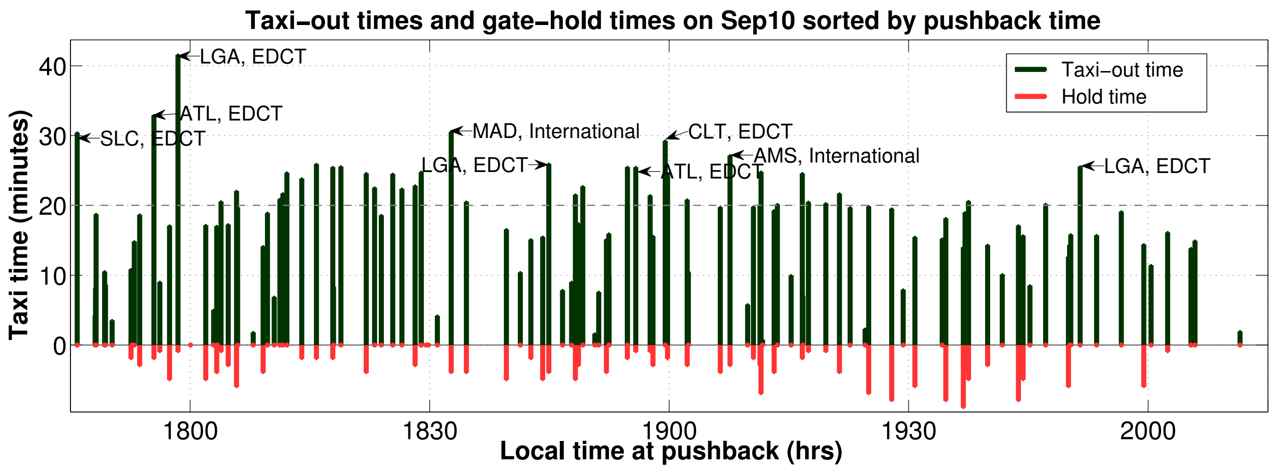

Fig. 11: Taxi-out and gate-hold times from the field test on September 10, 2010.

1930), the average number of jets taxiing out stayed close to 20 and the average taxi-out time was about 25 minutes.

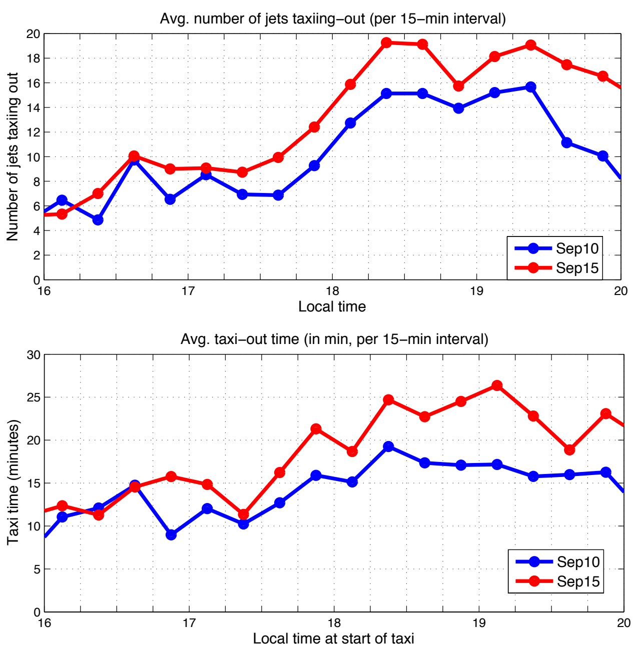

Fig. 12: Surface congestion (top) and average taxi-out times (bottom) per 15-minutes, for (blue) a day with pushback rate control, and (red) a day with similar demand, same runway configuration and visual weather conditions, but without pushback rate control. Delay attributed to EDCTs has been removed from the taxi-out time averages.

Similarly, Figure 13 compares the results of a characteristic pushback rate control day in runway configuration 27, 22L | 22L, 22R, August 26, to a similar day without pushback rate control. We observe that for on August 26, the number of jets taxiing out during the departure push between 1830 and 1930 hours stabilized at 15 with an average taxi-out time of about 20 minutes. On August 17, when pushback rate control was not in effect, the number of aircraft reached 20 at the peak of the push and the average taxi-out times were higher than those of August 26.

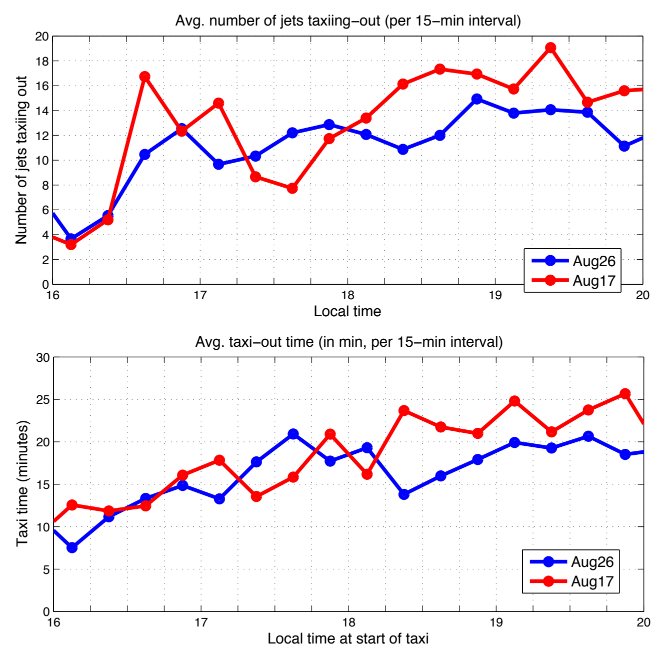

Fig. 13: Ground congestion (top) and average taxi-out times (bottom) per 15-minutes, for (blue) a day with pushback rate control, and (red) a day with similar demand, same runway configuration and weather conditions, but without pushback rate control. Delay attributed to EDCTs has been removed from the taxi-out time averages.

B. Runway utilization

The overall objective of the field test was to maintain pressure on the departure runways, while limiting surface congestion. By maintaining runway utilization, it is reasonable to expect that gate-hold times translate to taxi-out time reduction, as suggested by Figure 9. We therefore also carefully analyze runway utilization (top) and departure queue sizes (bottom) during periods of pushback rate control, as illustrated in Figure 14.

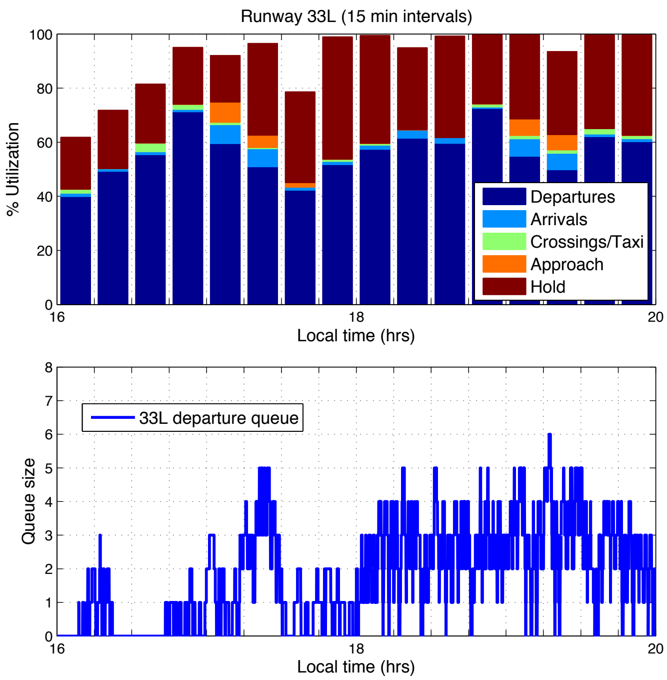

Fig. 14: Runway utilization plots (top) and queue sizes (bottom) for the primary departure runway (33L) during the field test on September 10, 2010. These metrics are evaluated through the analysis of ASDE-X data.

In estimating the runway utilization, we determine (using ASDE-X data) what percentage of each 15-min interval corresponded to a departure on takeoff roll, to aircraft crossing the runway, arrivals (that requested landing on the departure runway) on final approach, departures holding for takeoff clearance, etc. We note that between 1745 and 2000 hours, when gate-holds were experienced, the runway utilization was kept at or close to 100%, with a persistent departure queue as well.

Runway utilization was maintained consistently during the demo periods, with the exception of a three-minute interval on the third day of pushback rate control. On this instance, three flights were expected to be at the departure runway, ready for takeoff. Two of these flights received EDCTs as they taxied (and so were not able to takeoff at the originally predicted time), and the third flight was an international departure that had longer than expected pre-taxi procedures. Learning from this experience, we were diligent in ensuring that EDCTs were gathered as soon as they were available, preferably while the aircraft were still at the gate. In addition, we incorporated the longer taxi-out times of international departures into our predictions. As a result of these measures, we ensured that runway utilization was maintained over the remaining duration of the trial. It is worth noting that the runway was "starved" in this manner for only 3 minutes in over 37 hours of pushback rate control, demonstrating the ability of the approach to adapt to the uncertainties in the system.

V. Benefits analysis

Table II presents a summary of the gate-holds on the eight demo periods with sufficient congestion for controlling pushback rates. As mentioned earlier, we had no significant congestion when the airport was operating in its most efficient configuration (4L, 4R | 4L, 4R, 9).

TABLE II
SUMMARY OF GATE-HOLD TIMES FOR THE EIGHT DEMO PERIODS WITH SIGNIFICANT GATE-HOLDS.

	Date	Period	Configuration	No. of gate-holds	Average gate-hold (min)	Total gate-hold (min)
1	8/26	4.45-8PM	27,22L | 22L,22R	63	4.06	256
2	8/29	4.45-8PM	27,32 | 33L	34	3.24	110
3	8/30	5-8PM	27,32 | 33L	8	4.75	38
4	9/02	4.45-8PM	27,22L | 22L,22R	45	8.33	375
5	9/06	5-8PM	27,22L | 22L,22R	19	2.21	42
6	9/07	5-7.45PM	27,22L | 22L,22R	11	2.09	23
7	9/09	5-8PM	27,32 | 33L	11	2.18	24
8	9/10	5-8PM	27,32 | 33L	56	3.7	207
Total				247	4.35	1075

A total of 247 flights were held, with an average gate-hold of 4.3 min. During the most congested periods, up to 44% of flights experienced gate-holds. By maintaining runway utilization, we traded taxi-out time for time spent at the gate with engines off, as illustrated in Figures 9 and 11.

A. *Translating gate-hold times to taxi-out time reduction*

Intuitively, it is reasonable to use the gate-hold times as a surrogate for the taxi-out time reduction, since runway utilization was maintained during the demonstration of the control strategy. We confirm this hypothesis through a simple "what-if" simulation of operations with and without pushback rate control. The simulation shows that the total taxi-out time savings equaled the total gate-hold time, and that the taxi time saving of each flight was equal, in expectation, to its gate holding time. The total taxi-out time reduction can therefore be approximated by the total gate-hold time, or 1077 minutes (18 hours).

In reality, there are also second-order benefits due to the faster travel times to the runway due to reduced congestion, but these effects are neglected in the preliminary analysis.

B. *Fuel burn savings*

Supported by the analysis presented in Section V-A, we conduct a preliminary benefits analysis of the field tests by using the gate-hold times as a first-order estimate of taxi-out time savings. This assumption is also supported by the taxi-out time data from the tests, such as the plot shown in Figure 9. Using the tail number of the gate-held flights, we determine the aircraft and engine type and hence its ICAO taxi fuel burn index [12]. The product of the fuel burn rate index, the number of engines, and the gate-hold time gives us an estimate of the fuel burn savings from the pushback rate control strategy. We can also account for the use of Auxiliary Power Units (APUs) at the gate by using the appropriate fuel burn rates

[13]. This analysis (not accounting for benefits from reduced congestion) indicates that the total taxi-time savings were about 17.9 hours, which resulted in fuel savings of 12,000-15,000 kg, or 3,900-4,900 US gallons (depending on whether APUs were on or off at the gate). This translates to average fuel savings per gate-held flight of between 50-60 kg or 16-20 US gallons, which suggests that there are significant benefits to be gained from implementing control strategies during periods of congestion. It is worth noting that the per-flight benefits of the pushback rate control strategy are of the same order-of-magnitude as those of Continuous Descent Approaches in the presence of congestion [14], but do not require the same degree of automation, or modifications to arrival procedures.

C. *Fairness of the pushback rate control strategy*

Equity is an important factor in evaluating potential congestion management or metering strategies. The pushback rate control approach, as implemented in these field tests, invoked a First-Come-First-Serve policy in clearing flights for pushback. As such, we would expect that there would be no bias toward any airline with regard to gate-holds incurred, and that the number of flights of a particular airline that were held would be commensurate with the contribution of that airline to the total departure traffic during demo periods. We confirm this hypothesis through a comparison of gate-hold share and total departure traffic share for different airlines, as shown in Figure 15. Each data-point in the figure corresponds to one airline, and we note that all the points lie close to the 45-degree line, thereby showing no bias toward any particular airline.

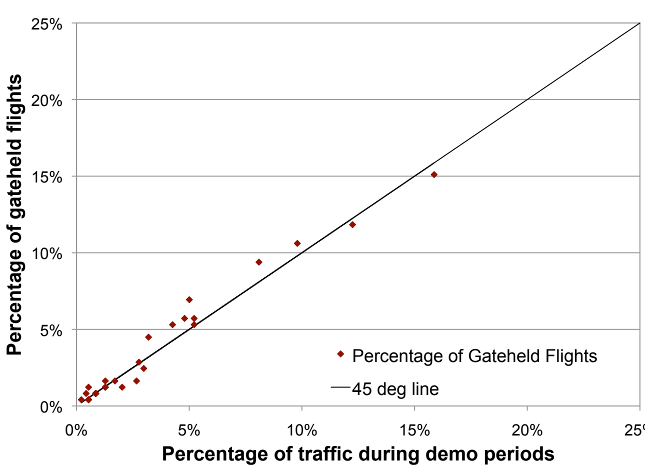

Fig. 15: Comparison of gate-hold share and total departure traffic share for different airlines.

We note, however, that while the number of gate-holds that an airline receives is proportional to the number of its flights, the actual fuel burn benefit also depends on its fleet mix. Figure 16 shows that while the taxi-out time reductions are similar to the gate-holds, some airlines (for example, Airlines 3, 4, 5, 19 and 20) benefit from a greater proportion of fuel savings. These airlines are typically ones with several heavy jet departures during the evening push.

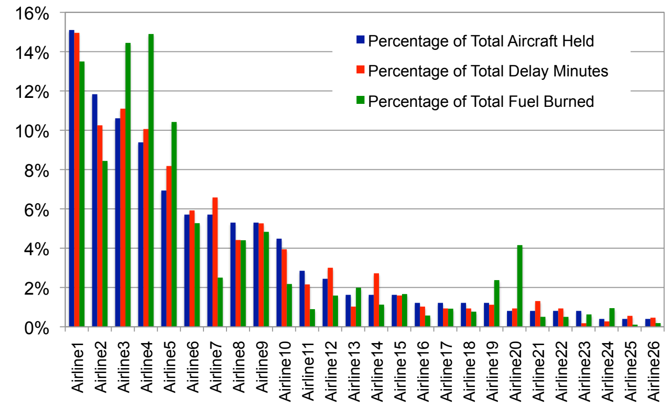

Fig. 16: Percentage of gate-held flights, taxi-out time reduction and fuel burn savings incurred by each airline.

VI. Observations and Lessons Learned

We learned many important lessons from the field tests of the pushback rate control strategy at BOS, and also confirmed several hypotheses through the analysis of surveillance data and qualitative observations. Firstly, as one would expect, the proposed control approach is an aggregate one, and requires a minimum level of traffic to be effective. This hypothesis is further borne by the observation that there was very little control of pushback rates in the most efficient configuration (4L, 4R | 4L, 4R, 9). The field tests also showed that the proposed technique is capable of handling target departure times (e.g., EDCTs), but that it is preferable to get EDCTs while still at gate. While many factors drive airport throughput, the field tests showed that the pushback rate control approach could adapt to variability. In particular, the approach was robust to several perturbations to runway throughput, caused by heavy weight category landings on departure runway, controllers' choice of runway crossing strategies, birds on runway, etc. We also observed that when presented with a suggested pushback rate, controllers had different strategies to implement the suggested rate. For example, for a suggested rate of 2 aircraft per 3 minutes, some controllers would release a flight every 1.5 minutes, while others would release two flights in quick succession every three minutes. We also noted the need to consider factors such as ground crew constraints, gate-use conflicts, and different taxi procedures for international flights. By accounting for these factors, the pushback rate control approach was shown to have significant benefits in terms of taxi-out times and fuel burn.

VII. Summary

This paper presented the results of the demonstration of a pushback rate control strategy at Boston Logan International Airport. Sixteen demonstration periods between August 23 and September 24, 2010 were conducted in the initial field trial phase, resulting in over 37 hours of research time in the BOS tower. Results show that during eight demonstration periods (about 24 hours) of controlling pushback rates, over 1077 minutes (nearly 18 hours) of gate holds were experienced during the demonstration period across 247 flights, at an average of 4.3 minutes of gate hold per flight (which correlated well to the observed decreases in taxi-out time). Preliminary fuel burn savings from gate-holds with engines off were estimated to be between 12,000-15,000 kg (depending on whether APUs were on or off at the gate).

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