MEPA Appendices

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MEPA Certificates and Responses to Comments

- Secretary of the Executive Office of Energy and Environmental Affairs Certificate on the *Logan Airport 2010 Environmental Data Report (2010 EDR)* and Massport's Responses to Comments raised in the Certificate.
- Copies of the Secretary's Certificates on the EDRs issued for the reporting years 2004, 2005, 2006, 2007, 2008, and 2009.

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Secretary of the Executive Office of Energy and Environmental Affairs Certificate on *2010 EDR* and Massport's Responses to Comments Raised in the Certificate

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December 16, 2011

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
2010 LOGAN AIRPORT ENVIRONMENTAL DATA REPORT

PROJECT NAME	: 2010 Environmental Data Report
PROJECT MUNICIPALITY	: Boston and Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority (Massport)
DATE NOTICED IN MONITOR	: November 9, 2011

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 (G. L. c. 30, ss. 61-62I) and with its implementing regulations (301 CMR 11.00).

The environmental review process for Logan Airport has been structured to occur on two levels: airport-wide and project-specific. The Environmental Status and Planning Report (ESPR) has evolved from a largely retrospective status report on airport operations to a broader analysis that also provides a prospective assessment of long-range plans. It has thus become, consistent with the objectives of the MEPA regulations, part of 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 2010 EDR is the subject of this review. In addition, the Scope for the 2011 ESPR is provided in this Certificate.

In general, the EDR has fulfilled its purpose of providing a "snapshot" of 2010 passenger and impact levels at Logan Airport. Most environmental parameters showed improvement in calendar year 2010. In particular, the technical studies in the 2010 EDR included reporting on and analysis of key indicators of airport activity levels, airport planning, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. Mitigation commitments for noise impacts and air quality remain key concerns both of this office and the commenters, and are presented in the form of project-specific Section 61 Findings, as well as more general mitigation that has emerged from the ESPR process.

A-1

The majority of comments received on the EDR focused on noise issues, including measurement of noise, modeling of noise contours, and noise abatement. In addition to responding to these comments, the 2011 ESPR and future EDRs should also report on the progress and other refinements for tracking noise and abatement efforts, as further described in the Scope for the 2011 ESPR 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.

The last Logan ESPR was filed for calendar year 2004. However, due to the current economic downturn, as described in the 2008 and 2009 EDRs, activity levels at Logan Airport and associated environmental impacts continue to remain well below historic levels. Therefore it was anticipated that in 2010, near-term activity levels and associated environmental effects were also expected to remain 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, did not occurr. Therefore, I allowed Massport to prepare a 2010 EDR in lieu of the scheduled ESPR. Massport has prepared the 2010 EDR, which will be followed by a 2011 ESPR. Massport proposed a schedule for filing the next ESPR in light of observed and expected activity levels and any other changes in airport operations that have occurred since the 2004 ESPR was filed.

Review of the 2010 EDR and Scope for the 2011 ESPR

General

The 2011 ESPR should follow the general format of the 2004 ESPR, presenting major policy discussions and an overview of the role of Logan Airport in the regional planning context. This should be followed by a status report on Massport's planning initiatives, projects, and mitigation measures. The ESPR should include an Executive Summary and Introduction, similar to previous ESPRs and EDRs. Massport must provide necessary background information to allow reviewing agencies and the public to understand the environmental policies and planning which form the context of the environmental reporting, technical studies, and environmental mitigation initiatives at Logan Airport. **A-2**

The 2011 ESPR should 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 used should begin with 2011 as the base year and project activity forecasts forward to calendar year 2030. In addition, the 2011 ESPR should use the results of the 2010 Logan Airport Air Passenger Survey and the findings of the Sustainable Ground Access Strategy and Service Plan effort to inform future access planning. **A-3** **A-4**

The technical studies in the 2011 ESPR 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 2011 ESPR must also respond to those issues explicitly noted in this Certificate and the comments received on the 2010 EDR. **A-5**

A distribution list for the 2011 ESPR (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. **A-6** **A-7**

Responses to Comments

The 2011 ESPR 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 2010 EDR is well-constructed and cross-referenced. Massport may follow the same format in addressing comments in the 2011 ESPR. **A-8**

The majority of comments received on the 2010 EDR focus on noise related issues, including measurement of noise, modeling of noise contours, and noise abatement, and emission

A-9 reduction issues. In addition to responding to these comments, the 2011 ESPR 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 chapter presents aviation activity statistics for Logan Airport in 2010 and compares activity levels to the prior year, including air passengers, aircraft operations, fleet mix, and cargo/mail volumes.

There were a number of significant changes in activity at Logan Airport in 2010. The total number of air passengers at Logan Airport increased by 7.5 percent to 27.4 million, compared to 25.5 million in 2009. In comparison, between 2008 and 2009 the number of air passengers using Logan Airport declined by 2.3 percent. This is below the historic peak reached in 2007. Also the total number of aircraft flights grew from approximately 345,310 in 2009 to 352,640, an increase of 2.1 percent. This remains below the historic peak achieved in 1998. Passenger aircraft operations did, however, decrease by 1.6 percent compared to 2009 levels. Compared to a decline of 48.6 percent in 2009, general aviation (GA) operations increased 19.9 percent in 2010, particularly as businesses increased their travel and use of GA transportation as the economy transitioned. GA accounted for 4.2 percent of aircraft activity at Logan Airport in 2010. In addition, dedicated air cargo operations decreased by 5.8 percent compared to the previous year.

The EDR reflects data that shows that the number of air passengers per aircraft operation increased, from an average of 73.9 passengers per aircraft operation in 2009 to an average of 77.8 in 2010. While legacy air carriers continued to reduce the number of aircraft operations at Logan Airport, low-cost carrier (LCC) operations increased by approximately 40 percent in 2010. The increase in operations by LCCs, primarily JetBlue Airways and Southwest Airlines, accounted for nearly all of this growth. Even though the number of dedicated air cargo aircraft operations decreased in 2010, air cargo volumes increased from 546 million pounds in 2009 to 572 million pounds in 2010, an increase of 4.7 percent.

A-10 The 2011 ESPR must report on airport activity levels, including information on aircraft operations, including fleet mix, passenger activity levels, and cargo and mail operations. 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.

A-11 For the 2011 ESPR, the Activity Levels chapter should include:

- Aircraft operations, including fleet mix and scheduled airline services at Logan Airport;
- Passenger activity levels;

- Cargo and mail activities;
- Compare 2011 aircraft operations, cargo/mail operations, and passenger activity levels to 2010 activity levels; and
- Report on national aviation trends in 2011 and compare to trends at Logan Airport.

A-11 con't.

It should 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 five years. Future year analyses should be based on the 2030 forecast. It should update the aircraft operations and passenger activity forecasts, and provide a discussion of analysis methodologies and assumptions, including anticipated fleet mix changes and other trends in the aviation industry. It should also report on the following:

A-12

- Compare 2011 operations to historic trends (to 2000) and forecasts for planning horizon year 2030;
- 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 Federal Aviation Administration (FAA) forecasts for Logan Airport and the U.S. industry.

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 provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2010. It also describes known future planning, construction, and permitting activities. In 2010 Massport completed the permitting process for redeveloping the Southwest Service Area (SWSA), a new consolidated rental car facility (ConRAC). Construction of this project began in July 2010. In July 2009, the MEPA review process began for the Logan Runway Safety Area (RSA) Improvements Project at Runway Ends 33L and 22R. In July 2010, Massport filed a combined federal/state Draft EA/EIR and the Final EA/EIR on January 31, 2011. Construction of the Runway 33L RSA improvements commenced in June 2011. In 2010 MEPA review was completed on the Green Bus Depot, a bus maintenance facility for Massport's clean fuel fleet buses in the North Service Area (NSA). The Green Bus Depot will be used to maintain the expanded shuttle bus fleet that will replace the Airport's aging compressed natural gas (CNG) bus fleet and the rental car company diesel shuttle buses. Construction of this project began in 2011.

The 2010 EDR reports multiple projects in the planning and design phase. Planning for the East Boston-Chelsea Bypass project commenced to develop a limited access roadway between Logan Airport and the new Chelsea Street Bridge. The Bypass roadway is expected to improve commercial vehicle access to the Airport, as well as reduce congestion on local East

Boston streets in the vicinity of Day Square, Eagle Square, and the Neptune Road corridor by directing airport-related commercial traffic to the new Bypass roadway. Massport filed an ENF on October 15, 2010, for which I determined that no further MEPA review was required. Construction is underway as of 2011. Massport also initiated planning for the Logan Airport Parking Deck Project (Economy Garage) along Prescott Street in the North Cargo Area (NCA) in 2010. The project was not subject to MEPA review and construction of the economy garage began in summer of 2010 and was completed and fully opened to the public in early 2011. Massport installed solar panel "trees" on the roof of the parking deck, and energy-efficient lighting throughout.

In the 2010 EDR, Massport also discusses completing the North Service Area (NSA) Roadway Corridor Project with final landscaping in 2011, which is a project to unify the existing roadway with new landscape. Construction of the NSA Roadway Corridor Project also began in 2010. Architectural design also commenced in December 2010 for two hangar upgrades in the NCA. In addition, Terminal B Garage repair and rehabilitation continued in 2010 where 32 solar panel trees (200 kilowatt (kW)) were installed on the top floor and the entire garage was fitted with high efficiency Light-Emitting Diode (LED) lighting. Taxiway G realignment construction was completed in 2010.

A-13 The 2011 ESPR should continue to assess planning strategies for improving Logan Airport's operations and services in a safe, secure, more efficient, and environmentally sensitive manner. As owner and operator of Logan Airport, Massport must accommodate and guide tenant development. The ESPR should describe the status of planning initiatives for the following areas:

- Roadway Corridor Project;
- Airport Parking;
- Terminal Area;
- Airside Area;
- Service and Cargo Areas; and
- Airport Buffers and Landscaping.

A-14 The 2011 ESPR should also indicate the status of long-range planning activities, including the status of public works projects implemented by other agencies within the boundaries of Logan Airport. The ESPR should also indicate the status and effectiveness of ground access changes, including roadway and parking projects, that consolidate and direct airport-related traffic to centralized locations and minimize airport-related traffic on streets in adjacent neighborhoods.

A-15

Regional Transportation

In general, the 2010 EDR has met the requirements with respect to regional transportation issues. It describes activity levels at New England's regional airports in 2010 and updates recent

planning activities. Massport has demonstrated that it is coordinating its planning with other transportation agencies, and that this planning effort is aimed at minimizing cumulative impacts from Logan Airport operations. The 2010 EDR includes estimates of potential passenger diversions from Logan, and outlines how Massport planning encourages those diversions.

The total number of air passengers utilizing New England's commercial service airports, including Logan Airport, increased from 42.0 million in 2009 to 43.1 million annual air passengers, an increase of 2.5 percent in 2010. While Logan Airport passenger traffic grew, air passenger levels continued to decline at the other regional airports. Passenger levels at the regional airports declined by 5.2 percent in 2010, compared to an increase of 7.5 percent at Logan Airport. This was largely due to legacy carriers withdrawing from smaller secondary markets and reducing their use of small regional jets.

Aircraft operations in the New England region remained largely flat, increasing slightly by 0.7 percent, from 1.03 million operations in 2009 to 1.04 million operations in 2010. The 2010 EDR reports that commercial airline operations declined by 0.25 percent. General aviation and military flights increased by 1.9 percent and 4.7 percent respectively. For the 2011 ESPR, Massport should continue to engage in cooperative metropolitan planning efforts including GreenDOT and the Healthy Transportation Compact, and the Boston Metropolitan Planning Organization (Boston MPO). **A-16**

The directives in the last ESPR Certificate were laid out to have Massport look at potential diversions, and explain how its planning and coordination with other agencies could impact potential diversions. The 2010 EDR has performed this task.

The 2011 ESPR should describe Logan Airport's role in the region's intercity transportation system by reporting on the following: **A-17**

Regional Airports

- 2011 regional airport operations, passenger activity levels, and schedule data within a 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, including the updated 2030 forecasts for both airports.

Regional Transportation System **A-18**

- Overview of the restructured Massachusetts Department of Transportation (MassDOT) and Massport's role in managing regional transportation 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.

Ground Transportation

The 2010 EDR reported on 2010 ground access conditions at the airport. This chapter reports on transit ridership, roadways, traffic volumes, and parking for 2010. Specifically, the total number of annual air passengers at Logan Airport increased 7.5 percent to 27.4 million, compared to 25.5 million in 2009. During the same period, average daily traffic on airport roadways increased by 5.1 percent from 2009 to 2010, while vehicle miles traveled (VMT) at the Airport increased by 4.8 percent. The number of vehicles parked at the Airport increased by four percent from 2009 to 2010. As stated previously, Massport began construction of the Logan Airport Parking Deck Project, located on the 1,000-space Economy Lot in the NCA. It consolidates an additional 2,000 commercial parking spaces from various on-airport temporary commercial parking lots into a single structured parking facility containing approximately 3,000 commercial parking spaces. The garage maintains on-airport parking capacity in compliance with the limits imposed by the Logan Airport Parking Freeze. The garage was fully opened in March 2011.

Ground access activity to Logan Airport generally increased for all travel modes from 2009 to 2010. In 2010, Massport administered the periodic *Logan Airport Air Passenger Ground Access Survey* which indicates that mode shares for high-occupancy vehicles (HOV) to the Airport have returned to 2004 levels (30 percent HOV mode share) after having decreased by two percent in the *2007 Air Passenger Ground Access Survey*. MBTA Silver Line boardings at the Airport continued to grow, increasing by five percent in 2010, while Blue Line boardings at Airport Station decreased slightly compared to 2009. In 2010, ridership on water transportation to the Airport increased by about one percent in comparison to the previous year. Limousine ridership increased by an estimated 16 percent, and taxi dispatches increased 12 percent from 2009 to 2010. In 2010, Logan Express air passenger ridership increased by about one percent compared to 2009 levels, whereas employee use of Logan Express increased by four percent, and accounts for 42 percent of the service's ridership.

A-19

The 2011 ESPR should report on 2011 ground access conditions at the airport and provide a comparison of 2011 findings to those of 2010 for the following:

- Detailed description of compliance with Logan Airport Parking Freeze;
- High-occupancy vehicle (HOV) ridership (including Blue Line, Silver Line, Water Transportation, and Logan Express);
- Logan Airport Employee Transportation Management Association (Logan TMA) services;
- Logan Airport gateway volumes;
- On-airport traffic volumes;
- On-airport vehicle miles traveled (VMT);
- Parking demand and management (including rates and duration statistics);
- Status of long-range ground access management strategy planning; and

- Results of the 2010 Logan Airport Air Passenger Survey.

A-19 con't.

The chapter should present a discussion of analytical methodologies and assumptions for the planning horizon year (2030) for traffic volumes, on-airport vehicle miles traveled (VMT) and parking demand.

A-20

The 2011 ESPR should present a discussion of the following topics:

- Massport's target HOV mode share along with incentives;
- Non-Airport through-traffic;
- Massport's cooperation with other transportation agencies to increase transit ridership to and from Logan Airport via the Blue Line, Silver Line, Water Transportation, and Logan Express;
- Report on Logan Express usage and efforts to increase capacity and usage;
- Progress on enhancing water transportation to and from Logan Airport;
- 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 EDR updates the status of the noise environment at Logan Airport in 2010, and describes Massport's efforts to reduce noise levels. 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 2011 ESPR represents an appropriate forum to serve this updating function.

The 2010 Day-Night Sound Level (DNL) contours are similar in size compared to 2009. The DNL 65 decibel (dB) contour remained the same in Revere and in most of Winthrop. The extent of the DNL 65 dB contour decreased slightly in the Point Shirley section of Winthrop due to the reduced number of departures from Runway 9 and the reduced number of aircraft arrivals over South Boston and East Boston. The geographic extent of the DNL 65 dB contour, however, did increase in East Boston near the Airport and over Boston Harbor due to an increase in departures from Runway 15R.

The 2010 EDR also reported on the findings of the Integrated Noise Model's (INM) results of the population impacted by airport noise and used both the 2010 and 2000 U.S. Census data as a basis for comparison. Using the 2000 Census, the overall number of people exposed to values greater than DNL 65 dB decreased by 11 percent in 2010, compared to 2009. An estimated 3,870 people were exposed to levels greater than DNL 65 dB as depicted in the 2010 contour, compared to 4,335 in 2009. This is the first time that the number of people exposed to the DNL 65 dB noise level has been fewer than 4,000 and that the number of people within the

DNL 65 dB in Boston has dropped below 1,000 to 711 people. Also the total population exposed to noise levels greater than DNL 70 dB decreased in 2010 compared to 2009. In 2009, the total population exposed to greater than DNL 70 dB was 243, and in 2010 the number dropped to 198.

The 2010 EDR also reports that in 2010, Massport provided sound insulation to 83 homes, nearly half of which are in Chelsea. The focus of this 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 Sound Insulation program, 11,219 homes have received sound insulation treatment in East Boston, South Boston, Winthrop, Revere, and Chelsea.

A-21 The information in this chapter is very informative and I encourage Massport to continue with more detailed analysis in the 2011 ESPR. I strongly advise Massport to consider and address the comments received that have raised noise related concerns. The comments from the City of Cambridge, as well as from individuals have raised a number of concerns and suggestions related to noise that Massport should address into the 2011 ESPR.

A-22 The 2011 ESPR should provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, the methodologies used to track noise, and any changes in noise modeling. The chapter must report on 2011 conditions and compare 2011 conditions to those of 2010 for the following:

A-23

- 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.

A-24 The chapter must report on 2011 conditions and compare those to 2010 conditions for the following noise indicators:

- Using the Federal Aviation Administration's (FAA) most current version of the Integrated Noise Model (INM) produce an accurate set of Day-Night Sound Level (DNL) noise contours;
- Noise-impacted population (using the 2010 Census data);
- Measured versus modeled noise values, including reasons for differences and any improvements attributable to the use of most current version of the Integrated Noise Model (INM);
- 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 chapter should 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. This chapter should also present a discussion of analysis methodologies and assumptions, including fleet mix and runway use assumptions, and report on future year conditions for 2030 for the following noise indicators: A-25 A-26

- Runway utilization;
- DNL noise contours; and
- Population counts.

The chapter should also report on noise abatement efforts and provide a status update on any new noise and operations monitoring system. At the public meeting held on November 16, 2011, several residents of the Point of Pines section of Revere requested that their homes be included in Massport's Residential Sound Insulation Program (RSIP). As discussed at the public meeting and shown in the 2010 EDR, Point of Pines falls outside the 60 DNL contour, and, therefore, is ineligible for funding in the FAA's RSIP that begins at the 65 DNL contour. However, in response to a resident's and the City Council's request, Massport has already committed to conducting supplemental noise monitoring during 2012 in the Point of Pines area to validate the results of the permanent noise monitor (Carey Circle, #17) in that section of Revere. The results of that analysis should be reported in the 2011 ESPR. A-27

Air Quality

The 2010 EDR provides an overview of airport-related air quality issues in 2010 and efforts to reduce emissions. The 2010 EDR reports that the total emissions of volatile organic compounds (VOC) were 1,019 kilograms per day (kg/day). This number is four percent higher than 2009 levels but is still following a long-term, downward trend decreasing by almost 78 percent since 1990. The increase is primarily due to the increase in landing and takeoff operations (LTOs) when compared to 2009. The total emissions of oxides of nitrogen (NOX) were 3,989 kg/day, or less than one percent higher than 2009 levels. In 2010, total NOx emissions at Logan Airport (net total with reductions) were approximately 742 tons per year (tpy) lower than Massport's 1999 Air Quality Initiative (AQI) benchmark. This represents a 32 percent decrease in NOx emissions since 1999. The total emissions of carbon monoxide (CO) were 7,160 kg/day, or 10 percent lower than 2009 levels. Due to the decreased use of No. 6 fuel oil, total emissions of particulate matter (PM) PM10/PM2.5 associated with Logan Airport heating and cooling decreased in 2010 by approximately 10 percent to 64 kg/day compared to 2009 levels.

The 2010 EDR reports that 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 2010 continued to be well within the National Ambient Air Quality Standards (NAAQS) for NO2. The 2010 EDR

also reported on Massport's two-phased Air Quality Monitoring Study that is collecting data on a variety of ambient air pollutants over a two year period and assessing air quality changes attributable to the operation of the new centerfield taxiway. The second phase of the Study concluded in 2011, after the centerfield taxiway became fully operational. Massport will submit the findings from this study to MassDEP in late 2011 or early 2012. The results of this study should also be reported in the 2011 ESPR.

A-28

Massport prepared an inventory of greenhouse gas (GHG) emissions directly and indirectly associated with Logan Airport operations. The 2010 GHG emission inventory was updated incorporating guidance developed by the Transportation Research Board's (TRB) Airport Cooperative Research Program (ACRP). The ACRP guidance was published in April 2009 for airport operators to develop an airport-specific GHG emissions inventory. The 2010 inventory assigns emissions based on ownership or control (e.g., Massport, airlines and other airport tenants, and the general public). The vast majority of emission sources at Logan Airport are owned or controlled by the airlines, airport tenants, and the general public (through emissions from motor vehicles). According to the EDR, Massport sources contribute 12 percent of the total GHG emissions for the Airport. Total Logan Airport GHG emissions in 2010 were slightly lower (0.4 percent) than 2009 levels.

A-29

The 2011 ESPR 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 also discuss analytical methodologies and assumptions and report on 2011 conditions using the most recent versions of the Emissions Dispersion Modeling System (EDMS) and MOBILE motor vehicle emissions. The chapter should also include:

A-30

- 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; and
- NOx emissions by airline.

A-31

This chapter must also report on the following air quality initiatives (AQI) for 2011:

- 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.

A-32

The 2011 ESPR should also include an inventory of greenhouse gas (GHG) emissions from Logan Airport in 2011. GHG emissions should be quantified for aircraft, 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 2011 GHG emissions inventory should be compared to the 2010 results. A-32 con't.

The ESPR should also present a discussion of analytical methodologies and assumptions and report on future year condition for 2030 for the following air quality indicators: A-33

- Emissions Inventory for CO;
- Emissions Inventory for NOx;
- Emissions Inventory for VOCs; and
- Emissions Inventory for GHGs.

In a comment letter from Mr. Pomicter, there is a request for a program to encourage the use of single-engine taxiing and suggested that Massport has not fulfilled its Section 61 mitigation commitments associated with the Logan Airside Improvements Project (EOEA #10458), specifically related to single-engine taxi procedures. The ESPR should include an update on Massport's efforts to encourage the use of single engine taxiing under safe conditions. I encourage Massport to communicate with airlines regarding the use of single engine taxiing, when safe to do so, within the Logan Airport operational context. An update of this effort should be provided in the 2011 ESPR. A-34

The 2011 ESPR should also report on the status of the Logan Health Study, as requested by a commenter, which is currently underway by the Massachusetts Department of Public Health (DPH), portions of which were funded by Massport. This DPH study was initially fully funded by the Commonwealth, but was later cut by the legislature. Massport agreed to fund the shortfall for a total of $195,000. This sum was transferred to the Commonwealth/ DPH in December 2010 and that study is now progressing to completion. Massport should continue to provide data to DPH in support of this analysis. The commenter also questioned why the Commonwealth had not yet completed the legislated study of health effects of particulate air pollution (and specifically fine and ultrafine particulate matter) from surface and air transportation required by the Transportation Reform Act of 2009. Because there are presently no federal or state public health standards for ultrafine particulate matter, Massport committed to provide $150,000 to MassDOT in support of the scoping of the analyses called for in the Transportation Reform Act. The 2011 ESPR should provide more details on this commitment. A-35 A-36

Water Quality/Environmental Compliance

The 2010 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, and tank management. In accordance with the requirements of the current NPDES permit for Logan Airport that was issued on July 31, 2007, Massport and all 27 co-permittees and tenants began preparation of an updated Stormwater Pollution Prevention Plan (SWPPP). Massport completed its SWPPP in December

of 2007 and tenant SWPPPs were completed in March 2008. Massport's SWPPP addresses stormwater pollutants in general, and also addresses deicing and anti-icing chemical, potential bacteria, fuel and oil, and other sources of stormwater pollutants.

In accordance with the Massachusetts Contingency Plan (MCP), the 2009 EDR reported that Massport continues to assess, remediate, and bring to regulatory closure areas of subsurface contamination. The 2010 EDR states that Massport is working towards achieving regulatory closure of the remaining MCP sites. In addition, preparation of the Environmental Management System (EMS) for facilities where fleet and field maintenance activities are conducted was on-going in 2010.

In 2010, there were 15 oil and hazardous material spills that required reporting to MassDEP, five of which involved a storm drainage system. One outfall sample out of a total of 19 samples at the Maverick Street Outfall and one outfall sample out of a total of 23 samples at the North Outfall exceeded the regulatory limits of the NPDES permit for the North, West, and Maverick Street Outfalls. The 2010 EDR reports that these exceedances were reported during April and November of 2010, respectively, as required. The 2010 Annual Certificates of Compliance were submitted to the U.S. Environmental Protection Agency (EPA) and MassDEP on December 21, 2010, for Massport and each tenant co-permittee.

A-37 The 2011 ESPR should report on the 2010 status of:

- 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 of the environmental management plan; and
- Fuel spill prevention.

A-38 The chapter should also present a discussion of the following topics:

- Future stormwater management improvements (if any) ; and
- Future MCP and tank management activities.

Massport should continue to report in the 2011 ESPR how it will assess, remediate, and bring to regulatory closure areas of subsurface contamination.

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 short-term goals set out in the Sustainability Plan were described in the 2010 EDR. Massport participated in the 2010 Environmental Benchmarking Survey sponsored by Airports Council International-North America (ACI-NA) to assess solar power, purchase of renewable energy, availability of low-emission ground transportation, recycling, and environmentally preferred purchasing.

The EDR describes Massport's continued sustainability efforts and details how sustainability is incorporated into many aspects of Massport's activities. The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2011 ESPR. The 2011 ESPR should report on the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have commenced construction. The mitigation commitments were made in the Section 61 Findings for the following projects which should be reported: A-39 A-40

- West Garage/Central Garage;
- International Gateway;
- Runway Ends 22R and 33L Runway Safety Area Improvements;
- Replacement Terminal A;
- Logan Airside Improvements Planning; and
- Southwest Service Area Redevelopment Program.

The 2011 ESPR should also update the status of Massport's mitigation commitments and also identify projects for which mitigation measures have been completed.

Distribution of the 2011 ESPR

Several commenters have requested more timely filings of future EDRs and the forthcoming 2011 ESPR and other information related to the airport. 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 2011 ESPR and report this information in a timely manner. Many commenters have suggested ways to improve the text, maps and graphics and Massport should consider those changes for future filings. For several recent projects, 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 2011 ESPR and future EDR submittals. A-41 A-42 A-43

Conclusion

I have determined that the 2010 EDR for Logan Airport has adequately complied with MEPA and that Massport must submit a 2011 ESPR that responds to the issues raised in

A-44 comments received. The 2011 ESPR must include a copy of this Certificate and a copy of each comment letter received on the 2010 EDR. 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.

December 16, 2011
Date

for Richard K. Sullivan Jr.

Comments Received:

12/09/2011	Air, Inc.
12/09/2011	City of Cambridge, Executive Department
12/09/2011	Nancy Timmerman
12/09/2011	Stephen Kaiser, PhD
12/09/2011	Darryl Pomicter
12/15/2011	Boston Transportation Department
12/15/2011	The Boston Harbor Association
12/15/2011	City of Boston Environment Department

RKS/ACC/acc

Comment #	Author	Topic	Comment	Response
A.1	Richard K. Sullivan, Jr., Secretary	Noise	The majority of comments received on the EDR focused on noise issues, including measurement of noise, modeling of noise contours, and noise abatement. In addition to responding to these comments, the 2011 ESPR and future EDRs should also report on the progress and other refinements for tracking noise and abatement efforts, as further described in the Scope for the 2011 ESPR below.	Information on noise and on-going improvements to address noise issues are provided in *Chapter 6, Noise Abatement* of this *2011 Logan Airport Environmental Status and Planning Report (2011 ESPR).*
A.2	Richard K. Sullivan, Jr., Secretary	MEPA	The 2011 ESPR should follow the general format of the 2004 ESPR, presenting major policy discussions and an overview of the role of Logan Airport in the regional planning context. This should be followed by a status report on Massport's planning initiatives, projects, and mitigation measures. The ESPR should include an Executive Summary and Introduction, similar to previous ESPRs and EDRs. Massport must provide necessary background information to allow reviewing agencies and the public to understand the environmental policies and planning which form the context of the environmental reporting, technical studies, and environmental mitigation initiatives at Logan Airport.	The *2011 ESPR* follows the same general format the *2004 ESPR* . The *2011 ESPR* presents major policy discussions and provides an overview of the role of Logan Airport within the region. Included in the *2011 ESPR* is a status update on planning initiatives, projects, and mitigation initiatives. Refer to *Chapter 3, Airport Planning,* and *Chapter 9, Project Mitigation Tracking.* To enhance review of this *2011 ESPR,* necessary background information is provided in the main chapters and supporting technical appendices of this document.
A.3	Richard K. Sullivan, Jr., Secretary	Activity Levels	The 2011 ESPR should 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 used should begin with 2011 as the base year and project activity forecasts forward to calendar year 2030.	*Chapter 2, Activity Levels,* reports on updates passenger and operation activity forecasts for Logan Airport and the other Massport airports. The new forecast includes 2011 as the current reporting year and provides passenger, aircraft and cargo activity levels for the forecast horizon year of 2030.
A.4	Richard K. Sullivan, Jr., Secretary	Ground Access	In addition, the 2011 ESPR should use the results of the 2010 Logan Airport Air Passenger Survey and the findings of the Sustainable Ground Access Strategy and Service Plan effort to inform future access planning.	The results from the *2010 Logan Airport Air Passenger Survey* and the *Sustainable Ground Access Strategy and Service Plan* are an important data source for Massport and are used to inform Massport's planning for ground access to and from the airport. See *Chapter 5, Ground Access to and from Logan Airport.*

Comment #	Author	Topic	Comment	Response
A.5	Richard K. Sullivan, Jr., Secretary	MEPA	The technical studies in the 2011 ESPR 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 2011 ESPR must also respond to those issues explicitly noted in this Certificate and the comments received on the 2010 EDR.	The *2011 ESPR* reports on the technical studies outlined in the Secretary's Certificate. *Chapter 2, Activity Levels,* reports on and analyzes the airport activity levels, and provides a new future forecast for 2030. The regional transportation system is presented in *Chapter 4, Regional Transportation. Chapter 5, Ground Access to and from Logan Airport,* provides information on ground access. *Chapter 6, Noise Abatement,* reports on and analyzes noise. *Chapter 7, Air Quality/Emissions Reduction* , reports on and analyzes air quality. Environmental management and water quality is reported on and analyzed in *Chapter 8, Water Quality/ Environmental Compliance and Management. Chapter 9, Project Mitigation Tracking,* provides project mitigation tracking. Finally, this appendix and *Appendix B, Comment Letters and Responses,* provides responses to comments in the Certificate and other comment letters.
A.6	Richard K. Sullivan, Jr., Secretary	MEPA	A distribution list for the 2011 ESPR (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document.	The distribution list for the *2011 ESPR* is provided in *Appendix D, Distribution.*
A.7	Richard K. Sullivan, Jr., Secretary	MEPA	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.	The ESPR and EDR certificates for previous reporting years back to 2004 are provided in *Appendix A, MEPA Certificates and Responses to Comments.* Supporting technical appendices are provided as necessary.
A.8	Richard K. Sullivan, Jr., Secretary	MEPA	The 2011 ESPR must include responses to comments that address all of the substantive comments from the letters listed at the end of this Certificate.	Individual responses to comments are provided in *Appendix B, Comment Letters and Responses,* of the *2011 ESPR.*
A.9	Richard K. Sullivan, Jr., Secretary	Noise	In addition to responding to these comments, the 2011 ESPR should continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commenters where appropriate.	*Chapter 6, Noise Abatement,* provides information on the requested topics. All comments have been addressed in Appendices A and B of the *2011 ESPR* .
A.10	Richard K. Sullivan, Jr., Secretary	Activity Levels	The 2011 ESPR must report on airport activity levels, including information on aircraft operations, including fleet mix, passenger activity levels, and cargo and mail operations. 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.	This *2011 ESPR* includes a report on national aviation trends since 2000 and provides an overview of the significant changes in the airport industry since that time. Recent trends are discussed and the chapter provides forecasts of aircraft operations (including a likely fleet mix) passenger activity levels, and cargo and mail operations for 2030. See *Chapter 2, Activity Levels.*

Comment #	Author	Topic	Comment	Response
A.11	Richard K. Sullivan, Jr., Secretary	Activity Levels	For the 2011 ESPR, the Activity Levels chapter should include: aircraft operations, including fleet mix and scheduled airline services at Logan Airport; passenger activity levels; cargo and mail activities; a compare the 2011 aircraft operations, cargo/mail operations, and passenger activity levels to 2010 activity levels; and a report on national aviation trends in 2011 and a comparison to trends at Logan Airport.	See the response to Comment A.10.
A.12	Richard K. Sullivan, Jr., Secretary	Activity Levels	It should 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 five years. Future year analyses should be based on the 2030 forecast. It should update the aircraft operations and passenger activity forecasts, and provide a discussion of analysis methodologies and assumptions, including anticipated fleet mix changes and other trends in the aviation industry. It should also report on the following: compare 2011 operations to historic trends (to 2000) and forecasts for planning horizon year 2030; present updated forecasts Logan Airport's passenger volumes, aircraft operations, and fleet mix; and compare forecast activity levels to historic trends, prior Logan Airport forecasts, and Federal Aviation Administration (FAA) forecasts for Logan Airport and the US industry.	*Chapter 2, Activity Levels,* reports on Massport's forecasts that have become the basis for planning. The Chapter also reports on the 2030 forecast. Specifically, *Chapter 2, Activity Levels* compares the 2011 operations to historic trends and the forecasts for 2030. The chapter presents 2011 and 2030 passenger volumes, aircraft operations, and fleet mix; and compares forecast activity levels to historic presents, prior Logan Airport forecasts, and FAA forecasts for Logan Airport and the U.S. aviation industry.
A.13	Richard K. Sullivan, Jr., Secretary	Airport Planning	The 2011 ESPR should continue to assess planning strategies for improving Logan Airport's operations and services in a safe, secure, more efficient, and environmentally sensitive manner. As owner and operator of Logan Airport, Massport must accommodate and guide tenant development. The ESPR should describe the status of planning initiatives for the following areas: Roadway Corridor Projects; Airport Parking; Terminal Area; Airside Area; Service and Cargo Areas; and Airport Buffers and Landscaping.	As part of planning for the safe and efficient operation of Logan Airport, Massport is mindful of environmental concerns and seeks to reduce the environmental impacts associated with Logan Airport activities. Updates on the status of the roadway corridor projects, Airport Parking, Terminal Area, Airside Area, Service and Cargo Areas, and Airport Buffers and Landscaping are provided in *Chapter 3, Airport Planning*. Additional information is also provided in *Chapter 5, Ground Access to and from Logan Airport.*
A.14	Richard K. Sullivan, Jr., Secretary	Airport Planning	The 2011 ESPR should also indicate the status of long-range planning activities, including the status of public works projects implemented by other agencies within the boundaries of Logan Airport.	The *2011 ESPR* reports on the status of long-range planning activities in *Chapter 4, Regional Transportation.*
A.15	Richard K. Sullivan, Jr., Secretary	Ground Access	The ESPR should also indicate the status and effectiveness of ground access changes, including roadway and parking projects, that consolidate and direct airport-related traffic to centralized locations and minimize airport-related traffic on streets in adjacent neighborhoods.	*Chapter 5, Ground Access to and from Logan Airport,* reports on the status and effectiveness of ground access changes that have consolidated and directed airport-related traffic to centralized locations minimizing the amount of airport-related traffic in adjacent neighborhoods.

Comment #	Author	Topic	Comment	Response
A.16	Richard K. Sullivan, Jr., Secretary	Regional Transportation	For the 2011 ESPR, Massport should continue to engage in cooperative metropolitan planning efforts including GreenDOT and the Healthy Transportation Compact, and the Boston Metropolitan Planning Organization (Boston MPO).	The *2011 ESPR* describes Massport collaboration with other regional transportation organizations in planning for the region's transportation needs. See *Chapter 4, Regional Transportation*
A.17	Richard K. Sullivan, Jr., Secretary	Activity Levels	The 2011 ESPR should describe Logan Airport's role in the region's intercity transportation system by reporting on the following related to Regional Airports and Regional Transportation System: *Regional Airports* : 2010 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.	The *2011 ESPR* reports on Massport's efforts to strengthen the regional transportation system; the agency's cooperation with other transportation agencies to promote efficient regional highway and transit operations; and metropolitan and regional rail initiatives and ridership. See *Chapter 4, Regional Transportation.*
A.18	Richard K. Sullivan, Jr., Secretary	Regional Transportation	The 2011 ESPR should describe Logan Airport's role in the region's intercity transportation system by reporting on the following related to Regional Airports and Regional Transportation System: *Regional Transportation System:* Massport's efforts in strengthening the regional transportation system; 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.	See the response to Comment A.17.
A.19	Richard K. Sullivan, Jr., Secretary	Ground Access	The 2011 ESPR should report on 2011 ground access conditions at the airport and provide a comparison of2011 findings to those of 2010 for the following: detailed description of compliance with the 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) membership and services; Logan Airport gateway volumes; on-airport traffic volumes; on-airport vehicle miles traveled (VMT); parking demand and management (including rates and duration statistics); parking demand and management (including rates and duration statistics; status of long-range ground access management strategy planning; and results of 2010 Logan Airport Air Passenger Survey.	*Chapter 5, Ground Access to and from Logan Airport,* reports on 2011 conditions and compares 2011 findings to those of 2010: for parking levels, HOV ridership, Logan TMA, Logan gateway volumes, on-airport traffic volumes, on-airport VMT, parking demand and management, and a status of long-range ground access management strategy planning. The results of the *2010 Logan Airport Air Passenger Survey* were reported in the *2010 EDR.*

Comment #	Author	Topic	Comment	Response
A.20	Richard K. Sullivan, Jr., Secretary	Ground Access	The chapter should present a discussion of analytical methodologies and assumptions for the planning horizon year (2030) for traffic volumes, on-airport vehicle miles traveled (VMT) and parking demand. The 2011 ESPR should present a discussion of the following topics: Massport's target HOV mode share along with incentives; non-airport thru-traffic; Massport's cooperation with other transportation agencies to increase transit ridership to and from Logan Airport via the Blue Line, Silver Line, Water Transportation, and Logan Express; report on Logan Express usage and efforts to increase capacity and usage; progress on enhancing water transportation to and from Logan Airport; 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.	This *2011 ESPR* uses an updated ground traffic analysis model - called VISSIM, which provides finer-grained information on the airport roadway system. This will enhance Massport's planning capabilities. A discussion of the analytical methodologies and assumptions for the 2030 traffic volumes, on-airport VMT, and parking demand is provided in the *Chapter 5, Ground Access to and from Logan Airport.* Massport continues to make strides in improving ground access options to and from Logan Airport. The additional requested information is provided in *Chapter 5, Ground Access to and from Logan Airport* .
A.21	Richard K. Sullivan, Jr., Secretary	Noise	The information in this chapter is very informative and I encourage Massport to continue with more detailed analysis in the 2011 ESPR. I strongly advise Massport to consider and address the comments received that have raised noise related concerns. The comments from the City of Cambridge, as well as from individuals have raised a number of concerns and suggestions related to noise that Massport should address into the 2011 ESPR.	Information on noise is provided in *Chapter 6, Noise Abatement,* of this *2011 ESPR.* All comments have been addressed in *Appendices A and B* of the *2011 ESPR.*
A.22	Richard K. Sullivan, Jr., Secretary	Noise	The 2011 ESPR should provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, the methodologies used to track noise, and any changes in noise modeling.	*Chapter 6, Noise Abatement,* provides information on the requested topics.
A.23	Richard K. Sullivan, Jr., Secretary	Noise	The chapter must report on 2011 conditions and compare 2011 conditions to those of 2010 for the following: fleet mix, including Stage II, Recertified (Hushkitted) Stage III, newly manufactured Stage III, and any qualifying Stage IV aircraft; nighttime operations; runway utilization (report on aircraft and airline adherence with runway utilization goals; Preferential runway advisory system (PRAS) compliance; and flight tracks.	Massport reports on 2011 conditions and compares them to those of 2010 for the following: fleet mix including: Stage II, Recertified Stage II, newly manufactured Stage III, and qualifying Stage IV aircraft; nighttime operations; runway utilization; PRAS compliance; and flight tracks. See *Chapter 6, Noise Abatement.*

Comment #	Author	Topic	Comment	Response
A.24	Richard K. Sullivan, Jr., Secretary	Noise	The chapter must report on 2011 conditions and compare those to 2010 conditions for the following noise indicators: Using the Federal Aviation Administration's (FAA) most current version of the Integrated Noise Model (INM) produce an accurate set of Day-Night Sound Level (DNL) noise contours; Noise-impacted population (using the 2010 Census data); Measured versus modeled noise values, including reasons for differences and any improvements attributable to the use of most current version of the Integrated Noise Model (INM); 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 *2011 ESPR* reports on 2011 conditions and compares them to those of 2010 for the following noise parameters: DNL noise contours, noise impacted population, measured versus modeled noise values, CNI, Times-Above for 65,75, 85 dBA threshold values, noise monitoring system status, and flight track monitoring reports. See *Chapter 6, Noise Abatement.*
A.25	Richard K. Sullivan, Jr., Secretary	Noise	The chapter should 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.	Noise abatement efforts, including results from the BLANS, and the noise and operations monitoring system updates are provided in *Chapter 6, Noise Abatement*.
A.26	Richard K. Sullivan, Jr., Secretary	Noise	This chapter should also present a discussion of analysis methodologies and assumptions, including fleet mix and runway use assumptions, and report on future year conditions for 2030 for the following noise indicators: runway utilization; DNL noise contours; and population counts.	*Chapter 6, Noise Abatement,* presents a discussion of the analysis methodologies and assumptions and reports on 2030 conditions for runway utilization, DNL noise contours, and population counts.
A.27	Richard K. Sullivan, Jr., Secretary	Noise	As discussed at the public meeting and shown in the 2010 EDR, Point of Pines falls outside the 60 DNL contour, and, therefore, is ineligible for funding in the FAA's RSIP that begins at the 65 DNL contour. However, in response to a resident's and the City Council's request, Massport has already committed to conducting supplemental noise monitoring during 2012 in the Point of Pines area to validate the results of the permanent noise monitor (Carey Circle, #17) in that section of Revere. The results of that analysis should be reported in the 2011 ESPR.	The Revere monitoring study for the Point of Pines Neighborhood is currently being coordinated with local residents regarding choosing a specific site and time frame for the study. *Chapter 6, Noise Abatement,* does provide data on Revere and the noise contours do reflect the flight tracks and runway use impacting the Point of Pines neighborhood.
A.28	Richard K. Sullivan, Jr., Secretary	Air Quality	The second phase of the [Air Quality Monitoring Study] concluded in 2011, after the centerfield taxiway became fully operational. Massport will submit the findings from this study to MassDEP in late 2011 or early 2012. The results of this study should also be reported in the 2011 ESPR.	The Centerfield Taxiway Air Toxics study concluded the data collection phase in September 2011. The final report, including study results and evaluation are expected to be released in 2013. A public meeting will be scheduled to discuss results with members of the public once the report is completed.

Comment #	Author	Topic	Comment	Response
A.29	Richard K. Sullivan, Jr., Secretary	Air Quality	The 2011 ESPR 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 also discuss analytical methodologies and assumptions and report on 2011 conditions using the most recent versions of the Emissions Dispersion Modeling System (EDMS) and MOBILE motor vehicle emissions.	The *2011 ESPR* reports on modeled air quality using EDMS and MOBILE motor vehicle emissions models to model carbon monoxide (CO), nitrogen oxides (NOx), volatile organic compounds (VOCs), and particulate matter (PM). In addition, Massport modeled NOx emissions by airline. *Chapter 7, Air Quality/Emissions Reduction,* reports on the model updates to EDMS and MOBILE and uses the most recent versions of the models to assess air quality conditions.
A.30	Richard K. Sullivan, Jr., Secretary	Air Quality	The chapter should also include: emissions inventory for carbon monoxide (CO); emissions inventory for oxides of nitrogen (NOx); emissions inventory for volatile organic compounds (VOCs); emission inventory for particulate matter (PM); nitrogen dioxide (NO2) monitoring; and NOx emissions by airline.	*Chapter 7, Air Quality/Emissions Reduction,* of this *2011 ESPR* includes emissions inventories for CO, NOx, VOC, PM, NO2 monitoring, and NOx emissions by airline.
A.31	Richard K. Sullivan, Jr., Secretary	Air Quality	This chapter should also report on the following air quality initiatives (AQI) for 2011: Air Quality Initiative Tracking; Massport's and Tenant's Alternative Fuel Vehicle Programs; and the status of other Logan Airport air quality studies undertaken by Massport or others, as available.	The *2011 ESPR* reports on the air quality initiative tracking, Massport's and tenant's alternative fuel vehicle programs; and the status of other air quality studies. See *Chapter 7, Air Quality/Emissions Reduction.*
A.32	Richard K. Sullivan, Jr., Secretary	Air Quality	The 2011 ESPR should also include an inventory of greenhouse gas (GHG) emissions from Logan Airport in 2011. GHG emissions should be quantified for aircraft, 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 2011 GHG emissions inventory should be compared to the 2010 results.	*Chapter 7, Air Quality/Emissions Reduction,* of this *2011 ESPR* includes a report on greenhouse gas (GHG) emissions at Logan Airport in 2011 and compares it to 2010 levels. The GHG emissions are quantified for aircraft, ground access equipment (GSE), motor vehicles, stationary sources, and electrical usage. The methodologies deployed follow Executive Office of Energy and Environmental Affairs (EOEEA) and ACRP guidelines.
A.33	Richard K. Sullivan, Jr., Secretary	Air Quality	The ESPR should also present a discussion of analytical methodologies and assumptions and report on future year condition for 2030 for the following air quality indicators: emissions inventory for carbon monoxide (CO); emissions inventory for oxides of nitrogen (NOx); emissions inventory for volatile organic compounds (VOCs); and emissions inventory for greenhouse gases (GHG).	*Chapter 7, Air Quality/Emissions Reduction,* of this *2011 ESPR* includes emissions inventories for CO, NOx, VOC, and GHG for 2030.
A.34	Richard K. Sullivan, Jr., Secretary	Air Quality	The ESPR should include an update on Massport' s efforts to encourage the use of single engine taxiing under safe conditions. I encourage Massport to communicate with airlines regarding the use of single engine taxiing, when safe to do so, within the Logan Airport operational context. An update of this effort should be provided in the 2011 ESPR.	The *2011 ESPR* provides an update on the efforts that Massport has undertaken to encourage the use of single engine taxiing. Refer to *Chapter 7, Air Quality/Emissions Reduction.*

Comment #	Author	Topic	Comment	Response
A.35	Richard K. Sullivan, Jr., Secretary	Air Quality	The 2011 ESPR should also report on the status of the Logan Health Study, as requested by a commenter, which is currently underway by the Massachusetts Department of Public Health (DPH), portions of which were funded by Massport.	Per verbal communication with the DPH Project Manager, Margaret Round and Commissioner , Suzanne Condon on 9/7/2012, DPH intends to send the report out for scientific peer review in 2012. A schedule for final issuance of the report will depend on the extent of peer review comments received.
A.36	Richard K. Sullivan, Jr., Secretary	Air Quality	Because there are presently no federal or state public health standards for ultrafine particulate matter, Massport committed to provide $150,000 to MassDOT in support of the scoping of the analyses called for in the Transportation Reform Act. The 2011 ESPR should provide more details on this commitment.	The Massachusetts Department of Transportation (MassDOT) is developing a response to the analysis called for in the Transportation Reform Act. Massport will fund up to $150,000 once the format and scope of the study is developed.
A.37	Richard K. Sullivan, Jr., Secretary	Water Quality	For 2011, the Water Quality/Environmental Compliance and Management chapter should report on the 2010 status of: the 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 Environmental Management Plan; and fuel spill prevention.	These water quality and environmental compliance activities are reported in *Chapter 8, Water Quality/ Environmental Compliance and Management.*
A.38	Richard K. Sullivan, Jr., Secretary	Water Quality	The chapter should also present a discussion of the following topics: future stormwater management improvements (if any); and future MCP and tank management activities. Massport should continue to report in the 2011 ESPR how it will assess, remediate, and bring to regulatory closure areas of subsurface contamination.	Massport and its tenants continue to make progress on bringing various sites to regulatory closure. These and other water quality/ environmental compliance activities are reported in *Chapter 8, Water Quality/ Environmental Compliance and Management.*
A.39	Richard K. Sullivan, Jr., Secretary	Sustainability	The EDR describes Massport's continued sustainability efforts and details how sustainability is incorporated into many aspects of Massport's activities. The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2011 ESPR.	These sustainability efforts are reported in *Chapter 1, Introduction/Executive Summary.*
A.40	Richard K. Sullivan, Jr., Secretary	Mitigation	The 2011 ESPR should report on the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have commenced construction. The mitigation commitments were made in the Section 61 findings for the following projects which should be reported: West Garage/Central Garage; International Gateway; Runway Ends 22R and 33L Safety Improvements; Replacement Terminal A; Logan Airside Improvements Planning; and Southwest Service Area Redevelopment Program. The 2011 ESPR should also update the status of Massport' s mitigation commitments and also identify projects for which mitigation measures have been completed.	The status of these mitigation efforts is reported in *Chapter 9, Project Mitigation Tracking.*

Comment #	Author	Topic	Comment	Response
A.41	Richard K. Sullivan, Jr., Secretary	MEPA	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 2011 ESPR and report this information in a timely manner.	Massport published advance information in October 2012 to provide reviewers with a preview of the data reported on in the *2011 ESPR*. Massport is continuing to explore opportunities to enhance the reporting of information on the website (http://www.massport.com/environment/Pages/Default.aspx). Currently, a visitor to Massport's environmental website could find information on green initiatives at Massport facilities, Massport's achievements in environmental efforts, Massport's environmental management policy, environmental reporting, and related links.
A.42	Richard K. Sullivan, Jr., Secretary	General	Many commenters have suggested ways to improve the text, maps and graphics and Massport should consider those changes for future filings.	Massport continually works to improve the text, maps, and graphics in all of their filings, including the EDRs and ESPRs. A few examples of improvements in this *2011 ESPR* are: a new Noise introduction section in Appendix H to give the lay reader an easy to understand description of key noise issues and terms and a new aerial graphic in Chapter 5, Ground Access, that shows the historical changes to the Logan Airport road network over time.
A.43	Richard K. Sullivan, Jr., Secretary	MEPA	For several recent projects, 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 2011 ESPR and future EDR submittals.	Massport will publish bilingual meeting and project notices and will make the services of an interpreter available upon request for the *2011 ESPR* and future EDR and ESPR filings.
A.44	Richard K. Sullivan, Jr., Secretary	MEPA	The 2011 ESPR must include a copy of this Certificate and a copy of each comment letter received on the 2010 EDR.	Individual responses to comments are provided in this *Appendix A* and as well as *Appendix B* of this *2011 ESPR.*

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Copies of Secretary of the Executive Office of Energy and Environmental Affairs Certificates issued for the Reporting Years 2004, 2005, 2006, 2007, 2008, and 2009

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August 16, 2006

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS ON THE ENVIRONMENTAL STATUS AND PLANNING REPORT

PROJECT NAME	: 2004 Logan Environmental Status and Planning Report
PROJECT MUNICIPALITY	: Boston / Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: June 7, 2006

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 at 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 Massachusetts Port Authority's (Massport) 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 EIRs. The ESPR is currently updated on a five-year basis, with much less detailed Environmental Data Reports filed in the years between submission of the ESPRs. The 2004 ESPR is the subject of this Certificate.

Background

In 1979, the Secretary of the Executive Office of Environmental Affairs (EOEA) 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

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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.

This 2004 ESPR was originally scheduled to be completed in 2005, but was postponed until 2006. The 2004 ESPR was delayed because of delays associated with the completion of the New England Regional Aviation System Plan (NERASP). Massport adopted the NERASP forecasts for its 2020 Logan Airport forecast of aviation activity in this ESPR, and upon which the analysis of 2020 environmental conditions is based. Postponing completion of the 2004 ESPR ensured that the forecasts used in the ESPR are the most current and accurate forecasts available.

Review of the 2004 ESPR

In general, the ESPR has responded to the scope. In particular, the 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 2004 ESPR included 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.

As always, EOEA remains committed to evaluating and addressing the cumulative impacts of airport operations on the nearby communities. In June 2001, Massport agreed to work with EOEA on structuring a proposed Air Quality Initiative (AQI). The Certificate indicated that Massport was "to solicit project submissions from local governments and community groups, which will be reviewed in an objective, science-based process by a neutral organization such as NESCAUM." This Certificate on the ESPR reiterates that Massport has committed to the Air Quality Initiative, a key program designed to mitigate the cumulative air quality impacts of airport operations. The 2005 EDR should detail how Massport is meeting this commitment. The 2005 EDR must also address all of the air quality issues raised by the commenters.

Although Massport has presented a detailed ESPR, I remain concerned with a number of environmental issues, specifically air quality and noise related issues, as outlined below.

Follow-up

Massport should submit the next EDR (analyzing conditions for the 2005 calendar year no later than December 15, 2006. I recognize that this Certificate requires the inclusion of considerable follow-up in that document. However, ESPRs invariably raise important issues which require follow-up sooner rather than later, and this ESPR is no exception. I anticipate that the EDR in a year following the publication of an ESPR will always have to include such analytical follow-up to the ESPR and respond to comments on the ESPR. Other EDRs should provide more of a

"snapshot" of the previous year's operations and impacts, with more substantial analysis awaiting the next GEIR. EDRs in years other than the year immediately following publication of an ESPR should therefore be considerably less voluminous and Massport should strive to submit these documents by July 31 of the year following the subject year.

Responses to Comments

The next EDR must include Responses to Comments which addresses all of the substantive comments from the letters listed at the end of this Certificate. The Response to Comments included in this ESPR is well-constructed and cross-referenced (although several comments have complained of general responses or document references in response to specific questions). Massport may follow the same format in addressing comments in the next EDR, although the Responses to Comments should pay particular attention to increased specificity, where necessary.

The majority of comments received on the EDR focused on air quality and noise related issues, including measurement of noise, modeling of noise contours, and noise abatement. In addition to responding to these comments, the 2005 EDR and future EDRs should also continue to report on the refinements to noise tracking and abatement efforts.

Airport Activity Levels

The ESPR included a chapter on airport activity levels, including information on aircraft operations, fleet mix, passenger activity levels, and cargo and mail operations. This chapter also reported on Massport's forecasts that will become the basis for Massport's strategic planning initiatives over the next few years. Past forecasts were based on low, medium, and high passenger activity levels. New forecasts are now based on the forecasts for 2020 developed for the New England Regional Airport System Plan (NERASP) study. This chapter included aircraft operations and passenger activity forecasts, and provided a discussion of methodologies and assumptions, including anticipated fleet mix changes and other trends in the aviation industry.

Air passenger traffic at Logan Airport continued to rebound in 2004, but remained below the peak year level reached in 2000. The total number of passengers using Logan Airport in 2004 increased by 14.7 percent over 2003 levels to 26.1 million passengers. Although the recovery in passenger demand was underway in 2004 at Logan Airport and throughout the industry, legacy commercial airlines continued to struggle financially as competition from low cost carrier (LCC) rivals increased and fuel prices remained high.

For the first time since 1998, total annual aircraft operations (arrivals and departures) at Logan Airport increased compared to the previous year and were at their highest level since 2001. Daily operations in 2004 averaged approximately 1,107 compared to approximately 1,027 in 2003, an increase of about 80 operations per day or about 8.6 percent. 2004 levels remain below historic peaks. The growth in aircraft activity was driven primarily by the entry and expansion of LCCs at Logan Airport in 2004. This increase in LCC services in 2004 stimulated growth in airport

passenger demand.

In 2004, Logan Airport ranked 19th among US airports in total cargo volume. All-cargo operations at Logan Airport declined by less than 1 percent in 2004. However, total cargo volume, including cargo carried in the belly compartments of passenger aircraft, rose by 0.6 percent.

Airport Planning

This section described the status of planning initiatives and projects through the planning horizon year (2020) for the Terminal Area; Airside Area; Service and Cargo Areas; and Edge Buffers and Landscaping. The Airport Planning Chapter also reported on the status of public works projects implemented by other agencies within the boundaries of Logan Airport.

Several projects were completed in 2004:

- The majority of construction of the main terminal and satellite concourse of Delta Air Lines' Replacement Terminal A Project was completed in 2004.
- A dedicated hourly parking area opened on the lower level of the Terminal B Garage in July 2004.
- Massport also launched Exit Express, Massport's convenient way to pay for parking.
- The Massachusetts Bay Transportation Authority's (MBTA's) $23 million new Blue Line Airport Station opened in June 2004.
- Demolition of the old MBTA Airport Station was completed in 2004.
- By the end of 2004, completion of the Central Artery/Tunnel (CA/T) Project and improvements to the roadway system were complete, allowing for a more efficient roadway network with shorter and more direct routes between destinations in the airport and the regional highway system.
- The Silver Line, the most recent addition to the transit system and Boston's first Bus Rapid Transit line, began limited service to Logan Airport in December 2004.

Both Massport and Logan Airport's tenants are proposing projects or exploring planning options to modernize and carry out future improvements at Logan Airport. Massport's planning criteria for Logan Modernization are based on accommodating 45 million annual passengers in airport terminals, facilities, and on airport roadways. Future projects and planning concepts include:

- Both Massport and Logan Airport's tenants are proposing projects or exploring planning options to modernize and carry out future improvements to the existing terminal facilities. Some projects and planning concepts include ongoing expansion and upgrade of Terminal E and constructing a new satellite Federal Inspectional Services (FIS) Facility at the southeast end of Terminal B.
- Some projects and planning concepts that are underway or under consideration include, consolidating flight kitchen facilities in the north service area, constructing new multi tenant maintenance facilities for ground service equipment (GSE), and constructing new

hangar facilities in the north cargo area.

- Airside improvements include upgrades and improvements to the airfield to enhance the operations efficiency and safety of Logan Airport. Some projects and planning concepts that are underway or under consideration include, installing a security wall along the perimeter of the air operations area, providing additional aircraft parking for certain types of aircraft, and an airside improvements planning project to reduce current and projected levels of aircraft delay.
- Buffer areas are being designed in consultation with Logan Airport's neighbors and other interested parties in an open community planning process. Some future airport buffer projects and planning concepts include, landscaping the former Navy Fuel Pier at Jefferies Point, installing a landscaped border in conjunction with the north service area Economy Parking Lot construction, and constructing a half-acre linear area with landscaping and lighting improvements along Maverick Street.
- Massport is considering a parking strategy to address future on-airport parking demands. Some ongoing and future parking projects and planning concepts include redeveloping three parcels into a combined economy parking facility with the capacity for up to 1,750 vehicles, proposed parking facility in the Southwest Service Area, and a new consolidated facility for all car rental operations

Regional Transportation Context

Overall, aviation activity levels at New England's regional airports increased in 2004, as passenger demand continued to rebound both within the region and nationally after the 2001 downturn. Just as the passenger decline seen at the regional airports in the wake of September 11, 2001 was less severe than the declines experienced at Logan Airport, the traffic recovery seen at the regional airports in 2004 was not as strong as the rebound experienced at Logan Airport. Growth at Logan Airport was largely fueled by a growing presence of LCC services. At the same time, regional airports continued to experience growth in 2004 and served a significant (42.5 percent) share of the region's air passenger traffic. Several factors have contributed to the success of the regional airports in recent years:

- Many of the regional airports benefited from the introduction and growth of LCC services over the past several years. This trend began when Southwest Airlines entered the New England market in 1996 by serving T.F. Green Airport in Warwick, Rhode Island and later expanding into the Manchester and Hartford/Bradley International Airports. The trend continued in 2004 when Spirit Airlines began service from T.F. Green Airport, Independence Air5 initiated low-fare service at several of the regional airports, and Southwest Airlines continued to increase service from its New England airports.
- Several of the smaller airports, particularly Burlington, Bangor, and Tweed-New Haven continued to benefit from the introduction of regional jets and gained new non-stop services to airline connecting hubs, which increase service options for regional airport passengers.

Ground Transportation

The chapter reported on 2004 conditions and provided a comparison of 2004 findings to previous years for variety of ground transportation indicators. The chapter also presented a discussion of analysis methodologies and assumptions for future year conditions for the planning horizon year 2020 for Traffic volumes, On-airport Vehicle miles traveled (VMT) and Parking demand.

- Completion of the CA/T and Logan Airport Modernization projects created a more efficient roadway network with shorter and more direct routes to destinations within Logan Airport.
- With the exception of water transportation, all scheduled and unscheduled high occupancy vehicle (HOV) transportation to Logan Airport saw increased ridership in 2004.
- Overall HOV mode share for air passengers increased from 25.8 percent in 1990 to 32 percent in 2003. Although the data shows a slight decrease to 30.3 percent in HOV modes in 2004, the 2003 HOV mode share was an all-time high, reflecting Massport's success in generally maintaining or increasing the percentage of passengers using HOV modes in all market segments.
- The most recent employee survey showed an employee HOV mode share of 26.8 percent.
- Airport-related average annual daily traffic (ADDT) volumes increased by 12.6 percent in 2004 over 2003 volumes. Despite this increase in ADDT volumes, the vehicle miles traveled (VMT) on Logan Airport's roadway system only increased by 3.5 percent in 2004 compared with the 2003 VMT. This reflects the effects of the changes in the airport roadway system resulting from the CA/T and Logan Airport Modernization projects, which result in a shorter average trip length, creating a much smaller increase in total VMT than in average weekday daily traffic volumes.
- Massport executed a Memorandum of Understanding with the MBTA to commence Silver Line bus rapid transit service in late 2004. Massport's support of the Silver Line Airport service will total more than $30 million over ten years.

Between 2003 and 2004, membership in the Transportation Management Association (TMA) declined by 800 employees, a 13.3% reduction. Massport stated in the ESPR that significant TMA funds had been expended for administrative functions resulting in underfunded programming. The Executive Office of Transportation's MassRIDES program will now provide a TMA coordinator at state expense. The EOT identified its expectation that Massport will "maintain its current level of effort, including both cash contributions and in-kind services.

The Secretary's June 15, 2001 Certificate on the AIPP directs Massport to require that all Logan employers join the TMA at the earliest possible opportunity. This mitigation measure is not listed in Table 10-7 and no plan is presented for meeting this requirement. A plan should be detailed in the 2005 EDR.

The ESPR indicated that two FAA programs had relocated to New Hampshire in 2004 and that Beacon-Skanska, having completed the construction of Terminal A, was no longer at Logan. Four additional corporate members left the TMA in 2004. The 2005 EDR should provide explanation for this.

The 2003 EDR stated that TMA shuttle ridership declined by 32.4 percent due to the elimination of services at mid-year due to lack of funding., but that the decrease in shuttle ridership had been more than off-set by increased Logan Express use. Massport should identify any efforts such as more active marketing of car/ridesharing options targeted to those who previously used the cancelled shuttles. This information should be provided in the 2005 EDR.

Noise

This chapter began with an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, the methodologies used to track noise, and what if any changes there was in noise modeling. The information in this chapter built upon the findings of the Boston Logan Overflight Noise Study. This chapter also updates the status Massport's efforts to reduce noise levels and provides noise contours population counts for 2020.

- Massport has continued to make improvements in the noise modeling process as the sophistication of noise models and data acquisition systems has advanced. Recent developments in noise modeling technologies and techniques employed in this 2004 ESPR and to be used in future years include: use of a new radar data acquisition system, known as a long-range PASSUR, for the source of all radar-based operations data; a new upgrade to Massport's radar data processing software; use of the latest update to the FAA's Integrated Noise Model, while retaining the unique capability to account for over-water sound propagation and hill effects unique to Logan Airport; incorporation of more than 1,800 modeled flight tracks, checked and updated where necessary to reflect 2004 radar data; use of radar data to determine the "best-fit" match among each of the nearly 402,000 radar traces captured by Logan Airport's noise monitoring system and the available climb profile contained within the INM database; procurement of an improved noise and operations monitoring system; procurement of automated altitude profile and noise contour generation software.
- From May to August 2004, Runway 4L-22R was closed either completely or partially to accommodate repaving. Due to this closure, jet aircraft departures on Runway 22R decreased by approximately 23 percent compared to 20036 while departures on other runways increased.
- As a result of changes in airport operations in 2004, the number of people exposed to Day-Night Sound Level (DNL) values greater than 65 dB increased compared to the number in 2003. An estimated 10,720 people were exposed to DNL levels greater than 65 dB in 2004, compared to 7,183 in 2003, and 8,309 in 2002. The majority of the increase occurred in East Boston off the northwest end of Runway 33L. The increases within the

65dB are in areas that were previously sound insulated. Despite these increases, the total count of people exposed to 65 dB DNL and above was 23 percent lower than in 2001.

- The 2004 Cumulative Noise Index (CNI) of 153.4 Effective Perceived Noise Level (EPNdB) remained well below the cap of 156.5 EPNdB. Although CNI also increased compared to 2003 and 2002 as a result of the increased number of operations, the 2004 level remained below the 2001 CNI value.

- The number of residential dwelling units for which Massport provided sound insulation in 2004 was 791. Since the program's inception, the total number of dwelling units receiving sound insulation is now 8,615. In addition, Massport completed sound insulation of a 36th school – the new Center School located in Winthrop.

The Logan Airport Noise Study is now expected to be conducted in at least three phases. I strongly encourage Massport to include a phase for the monitoring and assessment of altered flight paths so that any necessary modifications can be identified and implemented.

In addition, the ESPR indicated that there will be an increase from 2004 to 2020 in the number of Boston residents who will experience noise in the 70-75 DNL and the 75-80 DNL due to the use of parallel runways. Massport strive to identify ways to ensure that these increases do not occur. The 2005 EDR should include a preliminary discussion about how Massport will address projected exceedances.

Air Quality

This chapter presented an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, and the changes in air quality modeling. It also predicts emission levels for 2020.

- To ensure consistency and comparability between 1999 and 2004 air quality emissions, the 1999 air emissions inventory was updated with information that was not available when first reported and 1999 emissions were recalculated using the new version of the FAA's Emissions and Dispersion Modeling System (EDMS) v4.21. Additional data were also added to the 2004 inventory in order to increase the accuracy of the results, for example curbside queue times were updated and new parking areas were added to the inventory.

- In 2004, the emission inventory results were driven by an 8 percent increase in aircraft operations compared to 2003 activity levels. Increases in stationary source (fuel storage facilities, heating plant, etc.) emissions further contributed to the increase in levels of volatile organic compounds (VOCs) and oxides of nitrogen (NOx).
- In 2004, total VOC emissions at Logan Airport were estimated to be approximately 1,360

kilograms (kg)/day, which is an increase of 17 percent from 2003 levels. However, total VOC emissions at Logan Airport were 41 percent lower in 2004 than in 1999. The increase of VOC emissions between 2003 and 2004 was due to the increase in aircraft operations in 2004.

- In 2004, total NOx emissions from all airport-related sources were estimated to be 4,290 kg/day, which is an increase of 16 percent from 2003 levels, but is a 26 percent decrease as compared to 1999 levels. Once again, the increase in aircraft operations contributed the most to this increase in airport-related NOx in 2004.

- Total carbon monoxide (CO) emissions at Logan Airport in 2004 were estimated to be 9,852 kg/day, or 3 percent below 2003 levels. In 2004, total CO emissions at Logan Airport were 32 percent lower than 1999 levels. While CO emissions from aircraft increased due to increased aircraft operations, the use of alternative fuel vehicles (AFVs) and the lower emission rates of the motor vehicle fleet helped to reduce the overall CO emissions in 2004. Massport added three new AFVs to its fleet in 2004.

- Massport developed an Air Quality Initiative (AQI) in 2001 as a long-range program with the overall goal to maintain NOx emissions associated with Logan Airport at or below the 1999 level of 2,347 tpy. In 2004, NOx emissions from all airport-related sources were estimated to be 1,726 tpy, well below the 1999 level.

Through the June 15, 2001 Certificate of the Secretary of EOEA on the FEIR for the AIPP, Massport was directed to develop a program to maximize the use of single-engine taxiing procedures by all of its tenant airlines. Massport must describe in the 2005 EDR how it presently encourages reduced-engine (single-engine) taxiing. The cited issues of safety and practicality should be discussed and the program that will be implemented as noted in Table 10-7of the 2005 ESPR should be outlined.

Massport was also directed in the same Certificate to conduct follow-up air quality monitoring in neighborhoods surrounding the airport and surrounding flight paths. This mitigation measure does not appear in Table 10-7, "Logan Airside Improvements Planning Project, Details of Ongoing Section 61 Mitigation Measures." The 2005 EDR should address this measure in detail.

Table 7-13 of the 2004 ESPR , "Inventory of Tracking of NOx Emissions in tons per year for Logan Airport," contains numbers that have been "adjusted to reflect know reductions achieved by Massport and its tenants at Logan Airport." The 2005 EDR should include unadjusted numbers and detailed information about the means for achieving reductions and the emissions value of each reduction method.

Massport had agreed to work with EOEA on structuring a proposed Air Quality Initiative (AQI) in the June 2001 Certificate for the AIPP. The Certificate indicated that Massport was "to solicit

project submissions from local governments and community groups, which will be reviewed in an objective, science-based process by a neutral organization such as NESCAUM." There is no information in the ESPR about the substance and status of any process with EOEA or about the solicitation of information and objective, neutral, scientific review. The 2005 EDR should address this matter in detail.

Environmental Management/Water Quality/Environmental Compliance

This chapter reported on the activities of Massport's Environmental Management Unit in meeting the state's environmental regulatory requirements.

- In 2004, of the 126 spills reported to the Logan Airport Fire-Rescue Department, 18 spills (14 percent) were ten gallons or greater in quantity. Jet fuel spills accounted for 82 (65 percent) of the total spills, with 12 spills (15 percent) being ten gallons or greater in quantity. The remaining 44 spills involved gasoline, hydraulic oil, diesel fuel, ethylene glycol, propylene glycol, paint, and AVGAS. Of these spills, 6 (14 percent) were ten gallons or greater. Since 2002 there has been a reduction in the total volume of all spills.

- In accordance with the Massachusetts Contingency Plan (MCP), Massport continues to assess, remediate, and bring to regulatory closure areas of subsurface contamination.

Massport indicates that it has had limited success in identifying the causes of exceedances due to "first flush" pollutants in stormwater, the number of potential sources at Logan, and the size of drainage areas serving outfalls. Massport needs to develop a plan for maximizing its ability to identify causes. This plan should be identified in the 2005 EDR. Massport should also include in the 2005 EDR copies of any new NPDES stormwater and fire training permits.

Sustainability Initiatives

This Chapter presented Massport's on-going and upcoming sustainability initiatives at Logan Airport. Massport continues to demonstrate forward thinking in sustainability policies and practices for transportation agencies. I encourage Massport to require tenant participation and compliance with all elements of the plan as leases are renewed.

As I stated at the beginning of this Certificate, the 2005 EDR must provide responses to the issues raised in comments received. The 2005 EDR must include a copy of this Certificate and a copy of each comment letter received on the 2004 ESPR. In particular, Massport should provide a thorough examination of issues raised regarding individual noise monitoring locations, noise measurement and modeling, and noise abatement. Massport should consult directly with individual commentors where necessary.

A distribution list for the 2005 EDR (indicating those receiving documents, CDs, or Notices of

Availability) should be provided in the document. This section must also include copies of all GEIR/Annual Update Certificates issued since 1995 to provide context for reviewers. Supporting technical appendices should be provided as necessary.

August 16, 2006
Date

Robert W. Golledge, Jr.

Comments received:

07/25/06	Stephen Kaiser
08/08/06	Nancy Timmerman
08/09/06	MA Executive Office of Health and Human Services
08/09/06	John Vitagliano
08/09/06	Bruce Egan, Egan Environmental
08/10/06	City of Boston Environment Department
08/14/06	Boston Transportation Department

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February 15, 2007

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
2005 LOGAN AIRPORT ENVIRONMENTAL DATA REPORT

PROJECT NAME	: 2005 Environmental Data Report
PROJECT MUNICIPALITY	: Boston / Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: December 23, 2006

As Secretary of Environmental Affairs, I hereby determine that the Environmental Data 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 at 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 Massachusetts Port Authority's (Massport) 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 EIRs. The ESPR is currently updated on a five-year basis, with much less detailed Environmental Data Reports (EDR) filed in the years between submission of the ESPRs. The 2005 EDR is the subject of this Certificate.

Background

In 1979, the Secretary of the Executive Office of Environmental Affairs (EOEA) 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 2005 EDR

In general, the EDR has fulfilled its purpose of providing a "snapshot" of year 2005 passenger and impact levels at Logan Airport. Most environmental parameters showed significant improvement in calendar year 2005. In particular, the technical studies in the 2005 EDR included reporting on and analysis of key indicators of airport activity levels, airport planning, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking.

As always, EOEA remains committed to evaluating and addressing the cumulative impacts of airport operations on the nearby communities. In June 2001, Massport agreed to work with EOEA on structuring a proposed Air Quality Initiative (AQI). The Certificate indicated that Massport was "to solicit project submissions from local governments and community groups, which will be reviewed in an objective, science-based process by a neutral organization such as NESCAUM." The 2005 EDR reiterates that Massport has committed to the Air Quality Initiative, a key program designed to mitigate the cumulative air quality impacts of airport operations. The 2005 EDR details how Massport is meeting this commitment. The 2006 EDR should continue to report on the details of Massport's committment. In addition to the environmental issues listed below, the 2006 EDR should address all of the air quality and noise related issues raised by the commenters during the review of the 2005 EDR.

Follow-up

Massport should file the next EDR (covering operations for the 2006 calendar year) in calendar year 2007. The EDR should provide more of a "snapshot" of the 2006 operations and impacts, with more substantial analysis awaiting the next GEIR. Massport should also address the comments received on the current EDR when developing its 2006 EDR.

Responses to Comments

The next EDR must include Responses to Comments which addresses all of the substantive comments from the letters listed at the end of this Certificate. The Response to Comments

included in this EDR is well-constructed and cross-referenced. Massport may follow the same format in addressing comments in the next EDR, although the Responses to Comments should pay particular attention to increased specificity, where necessary.

The majority of comments received on the 2005 EDR focused on air quality and noise related issues, including measurement of noise, modeling of noise contours, and noise abatement. In addition to responding to these comments, the 2006 EDR and future EDRs should also continue to report on the refinements to noise tracking and abatement efforts.

Activity Levels

The Activity Levels chapter presents aviation activity statistics for Logan Airport in 2005 and compares activity levels to the prior year including air passengers, aircraft operations, fleet mix, and cargo/mail volumes. Air passenger traffic at Logan Airport continued to rebound in 2005, but remained below the peak year level reached in 2000. Specifically, the total number of passengers using Logan Airport in 2005 increased by 3.6 percent over the prior year to 27.1 million passengers. In 2005, total aircraft operations (409,066 operations) at Logan Airport increased by 0.9 percent over 2004 levels. While 2005 passenger traffic at Logan Airport was approximately equal to 1999 levels, in 2005 these passengers were being carried on approximately 86,000 fewer flights (495,000 flights in 1999 versus 409,066 flights in 2005). Several commenters raised concerns with the increase in passenger levels requesting long-term solutions to meeting demand which do not include expansion of Logan Airport's capacity or footprint. I advise Massport to consider and attempt to address these comments in the next 20006 EDR.

Planning

The Airport Planning chapter provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2005. It also describes known future planning, construction, and permitting activities. Specifically, several projects were completed in 2005 including the majority of construction of the main terminal and satellite concourse of Delta Air Lines' Replacement. Terminal A Project was completed in 2004, with final fit up and commissioning in 2005. Massport also launched Exit Express as part of an on-going program to improve parking facilities and improve air quality through enhanced circulation and reduced idling at the toll booths. In addition, as part of a cooperative venture between the Massachusetts Bay Transportation Authority (MBTA) and Massport, initial Silver Line service to the airport began in December 2004. Full Silver Line service to Logan Airport began on June 1, 2005.

The chapter also includes future planning including: ongoing expansion and upgrade of Terminal E and completion of West Garage Phase II(Central Garage Expansion); more efficient ways of using the limited land resources in the service areas; airside improvements include upgrades and improvements to the airfield to enhance the operations, efficiency and safety of Logan Airport; In addition, buffer areas are being designed in consultation with Logan Airport's neighbors and other interested parties in a community planning process. Massport is also considering a parking strategy to address future on-airport parking demands. Some ongoing and future parking projects and planning concepts include redeveloping three parcels into a combined economy parking

facility with the capacity for up to 1,750 vehicles and a new consolidated facility for all car rental operations.

Regional Transportation

This chapter describes activity levels at New England's regional airports in 2005 and updates recent planning activities. Overall, the number of air passengers utilizing New England's primary commercial service airports in 2005 rose by 5.3 percent over 2004. When measured by aircraft operations, however, activity levels fell by 0.6 percent. This reflects sweeping changes in both the commercial aviation and general aviation (GA) sectors of the industry. Passenger numbers rose despite capacity reductions as airlines operated at higher load factors. Carriers flew fewer flights to the regional airports than in 2004, but used larger aircraft on average in 2005, and carried more passengers. GA operations at New England airports declined by 3.8 percent from the 2004 levels. The Boston Transportation Department has raised a number of suggestions related to the Regional Transportation that Massport should consider in the 2006 EDR.

Ground Transportation

This chapter reports on transit ridership, roadways, traffic volumes, and parking for 2005. Specifically, ground transportation activity levels increased from 2004 to 2005 as a result of a 3.6 percent increase in the number of air passengers. In addition, traffic volumes on airport roadways increased by 5.8 percent, while the vehicle miles traveled (VMT) on the airport increased by 4.2 percent. The lower VMT growth when compared to overall traffic volume growth suggests that more direct connections over shorter roadway distances are provided. The facilities at the MBTA Blue Line Airport Station were also substantially improved in 2005, including the conversion from a manual to an automated fare collection system. In addition, full MBTA Silver Line service to Logan Airport began on June 1, 2005. In 2005, Terminal A and its associated access roadways were fully opened for operation. There were no other roadway modifications completed in 2005. In addition, contract negotiations began between Massport and the C & J Bus Company in New Hampshire to expand early morning transportation between New Hampshire and Logan Airport. This service began in 2006. Massport also re-bid its Logan Airport Transportation Management Association (Logan TMA) contract with the Executive Office of Transportation (EOT) through the MassRIDES program.

Noise

The Noise Abatement chapter updates the status of the noise environment at Logan Airport in 2005, and describes Massport's efforts to reduce noise levels. In 2005, the number of people exposed to Day-Night Sound Level (DNL) values greater than 65 decibels (dB) decreased compared to 2004. An estimated 6,477 people were exposed to DNL levels greater than 65 dB in 2005, compared to 9,438 in 2004, and 7,183 in 2003. The total count of people exposed to 65 dB Day-Night Sound Level (DNL) and above was 55 percent lower than in 2001. Winthrop, which has always experienced the highest levels of noise exposure of any community around Logan Airport, continued its decline in the number of people exposed to levels greater than 65 DNL. This number has dropped 81 percent since reaching its peak in 1998. The number of residents

exposed to noise over 75 DNL increased from 2004 but still remained below 2001 levels.

The 2005 Cumulative Noise Index (CNI) of 153.2 Effective Perceived Noise Level (EPNdB) remained well below the cap of 156.5 EPNdB. The CNI decreased slightly compared to 2004 even with a slight increase in the number of operations in 2005. This decrease is primarily due to decreased use of recertified aircraft by cargo operators. Massport provided sound insulation for 471 residential dwelling units in 2005. Since the program's inception, Massport has sound insulated a total of 9,086 dwelling units. The majority of the units insulated in 2005 were in Winthrop.

The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2006 EDR. I also strongly advise Massport to consider and address the numerous comments received that have raised noise related concerns in comments.

Air Quality

The Air Quality/Emissions Reduction chapter provides an overview of airport-related air quality issues in 2005 and efforts to reduce emissions. The 2005 emissions inventory results are driven by the small increase in aircraft operations at Logan Airport compared to 2004 levels. Compared to 2004 levels, total emissions of volatile organic compounds (VOCs) are estimated to have decreased by approximately 6 percent to 1,285 kilograms per day (kg/day). In 2005, total emissions of oxides of nitrogen (NOx) were estimated to be 4,187 kg/day, which is a 2 percent decrease from 2004 levels. Total emissions of carbon monoxide (CO) in 2005 were 9,556 kg/day, or 3 percent lower than 2004 levels.

For the first time, estimates of particulate matter emissions associated with Logan Airport are reported in this 2005 EDR in response to the recent availability of an FAA-approved method for computing particulate matter emission factors for aircraft. Total emissions of particulate matter (PM2.5) at Logan Airport in 2005 were approximately 83 kg/day [33 tons/year (tpy)]. NOx emissions at Logan Airport in 2005 were approximately 662 tpy lower than 1999 levels—a 28 percent decrease. It appears that there is an ongoing trend of decreasing nitrogen dioxide (NO2) concentrations at both the Massport and Massachusetts Department of Environmental Protection (MassDEP) monitoring sites located in the general vicinity of Logan Airport. In addition, annual NO2 concentrations at all monitoring locations were well below the NO2 air quality standards in 2005. The 2006 EDR should continue updates on the information presented in the 2005 EDR.

Water Quality/Environmental Compliance

This chapter describes Massport's ongoing environmental management activities including NPDES compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan, and tank management. Specifically, of the 97 spills reported in 2005, 15 (15 percent) were ten gallons or greater in quantity. Jet fuel spills accounted for 66 (68 percent) of the total spills, 12 of the jet fuel spills (18 percent) were ten gallons or greater in quantity. The remaining 31 spills involved gasoline, hydraulic oil, diesel fuel, and other substances. Of these spills, only

three (10 percent) were ten gallons or greater. In 2005, only eight samples exceeded the regulatory limits. The North Outfall had two samples which exceeded the 15 milligrams per liter (mg/L) National Pollutant Discharge Elimination System (NPDES) limit for oil and grease, and the Porter Street Outfall had one sample exceed this limit. The North Outfall had two samples which exceeded the 0.3 milliliters per liter (ml/L) daily maximum limit for settable solids, and the West Outfall had three samples exceed this limit. No other exceedances occurred. In accordance with the Massachusetts Contingency Plan (MCP), Massport should continue to report in the 2006 EDR how Massport will assess, remediate, and bring to regulatory closure areas of subsurface contamination.

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, 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. This chapter describes Massport's continued efforts.

As I stated at the beginning of this Certificate, the 2006 EDR must provide responses to the issues raised in comments received. The 2006 EDR must include a copy of this Certificate and a copy of each comment letter received on the 2005 EDR. In particular, Massport should provide a thorough examination of issues raised regarding individual noise monitoring locations, noise measurement and modeling, and noise abatement. Massport should consult directly with individual commentors where necessary.

A distribution list for the 2006 EDR (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document. This section must also include copies of all GEIR/Annual Update Certificates issued since 1995 to provide context for reviewers. Supporting technical appendices should be provided as necessary.

February 15, 2007
Date

Ian A. Bowles

Comments Received:

01/30/07	**State** Representative Robert A. DeLeo
01/31/07	Joseph Felzani
02/05/07	Boston Transportation Department
02/06/07	Nancy Timmerman
02/07/07	Stephen Kaiser
02/13/07	**City of Boston Environment Depar**tment

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November 1, 2007

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
2006 LOGAN AIRPORT ENVIRONMENTAL DATA REPORT

PROJECT NAME	: 2006 Environmental Data Report
PROJECT MUNICIPALITY	: Boston / Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: **Massachusetts** Port Authority
DATE NOTICED IN MONITOR	: September 25, 2007

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 (G. L. c. 30, ss. 61-62H) and with its implementing regulations (301 CMR 11.00).

The environmental review process at 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. In recognition of the increased role of planning in the GEIR process, the name of the document was changed to ESPR. 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 EIRs. The ESPR is currently updated on a 5-year basis, with much less detailed Environmental Data

Reports (formerly Annual Updates) filed in the years between ESPRs. The 2006 EDR is the subject of this Certificate.

In general, the EDR has fulfilled its purpose of providing a "snapshot" of year 2006 passenger and impact levels at Logan Airport. Most environmental parameters showed improvement in calendar year 2006. In particular, the technical studies in the 2006 EDR included reporting on and analysis of key indicators of airport activity levels, airport planning, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. Mitigation of noise impacts and air quality remain key concerns both of this office and the commenters. These commitments take the form of project-specific Section 61 Findings, as well as more general mitigation that has emerged from the ESPR process.

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 2006 EDR

As always, EEA remains committed to evaluating and addressing the cumulative impacts of airport operations on the nearby communities. In June 2001, Massport agreed to work with EEA on structuring a proposed Air Quality Initiative (AQI). The Certificate indicated that Massport was "to solicit project submissions from local governments and community groups, which will be reviewed in an objective, science-based process by a neutral organization such as NESCAUM." The 2006 EDR reiterates that Massport has committed to the Air Quality Initiative, a key program designed to mitigate the cumulative air quality impacts of airport operations. The 2006 EDR details how Massport is meeting this commitment. The 2007 EDR should continue to report on the details of Massport's commitment and address the concerns raised by the City of Boston's Environment Department on this issue. In addition to the environmental issues listed below, the 2007 EDR should address all of the air quality and noise related issues raised by the commenters during the review of the 2006 EDR.

Procedural

Given the overall strength of the analysis in the 2006 EDR, the 2007 EDR can restrict itself to providing an update on 2007 conditions, and respond to those issues explicitly noted in this

Certificate and the comments received as requiring response in the next EDR. The EDR should provide a "snapshot" of the 2007 operations and impacts, with more substantial analysis awaiting the next ESPR. Massport should file the 2007 EDR no later than October 15, 2008 (although I encourage Massport to file sooner, given the relatively few requirements for the next EDR).

A distribution list for the 2007 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 comments received on the 2006 EDR are thoughtful and detailed although I note that some of the comments were received only one day before this Certificate was to be issued. I request that during the review of the 2007 EDR that commenters make every attempt to submit comments by the close of the comment period to allow time for review. The 2007 EDR must include Responses to Comments which addresses all of the substantive comments from the letters listed at the end of this Certificate. The Response to Comments included in this EDR is well-constructed and cross-referenced. Massport may follow the same format in addressing comments in the next EDR, although the Responses to Comments should pay particular attention to increased specificity, where necessary.

The majority of comments received on the 2006 EDR focused on air quality and noise related issues, including measurement of noise, modeling of noise contours, and noise abatement. In addition to responding to these comments, the 2007 EDR and future EDRs should also continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commentors where necessary.

Organization of the Certificate

I have organized the remainder of this Certificate to respond to issues raised roughly in the order in which they were presented in the 2006 EDR, although I have for the most part incorporated discussion of issues raised in the technical appendix into the discussion of the environmental impact analyses.

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 2006 and compares activity levels to the prior year including air passengers, aircraft operations, fleet mix, and cargo/mail volumes. Air passenger traffic at Logan Airport reached 27.7 million, up from 27.1 million in 2005. The total number of aircraft

operations decreased in 2006 even though the total number of air passengers increased because airlines increased the number of passengers per aircraft operation. Specifically, the total number of aircraft operations declined from 409,066 in 2005 to 406,119 in 2006 which is a decrease of 0.7 percent. Air cargo volumes continued to decline from 728 million pounds in 2005 to 679 million pounds in 2006 with the largest volume decrease in the express/small packages. I advise Massport to consider and attempt to address all comments related to activity levels in the next 2007 EDR.

Planning

The Airport Planning chapter provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2006. It also describes known future planning, construction, and permitting activities. Specifically, several projects were completed in 2006. The new Terminal A, which opened on March 16, 2005, achieved Leadership in Energy and Environmental Design (LEED) certification in June 2006. It is the first airport terminal in the U.S. to earn this ranking. In addition, in November, 2006 the MBTA Silver Line service was enhanced with the addition of the Massachusetts Bay Transportation Authority's (MBTA) Charlie Card automatic fare collection kiosks in all Logan Airport terminals. Several construction projects were also completed, including the construction of the North Service Road (SR-2) Roadway Buffer, which consists of a sidewalk linking the Blue Line Airport Station to Logan Airport Terminals, and a landscaped area adjacent to the sidewalk. Construction of Phase 1 of the Southwest Service Area (SWSA) buffer, which began in 2005, was completed in the fall of 2006, and the Navy Fuel Pier Edge Buffer was completed in December 2006.

Regional Transportation

This chapter describes activity levels at New England's regional airports in 2006 and updates recent planning activities. Massport has demonstrated that it is coordinating its planning with other transportation agencies, and that this planning effort is aimed at minimizing cumulative impacts from Logan Airport operations. The 2006 EDR includes estimates of potential passenger diversions from Logan, and outlines how Massport planning encourages those diversions.

In general, the 2006 EDR has met the requirements laid out in the ESPR Certificate. The directives in the ESPR Certificate were laid out to have Massport look at potential diversions, and explain how its planning and coordination with other agencies could impact potential diversions. The 2006 EDR has performed this task.

Overall, the number of air passengers utilizing New England's primary commercial service airports in 2006 declined marginally, from 48.0 million to 47.9 million. When measured by the number of aircraft operations, however, activity levels fell by 4.4 percent, from 1.4 million operations to 1.3 million operations. This reflects substantial changes in the commercial aviation sector and the continued decline of general aviation (GA) noted in the 2005 EDR. Major airlines

reduced capacity at the regional airports in 2006 as they reconfigured their operations in an effort to consolidate gains made in bankruptcy and near-bankruptcy restructuring. Passenger declines were generally consistent with capacity reductions. In addition, the average aircraft size of scheduled flights to the regional airports declined in 2006 as airlines substituted regional jet service for mainline jets on certain routes. Declines in GA activity in New England (declined by 4.2 percent from 2005 levels) continue to outpace declines in the rest of the country. According to the FAA as reported in the 2006 EDR, GA activity declined by 1.3 percent nationally in 2006, largely due to rising fuel costs.

Ground Transportation

The 2006 EDR serves its purpose of updating 2006 ground access conditions on the airport, and has also adequately addressed the larger ground access issues identified in previous Certificates, as discussed below.

This chapter reports on transit ridership, roadways, traffic volumes, and parking for 2006. Specifically, ground transportation activity levels increased across the board from 2005 to 2006 as a result of a 2.4 percent increase in the number of air passengers. Also, a portion of I-90 connecting the City of Boston and areas to the south and west of Boston to Logan Airport was closed from July 2006 until early 2007, which is believed to have reduced traffic flows to and from the Airport. The 2006 EDR reports that ridership on the MBTA, Logan Express, water transportation, scheduled and unscheduled HOV Services, and taxis increased in 2006. This is due in part to the completion of roadway and other construction projects at the Airport, and to the closure of the I-90 connector to the Airport for much of 2006. Massport-subsidized service provided by the C & J Bus Company began in 2006 providing early morning transportation between New Hampshire and Logan Airport. The 2006 EDR also reports that the number of on-Airport parkers decreased by 8.4 percent in 2006.

Noise

The Noise Abatement chapter updates the status of the noise environment at Logan Airport in 2006, and describes Massport's efforts to reduce noise levels. The technical appendix contains useful and detailed information, while the main text provides a solid analysis of major noise issues. Many of the issues raised in the noise analysis are ongoing and require continuous monitoring a point raised by several commenters. The EDR represents an appropriate forum to serve this updating function.

In 2006, the overall number of people exposed to Day-Night Sound Level (DNL) values greater than 65 decibels (dB) decreased in 2006 compared to 2005. An estimated 5,583 people were exposed to DNL levels greater than 65 dB in 2006, compared to 6,477 in 2005, and 9,438 in 2004. For the second year in a row, fewer than 7,000 people experienced levels of 65 dB DNL and above. The 2006 Cumulative Noise Index (CNI) of 152.6 Effective Perceived Noise Level (EPNdB) remained well below the cap of 156.5 EPNdB. The CNI decreased compared to 2005

primarily because of decreased use of recertificated aircraft by cargo operators.

Massport provided sound insulation for 857 residential dwelling units in 2006. This is the largest number of units to receive sound insulation in the vicinity of the Airport in any one year since the beginning of the program. Since the program's inception, Massport has sound insulated a total of 9,943 dwelling units. The majority of the units insulated in 2006 were in Chelsea.

The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2007 EDR. I also strongly advise Massport to consider and address the comments received that have raised noise related concerns.

Air Quality

The Air Quality/Emissions Reduction chapter provides an overview of airport-related air quality issues in 2006 and efforts to reduce emissions.

The emissions inventory results are driven largely by improvements to the FAA Emissions and Dispersion Modeling System (EDMS), v5.0.1. These include the addition of aircraft main engine startup VOC emissions; adjustments to how aircraft performance profiles are modeled, which changed aircraft times-in-mode and thus emissions of all pollutants; an advanced method to calculate aircraft PM10/PM2.5 emissions; and updated ground support equipment (GSE) emission factors using NONROAD2005. The in-place air quality initiatives at Logan Airport and other ongoing efforts by Massport to minimize emissions also played a role, as did changes to aircraft taxi time, fleet mix, and number of operations.

The 2006 EDR reports that emissions inventory changes show an increase in VOC over 2005 levels attributed to the changes to EDMS. The 2006 EDR reported that total VOC emission number is up 34 percent (1,724 kg/day). The total NO_x emissions were one percent lower than reported in the 2005 EDR. In 2006, NOx emissions at Logan Airport were approximately 677 tons per year (tpy) lower than the 1999 threshold level established by Massport's Air Quality Initiative. This represents a 28 percent decrease since1999. There was a continuing trend of decreasing NO2 concentrations at both the Massport and Massachusetts Department of Environmental Protection (MDEP) monitoring sites located in the general vicinity of Logan Airport. In addition, in 2006 the annual NO2 concentrations at all monitoring locations were well below the NO2 air quality standards.

For the second year (2005 EDR was the first year), estimates of particulate matter emissions associated with Logan Airport are reported in this 2006 EDR in response to the recent availability of an FAA-approved method for computing particulate matter emission factors for aircraft. The total CO decreased 15 percent and the total PM_{10} /$PM_{2.5}$ decreased seven percent below the 2005 EDR reported numbers.

The 2006 EDR emissions inventory analysis used the actual aircraft fleet mix, except in the few

instances where aircraft/engine types or combinations were not available in the EDMS database. Data included aircraft type, engine, landing and takeoff operations (LTOs) and aircraft taxi times. Aircraft types are divided into four categories: commercial air carriers, commuter aircraft, general aviation and cargo.

The 2007 EDR should continue updates on the information presented in the 2006 EDR and address comments received related to air quality. In particular the City of Boston has raised several concerns the Massachusetts Department of Public Health's (DPH) Logan Airport Health Study and the air quality monitoring study. The 2007 EDR should update the status of discussions with the City of Boston related to this concern.

Last, I ask that Massport consult with the MEPA office regarding the recently promulgated Greenhouse Gas Emissions Policy and Protocol prior to subsequent filings.

Water Quality/Environmental Compliance

This chapter describes Massport's ongoing environmental management activities including NPDES compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan, and tank management. Specifically, Logan Airport experienced 92 hazardous material spills in 2006, 11 (12 percent) were considered reportable (i.e., over 10 gallons) under the applicable environmental regulations. Jet fuel spills accounted for 65 (71 percent) of the total spills, with nine of the jet fuel spills exceeding 10 gallons. The remaining 27 spills (29 percent) involved gasoline, hydraulic oil, diesel fuel, and other substances, including two reportable spills.

In 2006, only four of 332 outfall samples exceeded the regulatory limits. The West Outfall and the Maverick Street Outfall each had one sample which exceeded the 15 milligrams per liter (mg/L) National Pollutant Discharge Elimination System (NPDES) limit for oil and grease. The North Outfall had two samples which exceeded the 0.3 milliliters per liter (ml/L) daily maximum limit for settable solids. This is an improvement compared to 2005, when eight samples exceeded the regulatory limits. In accordance with the Massachusetts Contingency Plan (MCP), Massport continues to assess, remediate, and bring to regulatory closure areas of subsurface contamination. In 2006, two of its five MCP sites were closed out, and Massport was working towards achieving regulatory closure of the three remaining MCP sites. In accordance with the Massachusetts Contingency Plan (MCP), Massport should continue to report in the 2007 EDR how Massport will assess, remediate, and bring to regulatory closure areas of subsurface contamination.

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, 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.

This chapter describes Massport's continued efforts including Massport-wide sustainability and details how sustainability is incorporated into many aspects of Massport's activities: Planning and Design; Construction; Operations, Maintenance and Management; and Monitoring of Environmental Performance.

Massport has been a leader in sustainable development. Terminal A, which opened in 2005, received LEED certification in 2006. It is the first airport terminal in the country to receive such certification, and is a model for other airports in the country. In addition, in an effort to reduce air pollutants, Massport is phasing in alternative fuel vehicles in place of conventionally-fuel vehicles. At the airport, Massport maintains electric vehicles infrastructure, as well as a privately operated CNG station to power newer vehicles. The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2007 EDR.

November 1, 2007
Date

Ian A. Bowles

Comments Received:

10/24/07	Nancy Timmerman
10/25/07	Stephen Kaiser
10/26/07	**Town of Lincoln,** Lincoln Board of Selectmen
10/31/07	City of Boston's Environment Department
10/31/07	The Boston Harbor Association

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October 31, 2008

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
2007 LOGAN AIRPORT ENVIRONMENTAL DATA REPORT

PROJECT NAME	: 2007 Environmental Data Report
PROJECT MUNICIPALITY	: Boston / Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: **Massachusetts** Port Authority
DATE NOTICED IN MONITOR	: September 24, 2008

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 (G. L. c. 30, ss. 61-62I) and with its implementing regulations (301 CMR 11.00).

The environmental review process at 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. In recognition of the increased role of planning in the Generic Environmental Impact Report (GEIR) process, the name of the document was changed to ESPR. 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 EIRs. The ESPR is currently updated on a 5-year basis, with much less detailed Environmental Data Reports (EDR) (formerly Annual Updates) filed in the years between ESPRs. The 2007 EDR is the subject of this Certificate.

In general, the EDR has fulfilled its purpose of providing a "snapshot" of year 2007 passenger and impact levels at Logan Airport. Most environmental parameters showed improvement in calendar year 2007. In particular, the technical studies in the 2007 EDR included reporting on and analysis of key indicators of airport activity levels, airport planning, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. Mitigation of noise impacts and air quality remain key concerns both of this office and the commenters. These commitments take the form of project-specific Section 61 Findings, as well as more general mitigation that has emerged from the ESPR process.

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 2007 EDR

As always, EEA remains committed to evaluating and addressing the cumulative impacts of airport operations on the nearby communities. In June 2001, Massport agreed to work with EEA on structuring a proposed Air Quality Initiative (AQI). The Certificate indicated that Massport was "to solicit project submissions from local governments and community groups, which will be reviewed in an objective, science-based process by a neutral organization such as NESCAUM." The 2007 EDR reiterates that Massport has committed to the Air Quality Initiative, a key program designed to mitigate the cumulative air quality impacts of airport operations. The 2007 EDR details how Massport is meeting this commitment. The 2008 EDR should continue to report on the details of Massport's commitment and address the concerns raised by the commenters on this issue. In addition to the environmental issues listed below, the 2008 EDR should address all of the air quality and noise related issues raised by the commenters during the review of the 2007 EDR.

Procedural for 2008 EDR

Given the overall strength of the analysis in the 2007 EDR, the 2008 EDR can restrict itself to providing an update on 2008 conditions, and respond to those issues explicitly noted in this Certificate and the comments received as requiring response in the next EDR. The EDR should

provide a "snapshot" of the 2008 operations and impacts, with more substantial analysis awaiting the next ESPR. Massport should file the 2008 EDR no later than October 15, 2009 (although I encourage Massport to file sooner).

A distribution list for the 2008 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 comments received on the 2007 EDR are thoughtful and detailed. The 2008 EDR must include Responses to Comments which addresses all of the substantive comments from the letters listed at the end of this Certificate. The Response to Comments included in this EDR is well-constructed and cross-referenced. Massport may follow the same format in addressing comments in the next EDR, although the Responses to Comments should pay particular attention to increased specificity, where necessary.

The majority of comments received on the 2007 EDR focused on air quality and noise related issues, including measurement of noise, modeling of noise contours, and noise abatement. In addition to responding to these comments, the 2008 EDR and future EDRs should also continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commentors where appropriate.

Organization of the Certificate

I have organized the remainder of this Certificate to respond to issues raised roughly in the order in which they were presented in the 2007 EDR, although I have for the most part incorporated discussion of issues raised in the technical appendix into the discussion of the environmental impact analyses.

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 2007 and compares activity levels to the prior year including air passengers, aircraft operations, fleet mix, and cargo/mail volumes. In 2007, the total number of air passengers reached 28.1 million, up from 27.7 million in 2006. The increase in the total number of air passengers at Logan Airport was 1.4 percent compared to 2.4 percent in the previous year. Specifically, the total number of aircraft operations declined from 406,119 in 2006 to 399,537 in 2007, a decrease of 1.6 percent. Operations by general aviation (GA) aircraft

decreased most significantly (8.9 percent) in 2007 as compared to passenger and cargo operations. As a result of continued passenger growth and a reduction in operations, the number of air passengers per aircraft operation continued to increase in 2007. Air cargo volumes, continued to decline from 679 million pounds in 2006 to 632 million pounds in 2007. 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 2008 EDR.

Planning

The Airport Planning chapter provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2007. It also describes known future planning, construction, and permitting activities. Several projects were completed in 2007 including the International Gateway Project (Terminal E) Phase 2. The Federal Inspection Services (FIS) facility was enlarged and the new arrivals level was constructed with the other Phase 2 improvements. The replacement GA Facility in the North Cargo Area was completed and opened in June, 2007 and the southwest corner of Taxiway D was realigned. In addition, the Terminal Area Roadway Landscaping was completed in 2007 and significant portions of Bremen Street Park were completed in early 2007. Also Phase II of the West Garage Project was completed which added three levels of parking to the Central Garage.

Regional Transportation

In general, the 2007 EDR has met the requirements laid out in the ESPR Certificate with respect to regional transportation issues. This chapter describes activity levels at New England's regional airports in 2007 and updates recent planning activities. Massport has demonstrated that it is coordinating its planning with other transportation agencies, and that this planning effort is aimed at minimizing cumulative impacts from Logan Airport operations. The 2007 EDR includes estimates of potential passenger diversions from Logan, and outlines how Massport planning encourages those diversions. The total number of air passengers using New England's primary commercial service airports in 2007 increased marginally, from 47.13 million in 2006 to 47.2 million. Of the 47.2 million air passengers using New England's primary commercial service airports in 2007, 60 percent utilized Logan Airport as compared to 88 percent in 1995. When measured by the number of aircraft operations, activity levels fell by 2.1 percent, from 1.33 million operations in 2006 to 1.31 million operations in 2007.

The directives in the ESPR Certificate were laid out to have Massport look at potential diversions, and explain how its planning and coordination with other agencies could impact potential diversions. The 2007 EDR has performed this task. I direct Massport to continue the directive from the ESPR Certificate for the 2008 EDR.

This chapter also reflects that passenger traffic at the regional airports fell by 1.6 percent. Major airlines reduced capacity at the regional airports in 2007 because they eliminated unprofitable

routes and reduced their domestic flying to deal with the high and rising cost of fuel. Passenger declines were generally consistent with capacity reductions. Declines in GA activity in New England (declined by 3.5 percent compared with 2.6 percent nationally in 2007) continue to outpace declines in the rest of the country, which is largely attributed to the impact of rising fuel costs on recreational flying.

Ground Transportation

The 2007 EDR serves its purpose of updating 2007 ground access conditions on the airport, and has also adequately addresses the updating of the three new programs to support employees' use of alternative transportation options.

This chapter reports on transit ridership, roadways, traffic volumes, and parking for 2007. Specifically, ground transportation activity levels increased across the board from 2006 to 2007 as a result of a 1.4 percent increase in the number of air passengers. The re-opening of Interstate 90 (I-90) connecting the City of Boston and areas to the south and west of Boston to Logan Airport resulted in increased traffic flows to and from the Airport when compared to previous years. The 2007 EDR reports that ridership on water transportation, scheduled and unscheduled high occupancy vehicle (HOV) services, and employee ridership on Logan Express increased over 2005 levels. The 2007 EDR also reports that the number of on-Airport parkers decreased by 16.9 percent in 2007 compared to 2005. A portion of this decrease is likely due to the increase of pick-up and drop-off at the Airport.

I also note that this chapter discusses that the Logan Employee Transportation Management Association (Logan TMA) introduced and implemented three new programs to support employees' use of alternative transportation options: the Sunrise Shuttle, which provides shuttle services between 3:00 AM and 5:30 AM for Airport employees who reside in East Boston; the Logan TMA Preferential Carpooling, which provides free terminal garage parking to employees in Logan TMA member companies who carpool in groups of three or more; and the Commuter Cash program, which financially rewards employees ($3/day) who switch from driving alone to either carpooling, bicycling, walking, or using public transportation. The 2008 EDR should continue to update 2008 ground access conditions on the airport and report on the use of the three new programs to support employees' use of alternative transportation options.

Noise

The Noise Abatement chapter updates the status of the noise environment at Logan Airport in 2007, and describes Massport's efforts to reduce noise levels. The technical appendix contains useful and detailed information, while the main text provides a solid analysis of major noise issues. Many of the issues raised in the noise analysis are ongoing and require continuous monitoring, a point raised by several commenters. The future 2008 EDR represents an appropriate forum to serve this updating function.

2007 was the first full year of operation for Runway 14-32. Consistent with the 2002 Record of Decision (ROD) on the Airside Improvements Planning Project and based on FAA data, the runway was used primarily for arrivals over Boston Harbor during 2007. Consistent with historical patterns, despite the introduction of Runway 14-23, the FAA continued to rely on Logan Airport's north-south traffic flow in 2007. However, within the north-west flow, the FAA increased reliance on Runway 33L for departures with an associated reduction in Runway 27 departures. The changes in runway utilization in 2007 have led to changes in the noise environment. Since 2006, the noise contours over East Boston increased in extent and, over the same period, decreased over South Boston, Revere, and Winthrop.

The population within the 75-80 decibel (dB) DNL contours decreased in 2007 compared to 2006. In 2006, the population in the 75-80 dB DNL contour was 104 but in 2007 zero population was located in this coutour. In 2006, the population in the 70-75 dB DNL contour was 597 compared to 416 in 2007. The overall number of people exposed to Day-Night Sound Level (DNL) values greater than 65 decibels (dB) increased 36 percent compared to 2006. An estimated 7,591 people were exposed to DNL levels greater than 65 dB in 2007, compared to 5,583 in 2006. This is still well below the pre-September 11, 2001, level of 17,745. The residences exposed to DNL levels greater than 65 dB in 2007 are located within the 65 dB sound insulation contour, and thus are within areas that have been sound insulated by Massport. The comments from the Boston Transportation Department, the City of Cambridge as well as from individuals such as Mr. Peter Koff and Ms. Nancy Timmerman have raised a number of concerns and suggestions related to noise that Massport should consider incorporating into the 2008 EDR.

In 2007, Massport provided sound insulation to 548 homes, the majority of which were in Chelsea. Since the inception of Massport's Sound Insulation program, 10,461 homes in East Boston, South Boston, Winthop and Chelsea have received sound insulation.

The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2008 EDR. I also strongly advise Massport to consider and address the comments received that have raised noise related concerns.

Air Quality

The Air Quality/Emissions Reduction chapter provides an overview of airport-related air quality issues in 2007 and efforts to reduce emissions. The emissions inventory results were driven largely by three factors: changes in the aircraft fleet mix at the Airport (the airlines' substitution of select narrow-body aircraft with wide-body and commuter aircraft); the reported change in the aircraft average taxi/delay times at Logan Airport; and continual improvements to the FAA Emissions and Dispersion Modeling System (EDMS), v5.0.2, particularly in regard to the advanced method for calculating particulate matter (PM) emissions from aircraft engines. Because of the changes to the EDMS model, total modeled emissions of PM10/PM2.5 associated

with Logan Airport in 2007 appeared to have increased by approximately 64 percent to 128 kilograms per day (kg/day) compared to 2006 levels. By comparison, using the EDMS version available in 2006 (v5.0.1) total emissions of PM10/PM2.5 would have increased by approximately 5 percent to 82 kg/day due to a combination of changes in aircraft fleet mix and aircraft taxi/delay time. This data shows that the estimated increase in PM10/PM2.5 was due mostly to the updated EDMS model and not the result of significant changes in Airport operations. Nonetheless, the increases in modeled emissions are notable and I encourage Massport to revisit all feasible efforts to mitigate PM10/PM2.5 emmissions.

The 2007 EDR reports that the total emissions of volatile organic compounds (VOC) were 1,673 kg/day, or 3 percent lower than 2006 levels. Total emissions of carbon monoxide (CO) were 9,233 kg/day, or 13 percent higher than 2006 levels. Total emissions of oxides of nitrogen (NOX) were 4,457 kg/day, or 7 percent higher than 2006 levels. In 2007, total NOx emissions at Logan Airport were approximately 541 tons per year lower than the 1999 Air Quality Initiative (AQI) benchmark which represents a 27 percent decrease in NOx emissions at Logan Airport since 1999. There was also a continuing trend of decreasing nitrogen dioxide (NO2) concentrations at both the Massport and Massachusetts Department of Environmental Protection (MA DEP) monitoring sites located in the general vicinity of Logan Airport. In addition, the annual NO2 concentrations at all monitoring locations in 2007 were within the NO2 Air Quality Standards.

In the 2007 EDR Massport for the first time has voluntarily submitted its first emission inventory of greenhouse gas (GHG) emissions directly and indirectly associated with Logan Airport. "Direct emissions" are those that occur in areas located within the Airport's geographic boundaries and "indirect emissions" are those that occur off the Airport site. "Direct" GHG emissions associated with Logan Airport in 2007 were 0.37 million metric tons (MMT), and the sum of "direct" and "indirect" emissions was 0.69 MMT (less than 0.1 percent of state-wide totals). Massport has control of only 18 percent of these combined totals and will implement plans by 2009 to reduce further GHGs associated with its operations at Logan Airport helping minimize the Airport's carbon footprint.

The 2008 EDR should continue updates on the information presented in the 2007 EDR and address comments received related to air quality. In particular the Mr. Peter Koff has raised several concerns related to air quality monitoring and the Massachusetts Department of Public Health's (DPH) Logan Airport Health Study. The 2008 EDR should clarify this issue and update the status of any air quality monitoring related to this concern.

Water Quality/Environmental Compliance

This chapter describes Massport's ongoing environmental management activities including NPDES compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan, and tank management.

I note on July 31, 2007, the Environmental Protection Agency (EPA) and MA DEP issued a new National Pollutant Discharge Elimination System (NPDES) Program permit for Logan Airport's stormwater outfalls. The new NPDES permit regulates stormwater discharges from the North, West, Northwest, Porter Street, and Maverick Street Outfalls, and all of the airfield outfalls. The previous NPDES permit regulated stormwater discharges only from the North, West, Porter Street, and Maverick Street Outfalls. The new NPDES permit also has additional sampling requirements, including the requirement to sample for deicing compounds. In 2007, three of 404 outfall samples exceeded the regulatory limits contained in the NPDES permit. The Maverick Street Outfall had two samples exceed the 100 milligrams per liter (mg/L) daily maximum limit for Total Suspended Solids (TSS) and the West Outfall had one sample exceed this limit. This is an improvement compared to 2004 and 2006 when four samples exceeded the regulatory limits, and 2005 when eight samples exceeded the regulatory limits.

In 2007, Massport completed an update to the Airport's Stormwater Pollution Prevention Plan (SWPPP). The SWPPP addresses stormwater pollutants in general, and also addresses deicing and anti-icing chemical, potential bacteria, fuel and oil, and other sources of stormwater pollutants. Best management practices (BMPs) are included in the SWPPP. Also in accordance with the Massachusetts Contingency Plan (MCP), Massport continued to assess, remediate, and bring to regulatory closure areas of subsurface contamination. In 2007, Massport worked towards achieving regulatory closure of six remaining MCP sites. Massport should continue to report in the 2008 EDR how Massport will assess, remediate, and bring to regulatory closure areas of subsurface contamination.

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, 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.

This chapter describes Massport's continued efforts including Massport-wide sustainability and details how sustainability is incorporated into many aspects of Massport's activities: Planning and Design; Construction; Operations, Maintenance and Management; and Monitoring of Environmental Performance which are detailed in this chapter. The replacement GA Facility in the North Cargo Area, which was constructed in early 2007 and opened in June 2007, is an example of planning and design sustainability initiatives being undertaken at Logan Airport. The new GA Facility incorporates sustainable design, construction, and operational elements. On the operations and maintenance in 2007, Massport created preferred parking areas in garages and

parking areas throughout Logan Aiport to promote use of lower emitting vehicles. In cooperation with the City of Boston, in the spring of 2007, Massport began a limited head-of-line privilege program for taxis using AFVs, helping to increase the use of alternatively-powered taxis. Additionally, in 2007, Massport created a Cell Phone Waiting Lot, a new parking area where drivers picking up arriving passengers can park for a maximum of 30 minutes. The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2008 EDR.

Conclusion

As I stated at the beginning of this Certificate, the 2008 EDR must provide responses to the issues raised in comments received. The 2008 EDR must include a copy of this Certificate and a copy of each comment letter received on the 2007 EDR. 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. Massport should consult directly with individual commentors where appropriate.

October 31, 2008
Date

Ian A. Bowles

Comments Received:

10/20/2008	Boston Transportation Department
10/20/2008	Peter L. Koff, Engel & Schultz, LLP
10/24/2008	Stephen H. Kaiser, PhD
10/27/2008	City of Cambridge, Robert Healy, City manager
10/28/2008	Nancy Timmerman

IAB/ACC/acc

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November 13, 2009

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
2008 LOGAN AIRPORT ENVIRONMENTAL DATA REPORT

PROJECT NAME	: 2008 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, 2009

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 (G. L. c. 30, ss. 61-62I) and with its implementing regulations (301 CMR 11.00).

The environmental review process at 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 EIRs. The ESPR is currently updated on a 5-year basis, with less detailed Environmental Data Reports (EDR) (formerly Annual Updates) filed in the years between ESPRs. The EDR addressing airport operations during 2008 is the subject of this Certificate.

In general, the EDR has fulfilled its purpose of providing a "snapshot" of year 2008 passenger and impact levels at Logan Airport. Most environmental parameters showed improvement in calendar year 2008. In particular, the technical studies in the 2008 EDR included reporting on and analysis of key indicators of airport activity levels, airport planning, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. Mitigation of noise impacts and air quality remain key concerns both of this office and the commenters. These commitments take the form of project-specific Section 61 Findings, as well as more general mitigation that has emerged from the ESPR process.

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.

The last Logan ESPR was filed for calendar year 2004. Following the recent sequence of annual environmental filings, the environmental filing scheduled for next year was previously anticipated to be in the form of an ESPR rather than an EDR. However, due to the current economic downturn, as described in this 2008 EDR, activity levels at Logan Airport and associated environmental impacts continue to remain well below historic levels and recent peaks. In 2009, near-term activity levels and associated environmental effects are also expected to remain 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. Therefore, I will allow Massport to prepare a 2009 EDR in lieu of the scheduled ESPR. The 2009 EDR should address the activity levels observed in 2009 in comparison with those predicted in the 2004 ESPR. The 2009 EDR should explain Massport's proposed schedule for filing the next ESPR in light of observed and expected activity levels and any other changes in airport operations that have occurred since the 2004 ESPR was filed. Where appropriate, Massport must continue to identify and address any longer term aviation and environmental trends in each annual filing whether that will be in the form of an EDR or ESPR.

Review of the 2008 EDR and Scope for the 2009 EDR

Procedural for 2009 EDR

The 2009 EDR must provide an annual update on conditions at Logan Airport for calendar year 2009. The 2009 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 2008.

The 2009 EDR must respond to those issues explicitly noted in this Certificate and the comments received in the next EDR. The EDR should provide a "snapshot" of the 2009 operations and impacts, with more substantial analysis awaiting the next ESPR. Massport should file the 2009 EDR no later than October 15, 2010.

A distribution list for the 2009 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 comments received on the 2008 EDR are thoughtful and detailed. The 2009 EDR must include Responses to Comments which addresses all of the substantive comments from the letters listed at the end of this Certificate. The Response to Comments included in this EDR is well-constructed and cross-referenced. Massport may follow the same format in addressing comments in the next EDR, although the Responses to Comments should pay particular attention to increased specificity, where necessary.

The majority of comments received on the 2008 EDR focused on air quality and noise related issues, including measurement of noise, modeling of noise contours, and noise abatement. In addition to responding to these comments, the 2009 EDR and future EDRs should also continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commentors where appropriate.

Organization of the Certificate

I have organized the remainder of this Certificate to respond to issues raised roughly in the order in which they were presented in the 2008 EDR, although I have for the most part incorporated discussion of issues raised in the technical appendix into the discussion of the environmental impact analyses.

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 2008 and compares activity levels to the prior year including air passengers, aircraft operations, fleet mix, and cargo/mail volumes. The total number of air passengers at Logan Airport dropped to 26.1 million from 28.1 million in 2007. The decrease in the total number of air passengers was 7.1 percent. In addition, the total number of aircraft operations declined from 399,537 in 2007 to 371,604 in 2008, a decrease of 7 percent. The 2008 EDR also reports that the passenger aircraft operations decreased by 6.4 percent and operations by general aviation (GA) aircraft also declined by 16.8 percent from 2007. The average domestic load factor (average number of passengers per available seat) for flights also dropped to 72.8 percent, from 74.9 percent in 2007. However, the number of air passengers per aircraft operation was similar to the previous year with an average of 70.2 passengers per aircraft operation in 2008. In response to high and rising fuel prices and declining passenger demand, both low-cost carriers (LCCs) and legacy airlines reduced the number of aircraft operations at Logan Airport. Air cargo volumes, excluding mail, continued to decline from 632 million pounds in 2007 to 588 million pounds in 2008.

For the 2009 EDR, the Activity Levels chapter should include:

- Aircraft operations, including fleet mix and scheduled airline services at Logan Airport;
- Passenger activity levels;
- Cargo and mail activities;
- A comparison of the 2009 aircraft operations, cargo/mail operations, and passenger activity levels to 2008 activity levels; and
- A report on national aviation trends in 2009 and a comparison to trends at Logan Airport.

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 2009 EDR.

Planning

The Airport Planning chapter provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2008. It also describes known future planning, construction, and permitting activities. In 2008 the replacement Signature Flight Support GA Facility in the North Cargo Area (NCA) was certified under the U.S. Green Building Council Leadership in Energy and Environmental Design (LEED) Green Building Rating System. In addition, several other projects were also completed in 2008. The southwest corner taxiway system was realigned and the northern portion of the centerfield taxiway was constructed and was operational in 2008. Also Phase 1 of the Consolidated Maintenance Facility was constructed in the NCA and Phase 2, involving rehabilitation of the existing Facilities Building Number 2, began. Massport also completed renovations of the existing gas station in the NCA, which included installing Logan Airport's first E85 fuel dispensing tank. (E85 is an alcohol fuel

mixture that typically contains a mixture of up to 85 percent denatured ethanol and gasoline or other hydrocarbon.) In 2008 Massport also completed the final construction of the Bremen Street Park. In addition, a security wall was installed along the perimeter of the air operations area in the North Service Area.

For the 2009 EDR, the Airport Planning chapter should describe the status of planning initiatives for the:

- Terminal Area;
- Airside Area;
- Service and Cargo Areas; and
- Airport Buffers and Landscaping.

The chapter should also report on the status of public works projects implemented by other agencies within the boundaries of Logan Airport. Massport should continue to assess planning strategies for improving Logan Airport's operations and services in a, safe, secure, efficient, and environmentally sensitive manner.

Regional Transportation

In general, the 2008 EDR has met the requirements with respect to regional transportation issues. This chapter describes activity levels at New England's regional airports in 2008 and updates recent planning activities. Massport has demonstrated that it is coordinating its planning with other transportation agencies, and that this planning effort is aimed at minimizing cumulative impacts from Logan Airport operations. The 2008 EDR includes estimates of potential passenger diversions from Logan, and outlines how Massport planning encourages those diversions. The total number of air passengers utilizing New England's primary commercial service airports decreased from 47.2 million in 2007 to 44.4 million in 2008. This represents a passenger traffic decline of 5.9 percent. Activity levels as measured by the number of aircraft operations fell by 7.7 percent, from 1.31 million operations in 2007 to 1.21 million operations in 2008.

The decreases in passenger traffic and aircraft operations at New England airports reflect national trends in the face of volatile fuel prices and a worsening global economy. Specifically, of the 44.4 million air passengers using New England's primary commercial service airports, 59 percent of air passengers used Logan Airport in 2008 and 60 percent in 2007, as compared to 88 percent in 1995. In addition, air passenger traffic in the region fell more quickly than in the overall U.S. domestic market. As reported in the 2008 EDR, airlines introduced major reductions in operations through the year, eliminating less profitable routes and cutting frequencies in smaller markets. Fuel prices also forced airlines to ground less fuel efficient aircraft, as well as aircraft with high per seat operating costs, such as the small regional jets (with 50 seats or fewer) prevalent at the regional airports. As a result, the average number of seats per scheduled flight at the regional airports increased from 84 in 2007 to 88 in 2008. In comparison to 2007 levels, the operations by GA aircraft at New England regional airports declined by 7.6

percent. Declines in GA activity in New England also outpaced declines in the rest of the country. According to the FAA, GA activity fell by 5.6 percent nationally in 2008, due to high fuel costs resulting in a sharp decrease in recreational flying.

The directives in the ESPR Certificate were laid out to have Massport look at potential diversions, and explain how its planning and coordination with other agencies could impact potential diversions. The 2008 EDR has performed this task.

I direct Massport to continue the directive from the ESPR Certificate for the 2009 EDR. In addition, for 2009 EDR the chapter on Regional Transportation should describe Logan Airport's role in the region's intercity transportation system by reporting on the following related to Regional Airports and Regional Transportation System:

Regional Airports

- 2009 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 efforts in strengthening the regional transportation system;
- 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 2008 EDR serves its purpose of updating 2008 ground access conditions on the airport, and has also adequately addresses the updating of the three new programs to support employees' use of alternative transportation options.

This chapter reports on transit ridership, roadways, traffic volumes, and parking for 2008. Specifically, ground transportation activity levels associated with Logan Airport generally decreased for all surface transportation modes from 2007 to 2008 as a result of a 7 percent decline in the annual number of air passengers. In addition, the average daily traffic on Airport roadways decreased by 13 percent from 2007 to 2008, while vehicle miles traveled (VMT) decreased by 11 percent. This can be attributed directly to a decrease in annual passengers at the Airport. Air passenger ridership on Logan Express bus service also decreased by 14 percent in 2008 compared to 2007. However, Silver Line boardings at the Airport increased 5 percent. The increase in Silver Line ridership is likely due to new ridership as well as diversion from other services, such as from water transportation, limousines, and taxis. Ridership on water transportation decreased by 12 percent, limousine ridership decreased by 19 percent, and taxi

dispatches decreased 9 percent.

The 2008 EDR also documented that over the past several years, transit services have seen substantial increases in employee use. In 2008, the number of employees using Logan Express increased by 7 percent. In 2008, the Logan Transportation Management Association (Logan TMA) continued the operation of three programs that were introduced in 2007: 1) Sunrise Shuttle, which provides shuttle services between 3:00 A.M. and 5:30 A.M. for Airport employees who reside in East Boston; 2) Logan TMA Preferential Carpooling, which provides free parking at the West Garage to employees of Logan TMA member companies who carpool in groups of three or more; and 3) the Commuter Cash program, which financially rewards employees ($3/day) who switch from driving alone to either carpooling, bicycling, walking, or using public transportation. The number of vehicles parked on-Airport decreased by 14 percent in 2008 compared to 2007. The most significant change to the parking supply was the 40 percent reduction of spaces in the Economy Lot due to construction activities during most of the year.

The 2009 EDR should continue to update 2009 ground access conditions on the airport and report on the use of the three new programs to support employees' use of alternative transportation options. The chapter should also report on 2009 conditions and provide a comparison of 2009 findings to those of 2008 for the following:

- 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) membership and services;
- Logan Airport gateway volumes;
- On-airport traffic volumes;
- On-airport vehicle miles traveled (VMT). VMT will be calculated using the updated model created in 2004 that is based on the full build roadway network;
- Parking demand and management (including rates and duration statistics); and
- Ground access management strategy.

Noise

The Noise Abatement chapter updates the status of the noise environment at Logan Airport in 2009, and describes Massport's efforts to reduce noise levels. The technical appendix contains useful and detailed information, while the main text provides a solid analysis of major noise issues. Many of the issues raised in the noise analysis are ongoing and require continuous monitoring, a point raised by several commenters. The future 2009 EDR represents an appropriate forum to serve this updating function.

The decrease in aircraft operations in 2008 led to changes in the noise environment. The 2008 Day-Night Sound Level (DNL) contours were smaller in almost all locations compared to 2007. The 65 decibel (dB) DNL contour decreased in size in East Boston pulling back from

across the Chelsea River to the East Boston waterfront. Over Winthrop and Revere, the DNL 65 dB contour decreased slightly with additional reductions out over Boston Harbor. The population exposed to noise levels greater than DNL 70 dB decreased in 2008 compared to 2007. In 2007, the population exposed to noise levels greater than DNL 70 dB was 416 but in 2008 the number dropped to 249. The overall number of people exposed to DNL values greater than 65 dB decreased 26 percent in 2008 compared to 2007. An estimated 5,968 people were exposed to DNL levels greater than 65 dB as depicted in the 2008 contour, compared to 8,099 in 2007. The residences exposed to DNL levels greater than 65 dB in 2008 are located within the 65 dB sound insulation contour, and thus are within areas that already have been sound insulated by Massport.

In 2008, Massport provided sound insulation to 388 homes, the majority of which were in Chelsea. The focus of this program in Chelsea is to fulfill federal and state mitigation commitments related to the opening of Runway 14-32. Since the inception of Massport's Sound Insulation program, 10,849 homes have received sound insulation in East Boston, South Boston, Winthrop, and Chelsea.

In 2008, Massport continued installing an improved Noise Monitoring System (NOMS). The flight tracking system and all new noise monitors were operational in 2008. Combined with new noise monitor software, the system has an improved capability of correlating measured noise events with individual flight tracks. This has greatly reduced differences between measured and modeled DNL values.

The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2009 EDR. I also strongly advise Massport to consider and address the comments received that have raised noise related concerns. Several commenters have requested further explanation of the reasons for the increased use of Runway 33L for jet aircraft departures and corresponding decrease in use of Runway 27. The comments from the Boston Transportation Department, the Town of Winthrop, the City of Cambridge, as well as from individuals such as Mr. Peter Koff and Ms. Nancy Timmerman have raised a number of concerns and suggestions related to noise that Massport should incorporate into the 2009 EDR.

For 2009 the Noise Abatement chapter 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 2009 conditions and compare 2009 conditions to those of 2008 for the following:

- Fleet Mix, including Stage II, Recertified (Hushkitted) Stage III, newly manufactured Stage III, and any qualifying Stage IV aircraft;
- Nighttime operations;
- Runway utilization (report on aircraft and airline adherence with runway utilization goals);
- Preferential runway advisory system (PRAS) compliance; and
- Flight tracks, including a discussion of the update on the Standard Terminal Automation

Replacement System (STARS) radar and consolidation of the Boston Terminal Radar Approach Control (TRACON) at Merrimac, plus Massport's installation and use of PASSUR data.

The chapter should also report on 2009 conditions and compare those to 2008 conditions for the following noise indicators:

- Using the Federal Aviation Administration's (FAA) most current version of the Integrated Noise Model (INM), and RealContours and RealProfiles, 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 RealContours and RealProfiles;
- Cumulative Noise Index (CNI);
- Times-Above for 65, 75, and 85 dBA threshold values;
- Installation and benefits of the new noise monitoring system; and
- Flight track monitoring noise quarterly reports.

The chapter should also report on noise abatement efforts and provide a status update on the new noise and operations monitoring system.

Air Quality

The Air Quality/Emissions Reduction chapter provides an overview of airport-related air quality issues in 2008 and efforts to reduce emissions. The modeled emissions inventory results were driven principally by three factors: the lower number of aircraft operations at Logan Airport compared to 2007; the reported change in the aircraft average taxi/delay times at the Airport; and continual improvements to the FAA Emissions and Dispersion Modeling System (EDMS), v5.1, which has revised methods for calculating particulate matter (PM) and hydrocarbon (HC) emissions from aircraft engines, and has new functionality of calculating PM emissions from auxiliary power units (APUs). Because of the changes to the EDMS model and decreased air traffic, total emissions of PM10/PM2.5 associated with Logan Airport have decreased by approximately 37 percent to 81 kilograms per day (kg/day) compared to 2007 levels. By comparison, using the earlier version of EDMS total emissions of PM10/PM2.5 would have decreased by approximately 20 percent to 102 kg/day. This difference is attributed to modifications in the EDMS versions.

The 2008 EDR reports that the total emissions of volatile organic compounds (VOC) were 1,208 kg/day, or 28 percent lower than 2007 levels. The total emissions of carbon monoxide (CO) were 8,361 kg/day, or 9 percent lower than 2007 levels and the total emissions of

oxides of nitrogen (NOX) were 4,204 kg/day, or 6 percent lower than 2007 levels. In 2008, total NOx emissions at Logan Airport (net total with reductions) were approximately 656 tons per year (tpy) lower than Massport's 1999 Air Quality Index (AQI) benchmark. This represents a 28 percent decrease in NOx emissions since 1999. The 2008 EDR notes that other contributing factors to the results of the emissions inventory include the change in stationary source fuel usage, and the change in VMT and parking volumes. Air quality initiatives in place at the Airport and other ongoing efforts by Massport to minimize emissions also played a role. For example, there is 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 general vicinity of Logan Airport since 1999. In addition, the annual NO2 concentrations at all monitoring locations in 2008 were well within the National Ambient Air Quality Standards (NAAQS) for NO2.

For the second year, Massport prepared an emission inventory of greenhouse gas (GHG) emissions directly and indirectly associated with Logan Airport. "Direct" GHG emissions are those that occur in areas located within the Airport's geographic boundaries and "indirect emissions" are those that occur off the Airport site. "Direct" GHG emissions associated with Logan Airport were 0.35 million metric tons (MMT), and the sum of "direct" and "indirect" emissions was 0.65 MMT, or less than 1 percent of statewide totals. Massport operations at Logan Airport contribute only 18 percent of these combined totals. GHG emissions in 2008 were 6 percent lower than 2007 levels.

As part of the Section 61 findings for the centerfield taxiway component, the first phase of a two-phase Massport Air Quality Monitoring Study was initiated in September 2007 at ten locations on- and off-airport using both real time and time-integrated methods to measure fine particulates, volatile organic compounds (VOC), carbonyls, black carbon, and polynuclear aromatic hydrocarbons (PAHs). The 2008 EDR states that this first phase commenced in September 2007 and was completed September 2008, with a report summarizing the findings expected to be completed before the end of 2009. Massport has committed to post this report on Massport's website when completed. The study collected ambient data on a variety of air pollutants over a two year period and assessed air quality changes due to the operation of the new centerfield taxiway. Massport should consult with the Massachusetts Department of Public Health (DPH), the Massachusetts Department of Environmental Protection (MassDEP), the City of Boston Environment Department and Boston Public Health Commission (BPHC) to discuss the second phase of the protocol.

The 2009 EDR should continue updates on the information presented in the 2008 EDR and address comments received related to air quality. For 2009 the Air Quality/Emissions Reductions chapter 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 also discuss analysis methodologies and assumptions and report on 2009 conditions using the most recent versions of the Emissions Dispersion Modeling System

(EDMS) and MOBILE motor vehicle emissions. The chapter should also 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; and
- NOx emissions by airline.

This chapter should also report on the following air quality initiatives (AQI) for 2009:

- Air Quality Initiative Tracking;
- Massport's and Tenant's Alternative Fuel Vehicle Programs; and
- The status of other Logan Airport air quality studies undertaken by Massport or others.

The Air Quality Chapter should also include an inventory of GHG emissions from Logan Airport in 2009. GHG emissions should be quantified for aircraft, GSE, motor vehicles and stationary sources using emission factors and methodologies outlined in the Greenhouse Gas Emissions Policy and Protocol issued by EEA. The results of the 2009 GHG emissions inventory should be compared to the 2008 results. The 2008 EDR indicates that Massport commissioned a study to evaluate operational, economic and environmental benefits of cogeneration as a way reduce air emissions associated with the Central Utility Plant. If cogeneration is found feasible, energy consumption could be reduced Airport-wide as could the emissions of criteria pollutants (i.e., CO, NOx, etc.) and GHGs. The status of this study is not described. Therefore, an update should be provided in the 2009 EDR.

Water Quality/Environmental Compliance

This chapter describes Massport's ongoing environmental management activities including NPDES compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan, and tank management. In accordance with the requirements of the current NPDES permit for Logan Airport that was issued on July 31, 2007, Massport and all 27 co-permittees and tenants began preparation of updated Stormwater Pollution Prevention Plan (SWPPP). Massport completed its SWPPP in December of 2007 and tenant SWPPPs were completed in March 2008. Massport's SWPPP addresses stormwater pollutants in general, and also addresses deicing and anti-icing chemical, potential bacteria, fuel and oil, and other sources of stormwater pollutants.

The 2008 Annual Certificates of Compliance were submitted to U.S. Environmental Protection Agency and MA DEP in December 2008 for Massport and each co-permittee. Three out of a total of 73 outfall samples exceeded the regulatory limits of the National Pollutant Discharge Elimination System (NPDES) Program permit for the Airport's permitted outfalls. Two out of 23 samples exceeded the limits at the Maverick Street Outfall and one out of 24 samples exceeded a limit at the West Outfall. Over the past five years, the number of samples that exceeded the regulatory limits has ranged from three (2007) to eight (2005). Due to the large

size of the drainage areas and relatively low concentration of pollutants, it is typically not possible to trace exceedances to specific events. Where a known event, such as a spill, is reported, Massport routinely checks the drainage system for possible impacts from the event and takes corrective actions if necessary.

In accordance with the Massachusetts Contingency Plan (MCP), the 2008 EDR reports that Massport continues to assess, remediate, and bring to regulatory closure areas of subsurface contamination. The 2008 EDR states that Massport is working towards achieving regulatory closure of the remaining MCP sites. In addition, preparation of the Environmental Management System (EMS) for facilities, where fleet and field maintenance activities are conducted, was on-going in 2008.

For 2009 the Water Quality/Environmental Compliance and Management chapter should report on the 2009 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
- Fuel spill prevention
- Future stormwater management improvements (if any)
- Future MCP and tank management activities

Massport should continue to report in the 2009 EDR how Massport will assess, remediate, and bring to regulatory closure areas of subsurface contamination.

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, 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.

This chapter describes Massport's continued efforts including Massport-wide sustainability and details how sustainability is incorporated into many aspects of Massport's activities: Planning and Design; Construction; Operations, Maintenance and Management; and Monitoring of Environmental Performance which are detailed in this chapter. The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2009 EDR.

The 2008 EDR outlines how Massport is committed to sustainable practices to help reduce impacts associated with construction. For example, Massport requires contractors to comply with construction guidelines regarding demolition waste recycling, soil reuse, and air emissions from construction equipment. In addition, in 2008, Logan Airport became the first airport in the U.S. to use warm mix asphalt for its airfield pavement (Runway 4R). Warm-mix as opposed to hot-mix asphalt is heated to a lower temperature, which saves energy resulting in 20 percent lower GHG emissions than hot-mix asphalt. It also contains 18 percent recycled material. Another environmental benefit of warm mix asphalt is that it can be applied in a thicker layer, requiring fewer passes with construction vehicles and fewer emissions of associated pollutants.

Massport has several programs in place that contribute to the environmentally sustainable operation and maintenance of Logan Airport and its facilities. Massport also encourages its tenants to do the same. These programs and other sustainability initiatives include developing a policy that states that new development projects obtain certification under the U.S. Green Building Council Leadership in Energy and Environmental Design® (LEED) Green Building Rating System™ and include LEED accredited professionals on the design team. Massport is also establishing and implementing an Alternative Fuel Vehicle Policy (AFV) Policy that requires key personnel to review and consider AFVs when there is a request for a new or replacement vehicle and to select AFVs unless there is a compelling reason not to. In March 2008, Massport installed twenty 10-foot-tall wind turbines on the roof of Logan Office Center. The wind turbines are expected to generate approximately 100,000 kWh annually, or about 2 percent of the building's monthly energy use.

In 2008 Massport completed renovations to the existing gas station in the NCA to include installing an E85 fuel dispensing tank. As discussed earlier in this Certificate, E85 is a first-generation biofuel. Massport also established a bicycle security program with State Police Troopers providing additional patrols on bicycle, which helps to reduce vehicle-related emissions and fossil fuel use. Finally, Massport created preferred parking areas in garages and parking areas throughout Logan Aiport to promote use of lower emitting vehicles. I commend Massport for the existing and planned sustainability measures.

For 2009, this chapter should report on the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have commenced construction. The mitigation commitments were made in the Section 61 Findings for the following projects which should be reported:

- West Garage/Central Garage;
- International Gateway;
- Runway Ends 22R and 33L Safety Improvements;
- Replacement Terminal A; and
- Logan Airside Improvements Planning.

This chapter should also update the status of Massport's mitigation commitments and identify

projects for which mitigation is complete.

Conclusion

I have determined that the 2008 EDR for Logan Airport has adequately compiled with MEPA and that Massport may prepare a 2009 EDR in lieu of a multi-year ESPR for submission in 2010. As I stated at the beginning of this Certificate, the 2009 EDR must provide responses to the issues raised in comments received. The 2009 EDR must include a copy of this Certificate and a copy of each comment letter received on the 2008 EDR. 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. Massport should consult directly with individual commentors where appropriate.

November 13, 2009
Date

Ian A. Bowles

Comments Received:

10/26/2009	Peter L. Koff, Engel & Schultz, LLP
10/28/2009	Town of Winthrop, Noise Air Pollution & Airport Hazards Committee
11/05/2009	Nancy Timmerman
11/06/2009	City of Cambridge, Robert Healy, City Manager
11/09/2009	Boston Transportation Department
11/10/2009	City of Boston Environment Department

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November 12, 2010

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
2009 LOGAN AIRPORT ENVIRONMENTAL DATA REPORT

PROJECT NAME	: 2009 Environmental Data Report
PROJECT MUNICIPALITY	: Boston / Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: October 6, 2010

As Secretary 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 (G. L. c. 30, ss. 61-62I) and with its implementing regulations (301 CMR 11.00). The Proponent, the Massachusetts Port Authority (Massport) should submit an Environmental Data Report containing 2010 data no later than October 15, 2011.

The environmental review process at Logan Airport has been structured to occur on two levels: airport-wide and project-specific. With respect to airport-wide impacts, the periodic Environmental Status and Planning Report (ESPR) process 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 part of Massport's long range planning (consistent with the objectives of the MEPA regulations), and a vehicle for analyzing cumulative impacts associated with airport operations. 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 made by Massport in the context of project-specific environmental impact review. In addition, between preparation of each ESPR, Massport also provides more frequent (annual) Environmental Data Reports (EDRs) that contain data for the prior year's airport operations and impacts. EDRS also provide an updating on the status of outstanding mitigation commitments for all airport projects. The EDR addressing airport operations during 2009 is the subject of this Certificate.

In general, the EDR has fulfilled its purpose of providing a "snapshot" of year 2009 passenger and impact levels at Logan Airport. The technical studies in the 2009 EDR included reporting on and analysis of key indicators of airport activity levels, airport planning, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. Most environmental parameters showed improvement in calendar year 2009. However, mitigation of noise impacts and air quality remain key concerns both of this office and the commenters. In addition, there appears to be a trend of increased parking demand at the airport that should be carefully monitored by Massport, and which requires a corresponding focus on increasing public transit use. Finally, assessing the cumulative changes in airport operations and impacts associated with several recent Massport projects (e.g., the Consolidated Car Rental Facility, the Green Bus Depot, the East Boston-Chelsea Bypass and the parking consolidation in the North Cargo Area/Robie parcel) should be a priority of the airport-wide impact assessment reports moving forward. I expect that these topics will be addressed by Massport in the 2010 EDR (to be filed by October 15, 2011) as outlined further below. The next ESPR document containing farther-reaching planning and assessment measures will need to be submitted the following year.

Environmental Data Reporting Process

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 periodic ESPR documents (typically every five years) and provides data updates annually through the EDRs.

The last Logan ESPR was filed for calendar year 2004. However, due to the current economic downturn, as described in this 2008 EDR submitted in the October, 2009, activity levels at Logan Airport and associated environmental impacts continued to remain well below historic levels. Therefore it was anticipated that in 2009, near-term activity levels and associated environmental effects were also expected to remain well below levels previously analyzed for

Logan Airport. As a result, the forecasted aviation growth presented in the 2004 ESPR, the predicate upon which the ESPR schedule was initially established, had not occurred. Therefore, I allowed Massport to prepare a 2009 EDR in lieu of the scheduled ESPR.

Massport has indicated in the 2009 EDR that in 2010, near-term activity levels and associated environmental effects continue to remain well below levels previously analyzed for Logan Airport. Because the forecasted aviation growth presented in the 2004 ESPR has not occurred, Massport has requested to delay filing of the next ESPR until 2011. In addition, Massport is also currently in the process of updating its passenger and operations forecast for the next twenty years. Significantly, this data will allow Massport to more accurately project passenger and operation needs that will directly influence planning for future projects at Logan Airport. The data from this forecasting process will not be available in time for filing the next annual report. Therefore, I will allow Massport to prepare a 2010 EDR followed by a 2011 ESPR (which will be filed in 2012, containing data for 2011 as well as more comprehensive analysis of future plans). Given the two-year extension of the original filing deadline for the ESPR document, I expect Massport to ensure that the 2011 ESPR will not be delayed any further.

REVIEW OF THE 2009 EDR AND SCOPE FOR THE 2010 EDR

General

The 2010 EDR must provide an annual update on conditions at Logan Airport for calendar year 2010. It should address the activity levels observed in 2010 in comparison with those predicted in the 2004 ESPR and should also report on the cumulative effects of Logan Airport operations and activities compared to 2009. The 2010 EDR should continue to serve as a background/context against which projects at Logan Airport can be evaluated. Where appropriate, Massport must continue to identify and address any longer term aviation and environmental trends that will impact airport impacts or planning.

The 2010 EDR must respond to those issues explicitly noted in this Certificate and the comments received in the next EDR. The EDR should provide a "snapshot" of the 2010 operations and impacts, while more substantial analysis and longer-range planning are expected to be presented in the next ESPR. Massport should file the 2010 EDR no later than October 15, 2011.

A distribution list for the 2010 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. In addition, the document should contain copies of any MEPA Certificates issued for projects at Logan airport in 2010. Supporting technical appendices should be provided as necessary.

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 2009 and compares activity levels to the prior year including air passengers, aircraft operations, fleet mix, and cargo/mail volumes. The total number of air passengers at Logan Airport during 2009 dropped to 25.5 million, compared to 26.1 million in 2008. The decrease in the total number of air passengers was 2.3 percent, compared to a decrease of 7.1 percent in the previous year. In addition, the total number of aircraft operations declined from 371,604 in 2008 to 345,306 in 2009, a decrease of 7.1 percent. The 2009 EDR also reports that the passenger aircraft operations decreased by 3.8 percent and operations by general aviation (GA) aircraft also declined by a dramatic 48.6 percent in 2009. Also the 2009 EDR reports that the cargo operations decreased by 23.2 percent in 2009, compared to 2008.

The EDR presents data indicating that the number of air passengers per aircraft operation increased, from an average of 70.2 passengers per aircraft operation in 2008 to an average of 73.9 passengers per aircraft operation in 2009. The passenger load factor (the percentage of seats occupied by revenue passengers) also increased slightly from 72.8 to 72.9. This reflects greater air carrier efficiency. While legacy airlines, such as Delta Air Lines, Continental Airlines, and US Airways, reduced aircraft operations significantly at Logan Airport, low-cost carriers (LCCs) operations increased by 12.3 percent. In addition to a continuing expansion in service offerings by JetBlue Airways, Logan Airport saw operations for two new LCCs, Southwest Airlines and Virgin America, begin in 2009. In addition, the 2009 EDR reports that the air cargo volumes declined 12.1 percent from 621 million pounds in 2008 to 546 million pounds in 2009. The largest volume decrease occurred in the express/small packages segment.

For the 2010 EDR, the Activity Levels chapter should include:

- Aircraft operations, including fleet mix and scheduled airline services at Logan Airport;
- Passenger activity levels;
- Cargo and mail activities;
- A comparison of the 2010 aircraft operations, cargo/mail operations, and passenger activity levels to 2009 activity levels; and
- A report on national aviation trends in 2010 and a comparison to trends at Logan Airport.

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 provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2009. It also describes known future

planning, construction, and permitting activities. Construction of a 9,300-foot long centerfield taxiway (Taxiway M) was completed and opened in summer of 2009. Also in 2009 Massport continued the permitting for redevelopment of the Southwest Service Area (SWSA) at Logan Airport which includes consolidation of the rental car operations and their shuttle buses into a single coordinated operation that will result in reduced vehicle miles traveled and the associated air emissions. A Final EIR for the project was filed in March 2010, and a Certificate that determined that the EIR adequately and properly complies with MEPA. In addition, in 2009, Massport began the MEPA review process for the proposed Logan Runway Safety Area (RSA) Improvements at Runway ends 33L and 22R. A Draft EIR was submitted on that project in 2010. Preliminary design of a proposed Green Bus Depot for bus maintenance in the North Service Area (NSA) began in 2009 and an expanded ENF for the Green Bus Depot was filed in 2010.

During 2009 Massport published the Sustainable Design Standards and Guidelines (SDSG) for use by architects, engineers, and planners working on capital improvement projects for Massport facilities. The 2009 EDR reports multiple projects in the planning and design phase. Planning commenced for two hangar upgrades. Massport also commenced with Terminal B Garage repair and rehabilitation where solar panel "trees" were installed on the roof. An extension to Taxiway D was completed and the Taxiway G realignment construction commenced.

Planning for the North Service Area (NSA) Roadway Corridor project began. The NSA Roadway Corridor Project coordinates the roadway and urban design vision for North Service Road and Frankfort Street with ongoing design and construction efforts in the NSA. The 2009 EDR reports that the planning commenced for the Logan Airport Parking Deck Project on the Robie Parcel within the North Cargo Area (NCA) with the construction beginning in spring 2010. The NSA Roadway Corridor project will coordinate the NCA Logan Airport Parking Deck Project, East Boston-Chelsea Bypass Project, the SWSA Redevelopment Project, and the NSA Buffer Project to develop a unified utility, roadway, and landscape vision for the NSA roadway corridor between Prescott Street and Neptune Road. Massport has also begun planning for the East Boston-Chelsea Bypass Project, to develop a limited access roadway between Logan Airport and the new Chelsea Street Bridge. An ENF for this project is currently under review by the MEPA Office.

For the 2010 EDR, the Airport Planning chapter should describe the status of planning initiatives for the:

- Roadway Corridor Projects;
- Airport Parking;
- Terminal Area;
- Airside Area;
- Service and Cargo Areas; and
- Airport Buffers and Landscaping.

I expect that this chapter will contain a comprehensive discussion about the coordination of parking efforts at Logan in light of the construction of the Parking Deck Project on the Robie Parcel, beyond what was presented in the 2009 EDR (or that such information will be presented elsewhere in the document). The discussion should include information on the use of the new Parking Deck (or a schedule for implementing use) and the corresponding changes in use (e.g., uses that have been shifted or eliminated) of other parking areas at Logan. I understand that data will also be available about parking patterns as a result of ongoing passenger surveys being undertaken by Massport and the results of these surveys should inform the discussions about airport-wide parking operations.

I also note that several of the projects described in the planning chapter of the 2009 EDR are designed, at least in part, to consolidate and direct airport-related traffic to centralized locations and to minimize airport-related traffic on external streets in adjacent neighborhoods. The 2010 EDR should report, to the extent possible, on the status and effectiveness of these cumulative efforts.

The EDR should also report on the status of public works projects implemented by other agencies within the boundaries of Logan Airport. Massport should continue to assess planning strategies for improving Logan Airport's operations and services in a, safe, secure, efficient, and environmentally sensitive manner.

Regional Transportation

In general, the 2009 EDR has met the requirements with respect to regional transportation issues. The directives in the ESPR Certificate were laid out to have Massport look at potential diversions, and explain how its planning and coordination with other agencies could impact potential diversions. The 2009 EDR has performed this task.

The chapter describes activity levels at New England's regional airports in 2009 and updates recent planning activities. Massport has demonstrated that it is coordinating its planning with other transportation agencies, and that this planning effort is aimed at minimizing cumulative impacts from Logan Airport operations. The 2009 EDR includes estimates of potential passenger diversions from Logan, and outlines how Massport planning encourages those diversions.

The decreases in passenger traffic and aircraft operations at New England airports reflect national trends in the face of volatile fuel prices and a worsening global economy. Specifically, of the total number of air passengers utilizing New England's primary commercial service airports, including Logan Airport, decreased from 44.4 million in 2008 to 42 million in 2009. This represents a passenger traffic decline of 5.4 percent. In the region, activity levels as measured by the number of aircraft operations fell by 14.2 percent, from 1.21 million operations in 2008 to 1.03 million operations in 2009. In addition, air passenger traffic at the regional

airports in New England declined, as the challenging operating environment for airlines affected smaller communities disproportionately. Airlines introduced major reductions in operations throughout the year, eliminating less profitable routes and cutting frequencies in smaller markets. LCCs, such as Southwest Airlines and JetBlue Airways, also stopped expanding their operations at regional airports in recent years, and are now instead focusing on expansion in larger air service markets with a strong business travel portfolio.

Massport also reported in the 2009 EDR that there were continued negotiations with the City of Worcester to purchase Worcester Regional Airport. In June 2010, the City of Worcester transferred the airport to Massport for $17 million.

Massport should continue the directive from the ESPR Certificate for the 2010 EDR. In addition, for 2010 EDR the chapter on Regional Transportation should describe Logan Airport's role in the region's intercity transportation system by reporting on the following related to Regional Airports and Regional Transportation System:

Regional Airports

- 2010 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 efforts in strengthening the regional transportation system;
- 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 2009 EDR serves its purpose of updating 2009 ground access conditions on the airport, and has also adequately addresses the updating of the three new programs to support employees' use of alternative transportation options.

This chapter reports on transit ridership, roadways, traffic volumes, and parking for 2009. Specifically, ground transportation activity levels associated with Logan Airport generally decreased for all surface transportation modes from 2008 to 2009 as a result of a 2.3 percent decline in the annual number of air passengers. The 2009 EDR reports that the average daily traffic on airport roadways decreased by 7 percent from 2008 to 2009, while vehicle miles traveled decreased by 5 percent.

Data in the 2009 EDR reports that Massachusetts Bay Transportation Authority (MBTA)

transit ridership to the Airport, including the Blue Line and the Silver Line, increased in 2009. Silver Line boardings at the Airport continued to grow, increasing by 11 percent in 2009 (compared to a 5 percent increase in 2008). In contrast, air passenger ridership on Logan Express bus, by water transportation, and by limousine decreased in 2009. From 2008 to 2009, Logan Express air passenger ridership decreased by 8 percent, ridership on water transportation decreased by 8 percent, limousine ridership decreased by 11 percent, and taxi dispatches decreased 7 percent. The 2009 EDR reports that over the past several years, transit services, including Logan Express, have experienced substantial increases in employee use. In 2009, employee use of Logan Express increased 4 percent over 2008 levels.

Despite improvements in use of the MBTA's Blue Line and Silver Line, the number of vehicles parked on-Airport increased by 11 percent in 2009 compared to 2008. The EDR states that Massport continued to comply with the Logan Airport Parking Freeze, and the document contained copies of Massport's bi-annual Parking Space Inventory reports that are submitted to the Massachusetts Department of Environmental Protection to document Massport's compliance with the Parking Freeze.

The 2010 EDR should continue to update 2010 ground access conditions on the airport and report on the use of the three new programs to support employees' use of alternative transportation options. The chapter should also report on 2010 conditions and provide a comparison of 2010 findings to those of 2009 for the following:

- Detailed description of compliance with the 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) membership and services;
- Logan Airport gateway volumes;
- On-airport traffic volumes;
- On-airport vehicle miles traveled (VMT). VMT will be calculated using the updated model created in 2004 that is based on the full build roadway network;
- Parking demand and management (including rates and duration statistics); and
- Ground access management strategy.

I am troubled by the increased demand for vehicle parking at Logan demonstrated by the 2009 data reported in the EDR, a concern that I understand is shared by Massport. Although Massport has already dedicated significant resources to encouraging transit use, the increased parking demand data suggest that greater efforts are warranted. The 2010 EDR should report on Massport's efforts in this regard. In addition, I expect that this will be a significant component of the long-range planning efforts Massport is currently undertaking.

Noise

The Noise Abatement chapter updates the status of the noise environment at Logan Airport in 2009, and describes Massport's efforts to reduce noise levels. The technical appendix contains useful and detailed information, while the main text 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 2010 EDR represents an appropriate forum to serve this updating function.

The decrease in the number of aircraft operations in 2009 resulted in changes in the noise environment. The 2009 Day-Night Sound Level (DNL) contours were smaller in many locations compared to 2008. The 65 dB DNL contour decreased in size in East Boston. The contour reduced in size over Winthrop and towards South Boston from Runway 27, but increased slightly north of the Airport over Revere due to an increase in departures from Runway 4R. The contour also increased south of the Airport over South Boston due to an increase in arrivals to Runways 4L and 4R. These changes are due to extended closings of Runway 9-27 for resurfacing in 2009.

In 2009 Massport completed installation of an improved Noise Monitoring System (NOMS). The Era Systems Corporation's (ERA) flight tracking system and all new noise monitors were operational in 2009. Combined with new noise monitor software, the system has an improved capability of correlating measured noise events with individual flight tracks.

The 2009 EDR reports that the overall number of people exposed to DNL values greater than 65 decibels (dB) decreased by 43 percent in 2009 compared to 2008. An estimated 4,335 people were exposed to DNL levels greater than 65 dB, as depicted in the 2009 contour, compared to 7,579 in 2008. This is the first time that the number of people exposed to the 65 dB noise level has been fewer than 5,000 since reporting this data in the EDR format. The total population exposed to noise levels greater than DNL 70 dB decreased from 249 in 2008 to 243 in 2009. There was a reduction of noise for 73 people in Winthrop but an increase of noise for 67 people exposed to greater than DNL 70 dB in Boston. The EDR reports that all of the residences exposed to DNL levels greater than 65 dB in 2009 that have chosen to participate in the soundproofing program have been sound-insulated by Massport. In 2009, Massport provided sound insulation to 83 homes, nearly half of which were in Chelsea. The focus of this 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 sound insulation program, 11,136 homes have been sound-insulated in East Boston, South Boston, Winthrop, Revere, and Chelsea.

The information in this chapter is very informative and I encourage Massport to continue this format in the 2010 EDR. I also strongly advise Massport to consider and address the comments received that have raised noise related concerns. Commenters have requested further explanation of the reasons for the increased use of Runway 33L for jet aircraft departures and corresponding decrease in use of Runway 27. The comments from the City of Cambridge, as well as from individuals such as Ms. Timmerman, P.E., have raised a number of concerns and

suggestions related to noise that Massport should incorporate into the 2010 EDR.

For 2010 the Noise Abatement chapter 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 2010 conditions and compare 2010 conditions to those of 2009 for the following:

- Fleet Mix, including Stage II, Recertified (Hushkitted) Stage III, newly manufactured Stage III, and any qualifying Stage IV aircraft;
- Nighttime operations;
- Runway utilization (report on aircraft and airline adherence with runway utilization goals);
- Preferential runway advisory system (PRAS) compliance; and
- Flight tracks, including a discussion of the update on the Standard Terminal Automation Replacement System (STARS) radar and consolidation of the Boston Terminal Radar Approach Control (TRACON) at Merrimac, plus Massport's installation and use of PASSUR data.

The chapter should also report on 2010 conditions and compare those to 2009 conditions for the following noise indicators:

- Using the Federal Aviation Administration's (FAA) most current version of the Integrated Noise Model (INM), and RealContours and RealProfiles, 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 RealContours and RealProfiles;
- Cumulative Noise Index (CNI);
- Times-Above for 65, 75, and 85 dBA threshold values;
- Installation and benefits of the new noise monitoring system; and
- Flight track monitoring noise quarterly reports.

The chapter should also report on noise abatement efforts and provide a status update on the new noise and operations monitoring system.

Air Quality

The Air Quality/Emissions Reduction chapter provides an overview of airport-related air quality issues in 2009 and efforts to reduce emissions. The modeled emissions inventory results were driven principally by the lower number of aircraft operations at the Airport compared to 2008, and continual refinements to the FAA Emissions and Dispersion Modeling System

(EDMS). The 2009 EDR reports that the total emissions of volatile organic compounds (VOC) were 980 kg/day, or 19 percent lower than 2008 levels. Total emissions of oxides of nitrogen (NOX) were 3,979 kg/day, or 5 percent lower than 2008 levels. In 2009, total NOx emissions at Logan Airport (net total with reductions) were approximately 746 tons per year (tpy) lower than the 1999 Massport's Air Quality Initiative (AQI) benchmark. This represents a 32 percent decrease in NOx emissions since 1999. Total emissions of carbon monoxide (CO) were 7,925 kg/day, or 5 percent lower than 2008 levels. Because of the refinements to the EDMS model and decreased air traffic, total emissions of particulate matter (PM) PM10/PM2.5 associated with operations at Logan Airport have decreased by approximately 12 percent to 71 kilograms per day (kg/day) compared to 2008 levels. By comparison, using the earlier EDMS v5.1 total emissions of PM10/PM2.5 would have decreased by approximately 2 percent to 79 kg/day. This variation is attributed to differences in the EDMS versions.

As part of the Section 61 findings for the centerfield taxiway component, the first phase of a two-phase Massport Air Quality Monitoring Study was initiated in September 2007 at ten locations on- and off-airport using both real time and time-integrated methods to measure fine particulates, volatile organic compounds (VOC), carbonyls, black carbon, and polynuclear aromatic hydrocarbons (PAHs). The 2009 EDR reports that 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 general vicinity of Logan Airport. In addition, the annual NO2 concentrations at all monitoring locations in 2009 were well within the National Ambient Air Quality Standards (NAAQS) for NO2. The first phase of a two-phase Massport Air Quality Monitoring Study commenced in September 2007, and was completed September 2008, and a final report will be issued summarizing the findings. The study is collecting ambient data on a variety of air pollutants over a two-year period and will assess air quality changes attributable to the operation of the new centerfield taxiway. The second phase of the study will begin in September 2010 now that the centerfield taxiway is completed and fully operational.

Massport prepared an emission inventory of greenhouse gas (GHG) emissions directly and indirectly associated with Logan Airport. The 2009 GHG emission inventory has been updated incorporating guidance developed by the Transportation Research Board's (TRB) Airport Cooperative Research Program (ACRP). The ACRP guidance was published in April 2009 to be used by airport operators developing an airport specific GHG emissions inventory. While not including emissions from the cruise phase of flight above 3,000 feet, in a change from previous EDRs, the 2009 inventory assigns emissions based on ownership and control boundaries (i.e., emissions and sources associated with Massport, airport tenants and the general public). The vast majority of the emission sources at Logan Airport are owned or controlled by the airlines, other airport tenants, and passenger vehicles. Massport operations contribute only 11 percent of the total GHG emissions for the Airport. Total Logan Airport GHG emissions in 2009 were 14 percent lower than 2008 levels.

Massport has also made attempts to reduce aircraft emissions by working 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 other taxiway improvements. Runway 14-32 became operational in November 2006 and the centerfield taxiway was fully opened in summer 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 which was included in Appendix L. Commenters on the 2009 EDR have requested that Massport increase efforts to encourage the use of single engine taxiing. An update of these efforts should be reported in the 2010 EDR.

The 2010 EDR should continue updates on the information presented in the 2009 EDR and address comments received related to air quality. For 2010 the Air Quality/Emissions Reductions chapter 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 also discuss analysis methodologies and assumptions and report on 2010 conditions using the most recent versions of the Emissions Dispersion Modeling System (EDMS) and MOBILE motor vehicle emissions. The chapter should also 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; and
- NOx emissions by airline.

This chapter should also report on the following air quality initiatives (AQI) for 2010:

- Air Quality Initiative Tracking;
- Massport's and Tenant's Alternative Fuel Vehicle Programs; and
- The status of other Logan Airport air quality studies undertaken by Massport or others.

The Air Quality Chapter should also include an inventory of GHG emissions from Logan Airport in 2010. GHG emissions should be quantified for aircraft, GSE, motor vehicles and stationary sources using emission factors and methodologies outlined in the Greenhouse Gas Emissions Policy and Protocol issued by EEA. The results of the 2010 GHG emissions inventory should be compared to the 2009 results.

Water Quality/Environmental Compliance

This chapter describes Massport's ongoing environmental management activities including NPDES compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan, and tank management. In accordance with the requirements of the current

NPDES permit for Logan Airport that was issued on July 31, 2007, Massport and all 27 co-permittees and tenants began preparation of updated Stormwater Pollution Prevention Plan (SWPPP). Massport completed its SWPPP in December of 2007 and tenant SWPPPs were completed in March 2008. Massport's SWPPP addresses stormwater pollutants in general, and also addresses deicing and anti-icing chemical, potential bacteria, fuel and oil, and other sources of stormwater pollutants. The 2009 Annual Certificates of Compliance were submitted to the U.S. Environmental Protection Agency (EPA) and MassDEP on December 28, 2009, for Massport and each co-permittee.

In accordance with the Massachusetts Contingency Plan (MCP), the 2009 EDR reports that Massport continues to assess, remediate, and bring to regulatory closure areas of subsurface contamination. The 2009 EDR states that Massport is working towards achieving regulatory closure of the remaining MCP sites. In addition, preparation of the Environmental Management System (EMS) for facilities, where fleet and field maintenance activities are conducted, was on-going in 2009.

In 2009, there were six reportable oil and hazardous material spills detailed in the 2009 EDR. Massport received a Notice of Noncompliance (NON) from the MassDEP on September 18, 2009. The NON listed a total of 13 stormwater discharge samples that exceeded permit limits in the period since the NPDES permit was issued in July 2007. In response to the NON, Massport implemented corrective actions throughout the Airport directed at specific issues identified in the NON, as well as generally reviewing and updating standard practices at the Airport. One of the outfall samples out of a total of 72 samples at the Maverick Street Outfall exceeded the regulatory limits of the NPDES permit for the North, West and Maverick Street outfalls which was reported.

In accordance with the requirements of the NPDES permit for Logan Airport, Massport conducted a water quality study to evaluate the potential biological, chemical, and toxicological impacts of de-icer discharges on Boston Harbor. The study concluded that de-icer discharges do not negatively impact dissolved oxygen levels in the harbor, do not contain materials in concentrations over water quality criteria or toxicological benchmarks, and do not adversely affect the designated uses of the receiving waters.

For 2010 the Water Quality/Environmental Compliance and Management chapter should report on the 2010 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
- Fuel spill prevention

- Future stormwater management improvements (if any)
- Future MCP and tank management activities

Massport should continue to report in the 2010 EDR how Massport will assess, remediate, and bring to regulatory closure areas of subsurface contamination.

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, 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.

This chapter describes Massport's continued efforts including Massport-wide sustainability and details how sustainability is incorporated into many aspects of Massport's activities: Planning and Design; Construction; Operations, Maintenance and Management; and Monitoring of Environmental Performance which are detailed in this chapter. The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2010 EDR.

The 2009 EDR outlines how Massport is committed to sustainable practices to help reduce impacts associated with construction. For example, Massport requires contractors to comply with construction guidelines regarding demolition waste recycling, soil reuse, and air emissions from construction equipment. In 2009, Massport undertook the 2010 Environmental Benchmarking Survey sponsored by Airport Council International North America (ACI-NA) to assess solar power, purchase of renewable energy, availability of low emission ground transportation, recycling and "green" purchasing.

The new Signature Flight Support GA Facility in the North Cargo Area, opened in 2007, the first LEED certified GA facility in the United States. This GA Facility at Logan Airport is serving as a model for new Signature Flight Support GA facilities around the U.S., including at Chicago O'Hare International Airport. The 2009 EDR also reports on the International Standards Organization (ISO) 14001 standard certification for Massport's Logan Airport Facilities II (vehicle maintenance, landscaping, and snow removal) that was completed in December 2006 and was recertified in December 2009. ISO Certification for Facilities I (Central Heating and Cooling Plant) and Facilities III (Electrical and Structural) is scheduled for 2010.
Massport began construction in 2010 on the new Consolidated Rental Car Facility (ConRAC). It will meet the Commonwealth of Massachusetts "LEED Plus" requirements and strive for LEED Silver level certification or better. The ConRAC will include the infrastructure necessary to accommodate future plug-in stations for electric vehicles and other alternative fuel sources such

as E-85 (ethanol). The ConRAC could accommodate car sharing services, such as ZipCar, at a later date. The ConRAC design includes pedestrian and bicycle accommodations including secure bicycle storage. The facility will include efficient water systems including water reclamation for vehicle wash water, and use of stormwater for non-potable uses such as vehicle washing and landscaping irrigation. At least 2.5 percent of the proposed program's overall electricity needs will be met with solar or wind power, or another form of renewable energy. Rental car companies have pledged to maintain rental car fleets which include hybrid or alternativefuel/ low-emitting vehicles.

In 2009, Massport began a four-year rehabilitation of the Terminal B parking garage, which includes the installation of solar panels on the top parking deck and high efficiency Light-Emitting-Diode (LED) lighting throughout the structure. The use of motion-detecting LED fixtures will use approximately 50 percent less electricity than the existing lighting, reducing existing usage by 2,261,218 killowatt-hours (kWhs) of electricity per year. This, along with other energy conservation measures, will reduce 1,307 metric tons of carbon dioxide (CO2) the equivalent of not using 3,040 barrels of oil or 148,385 gallons of gasoline annually. The Airport expects a savings of $3.8 million in electrical usage over the next 20 years based on costs of $0.12 per kWh. Additionally, the installation of 16 solar panel trees is expected to produce 83,980 kWhs of electricity, or 2.5 percent of the total garage annual consumption. This is equal to the reduction of 50 metric tons of CO2 the equivalent of not using 115 barrels of oil or 5,637 gallons of gasoline annually. Each solar panel is a single structure design with a stem and steel frame that uses solar panels as a roof over parked cars. The design has the added benefit of collecting rainwater that will be used for landscaping and cleaning projects on the Airport. Each solar array is mounted on an air ventilation unit on the roof of the garage and does not affect parking operations or the number or spaces available to travelers.

For 2010, this chapter should report on the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have commenced construction. The mitigation commitments were made in the Section 61 Findings for the following projects which should be reported:

- West Garage/Central Garage;
- International Gateway;
- Runway Ends 22R and 33L Safety Improvements;
- Replacement Terminal A;
- The Consolidated Rental Car Facility; and
- Logan Airside Improvements Planning.

This chapter should also update the status of Massport's mitigation commitments and identify projects for which mitigation is complete.

Responses to Comments

The 2010 EDR must include Responses to Comments which addresses all of the substantive comments from the letters listed at the end of this Certificate. The Response to Comments included in this EDR is well-constructed and cross-referenced. Massport may follow the same format in addressing comments in the next EDR, although the Responses to Comments should pay particular attention to increased specificity, where necessary.

The majority of comments received on the 2009 EDR focused 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 2010 EDR should continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commentors where appropriate.

Conclusion

I have determined that the 2009 EDR for Logan Airport has adequately compiled with MEPA and that Massport may prepare a 2010 EDR in lieu of a multi-year ESPR for submission in 2011.

November 12, 2010
Date

Ian A. Bowles

Comments Received:

11/04/10	Darryl Pomicter (email)
11/05/10	Nancy Timmerman
11/05/10	City of Cambridge, Executive Department
11/09/10	Jerome Falbo

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Comment Letters and Responses

- The eight comment letters received by the Massachusetts Environmental Policy Act (MEPA) Office on the *2010 Environmental Data Report (2010 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:
  - Maura Zlody, City of Boston Environment Department
  - Robert D'Amico, City of Boston Transportation Department
  - Robert Healy, City of Cambridge
  - Vivien Li, The Boston Harbor Association
  - Aaron Toffler, Esq., AIR, Inc.
  - Stephen Kaiser, PhD., Cambridge community member
  - Darryl Pomicter, member of the Citizen Advisory Committee (Emails dated December 9, 2011 and November 10, 2012)
  - Nancy Timmerman, P.E., consultant in Acoustics and Noise Control

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December 15, 2011

Richard K. Sullivan, Jr., Secretary
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, Massachusetts 02114

Re: Boston-Logan Airport 2010 Environmental Data Report - EEA #3247

Dear Secretary Sullivan:

The City of Boston Environment Department has reviewed the Boston-Logan Airport 2010 Environmental Data Report (EDR) filed by the Massachusetts Port Authority (Massport) for Boston-Logan International Airport (Logan) and offers the following comments.

Massport has asked that the next filing, a 2011 Environmental Status and Planning Report (ESPR), be submitted to MEPA in Spring 2013. This department would support an extension for a full report should a response to comments and requested information be provided by Spring 2012. **B-1**

We thank Massport for providing a CD of this EDR and also making it available on the Massport Web site.

Section 61 Mitigation Measures
Massport is subject to numerous mitigation commitments for past and current/upcoming projects. The following are currently of particular interest to this department.

Regional Transportation Policy commitments

- Engage in promoting increased utilization of regional airport 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.

Massport identifies this commitment as implemented and states in the EDR that, "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."

- Continue to work with FAA/regional airport directors to complete a New England Airports System Study to evaluate regional airports performance.

Massport indicates that the NERASP Study as published in October 2006; it considers this measure to be implemented.

In numerous filings with MEPA, Massport has cited its work on the NERASP Study and has referenced it as the basis for conclusions. We have requested several times that Massport provide the report as an Appendix **B-2**

B-2 con't. and be specific about findings and their basis when the study is cited. We reiterate this request.

Logan TMA Participation

- 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.
- Report on Progress of Logan TMA.
- Massport will encourage participation by all employees, but will particularly target the airport's largest employers.

B-3 Massport identifies these commitments as implemented but there is no information in the EDR regarding the current status of employer participation in the TMA or the current status of the TMA and its members. Given the challenges the TMA has encountered and its importance in maximizing non-auto commuting, we believe that an update of the current situation and expected future of TMA membership and programs should be provided and that this Finding be considered Ongoing rather than Implemented.

Operational Mitigation Measures

- Using single engine taxiing and pushback to the extent feasible and practicable, recognizing that such use always at the discretion of the pilot in charge of the aircraft based upon his or her experience and safety and operational considerations.

B-4 We applaud Massport for engaging MIT in studies of single-engine taxiing and pushback rate control. We understand that Massport will continue to survey airlines periodically about single-engine taxiing. The status of pushback rate control is not discussed; we would welcome an update and discussion.

Activity Levels

Significant changes in activity at Logan Airport in 2010 include the following:

- The total number of air passengers increased by 7.5 percent to 27.4 million. The historic peak passenger level was 28.1 million in 2007.
- The total number of aircraft operations grew from approximately 345,310 in 2009 to 352,640, an increase of 2.1 percent.
- Passenger aircraft operations, which represent 94.1 percent of overall operations, decreased by 1.6 percent compared to 2009 levels. Their levels had declined by 48.6 percent between 2008 and 2009.
- General aviation (GA) operations increased 19.9 percent in 2010, due to increased business travel and use of GA transportation. GA accounted for 4.2 percent of aircraft activity at Logan Airport in 2010.
- The number of air passengers per aircraft operation continued to increase, climbing from an average of 73.9 passengers per aircraft operation in 2009 to an average of 77.8 passengers per aircraft operation in 2010. The number of International passengers decreased slightly over 2009 levels.
- While legacy air carriers continued to reduce the number of aircraft operations at Logan Airport, low-cost carrier (LCC) operations increased by approximately 40 percent in 2010. The increase in operations by LCCs, primarily JetBlue Airways and Southwest Airlines, accounted for nearly all of this growth.
- Dedicated air cargo operations decreased by 5.8 percent compared to 2009.
- Even though the number of dedicated air cargo aircraft operations decreased in 2010, air cargo volumes increased from 546 million pounds in 2009 to 572 million pounds in 2010, an increase of 4.7 percent.

Planning

- Southwest Service Area (SWSA) Redevelopment Program - Construction of this project began in July 2010.
- Logan Runway Safety Area (RSA) Improvements Project at Runway Ends 33L and 22R - Construction of the Runway 33L RSA improvements commenced in June 2011.

- Green Bus Depot - Preliminary design of a bus maintenance facility for Massport's clean fuel fleet buses in the North Service Area (NSA) began in 2009; construction is now underway.
- East Boston-Chelsea Bypass Project - Planning for the East Boston-Chelsea Bypass project commenced to develop a limited access roadway between Logan Airport and the new Chelsea Street Bridge. The Bypass roadway is expected to improve commercial vehicle access to the Airport, as well as reduce congestion on local East Boston streets in the vicinity of Day Square, Eagle Square, and the Neptune Road corridor by directing airport-related commercial traffic to the new Bypass roadway. An ENF was filed on October 15, 2010; on December 1, 2010, the EEA Secretary, in his Certificate, determined that no further MEPA review was required. Construction is underway as of the date of this filing.
- Logan Airport Parking Deck Project - Planning for the Logan Airport Parking Deck Project (Economy Garage) along Prescott Street in the North Cargo Area (NCA) was initiated in 2010. In response to a Massport request, the MEPA Office confirmed that the project was not subject to MEPA review. Construction of the economy garage began in summer of 2010 and was completed and fully opened to the public in early 2011. Solar panel "trees" were installed on the roof of the parking deck, and energy-efficient lighting was also installed throughout. Reporting required by the EEA Secretary is provided in *Chapter 5, Ground Access to and from Logan Airport,* and further details of its energy-saving features are provided in this chapter.
- North Service Area (NSA) Roadway Corridor Project - Massport anticipates completing the project with final landscaping in 2011. The NSA Roadway Corridor Project is not a new roadway but a corridor improvement project. This project is intended to unify the existing roadway with new landscape and urban design elements along this highly visible roadway corridor, providing an important public edge along the corridor. The project will coordinate with other projects including the Logan Airport Parking Deck Project, entrance to the East Boston-Chelsea Bypass Project, and interface with the Neptune Road Buffer Project. The NSA Roadway Corridor extends approximately from Building 11 up to and including Neptune Road. Construction of the NSA Roadway Corridor Project began in 2010. Most of the project's infrastructure, including curbing, sidewalks, lighting and fencing have been installed.
- Hangar Upgrade Projects - Architectural design commenced in December 2010 for two hangar upgrades in the NCA.
- Terminal B Garage Improvement Project Terminal B Garage repair and rehabilitation continued in 2010. In addition to overall upgrades, 32 solar panel trees (200 kilowatt (kW)) were installed on the top floor and the entire garage was fitted with high efficiency Light-Emitting-Diode (LED) lighting.
- Taxiway G Realignment Project - Taxiway G realignment construction was completed in 2010.

Regional Transportation

In 2010, New England's commercial service airports included:

- Logan Airport
- Bradley International Airport, Connecticut (CT)
- T.F. Green Airport, Rhode Island (RI)
- Manchester-Boston Regional Airport, New Hampshire (NH)
- Portland International Jetport, Maine (ME)
- Burlington International Airport, Vermont (VT)
- Bangor International Airport (ME)
- Tweed New Haven Airport (CT)
- Portsmouth International Airport at Pease (NH)
- Worcester Regional Airport, Massachusetts (MA)
- Hanscom Field (MA)

The total number of air passengers utilizing New England's commercial service airports, including Logan Airport, increased from 42.0 million in 2009 to 43.1 million annual air passengers. This represents an increase of 2.5 percent, which is in line with an overall increase of 2.4 percent in the U.S. passenger market.

The challenging airline operating environment affected smaller communities disproportionately. Within the region, Logan Airport passenger traffic grew, while air passenger levels continued to decline at the other regional airports. Of the 43.1 million air passengers using New England's commercial service airports in 2010, 63.6 percent of air passengers used Logan Airport compared to 56.4 percent in 2005. Passenger levels at the regional airports declined by 5.2 percent in 2010, compared to an increase of 7.5 percent at Logan Airport. This was largely due to legacy carriers withdrawing from smaller secondary markets and reducing their use of small regional jets, and LCCs, such as Southwest Airlines and JetBlue Airways, focusing on expansion in larger air service markets with a strong business travel portfolio like Logan Airport.

Aircraft operations in the New England region remained largely flat, increasing slightly by 0.7 percent, from 1.03 million operations in 2009 to 1.04 million operations in 2010. Commercial airline operations declined by 0.25 percent while GA and military operations increased by 1.9 percent and 4.7 percent, respectively.

B-5 Table 4.3, *Share of Scheduled Domestic Departures – Logan Airport and the Ten Regional Airports*, show Logan' s numbers from 2005-2010 then group other airports – cumulative numbers are reported for Bradley, Manchester-Boston and T.F. Green with another set of cumulative numbers for Bangor, Burlington, Hanscom, Portland, Portsmouth, Tweed-New Haven and Worcester. There is no explanation for reporting cumulative data. Given their individual roles in regional transportation, data for each airport should be reported individually.

Massport indicates that in 2010 it continued to engage in cooperative metropolitan planning efforts including GreenDOT, the Healthy Transportation Compact, and the Boston Metropolitan Planning Organization (Boston MPO), also known as the Metropolitan Area Planning Council (MAPC).

B-6 As we have previously requested, Massport should provide information in EDRs/ESPRs about the goals of each planning effort, the specific activities of each effort and details about the role that Massport has played in each.

Massport's Hanscom Field (BED) is located in Bedford, MA, approximately 15 miles northwest of Logan Airport; it is New England's premier facility for business/corporate GA. Hanscom Field serves as a GA reliever airport for Logan Airport, accommodating a variety of GA operations. In 2010, there were 161,940 aircraft operations at Hanscom, approximately eleven times the number of GA operations that occurred at Logan. In addition to its role as a GA facility, Hanscom has also accommodated niche commercial airline services in the past. However, Hanscom Field lost all scheduled commercial service at the beginning of 2008 when Boston-Maine Airways discontinued services to Portsmouth and Trenton. Linear Air, an air taxi charter company, provides private air transportation from Hanscom Field to cities throughout the Northeast and eastern Canada. Streamline currently provides scheduled charter service between Hanscom and Trenton, New Jersey (NJ). Table 4-1, *Passenger Activity at New England Regional Airports and Logan Airport*, show that Hanscom had 0.02 million passenger levels in 2005, 2006 and 2007 and 0.00 in 2008, 2009 and 2010.

B-7 Information on operations by Streamline and Linear Air should be provided, now and in EDRs/ESPRs, as should a description of Massport's efforts attract and retain niche commercial service at Hanscom.

Ground Transportation

Key findings for On-Airport Transportation include:

- The total number of annual air passengers at Logan Airport increased 7.5 percent to 27.4 million, compared to 25.5 million in 2009. During the same period, average daily traffic on airport roadways increased by 5.1 percent from 2009 to 2010, while VMT on the Airport increased by 4.8 percent.
- The number of vehicles parked on-Airport (measured by the revenue parking exits) increased by 4 percent in 2010 compared to 2009 levels.

Massport began construction of the Logan Airport Parking Deck Project, located on the 1,000-space Economy Lot in the NCA. It consolidates an additional 2,000 commercial parking spaces from various on-airport temporary commercial parking lots into a single structured parking facility containing

- approximately 3,000 commercial parking spaces. The garage maintains on-airport parking capacity in compliance with the limits imposed by the Logan Airport Parking Freeze. The garage was fully opened in March 2011.

Key findings for Ground Access Activity include:

- Ground access activity to Logan Airport generally increased for all modes from 2009 to 2010 as a result of a 7.5 percent growth in the number of annual air passengers, as described in Chapter 2, Activity Levels.
- In 2010, Massport administered the periodic Logan Airport Air Passenger Ground Access Survey (Survey). Massport identifies the Survey as its primary tool for understanding the changes in ground access patterns and the effectiveness of its policies and services.
- Passenger origins remain similar to those identified in the 2007 Survey while weekday market share of business trips decreased.
- The 2010 Survey indicates that shares of high-occupancy vehicles (HOV) modes to the Airport have returned to 2004 levels (30 percent HOV mode share); the 2007 Survey had shown a 2 percent decrease.
- Metropolitan Bay Transportation Authority (MBTA) Silver Line boardings at the Airport continued to grow, increasing by 5 percent in 2010, while Blue Line boardings at Airport Station decreased slightly compared to 2009.
- In 2010, ridership on water transportation to the Airport increased by about 1 percent in comparison to the previous year.
- Limousine ridership increased by an estimated 16 percent, and taxi dispatches increased 12 percent in 2010 compared to 2009. Despite the increase in dispatches, the relative share in the use of these modes did not increase, according to the 2010 Logan Airport Air Passenger Ground Access Survey.
- Over the past several years, transit services, including Logan Express bus service, have experienced increases in employee use. In 2010, Logan Express air passenger ridership increased by about 1 percent compared to 2009 levels, whereas employee use of Logan Express increased by 4 percent, and accounts for 42 percent of the service's ridership during this time period.
- Taxi dispatches increased by 12.1 percent in 2010 over the 2009 level.

Logan Express

- Framingham use was up 3.2 percent in 2010 after reductions of 9.4 in 2008 and 2.9 percent in 2009.
- Braintree was up 3.8 percent in 2010 after 4.8 and 1.7 percent decreases in 2008 and 2009, respectively.
- Woburn use was up 3.0 percent in 2010 after having been down 7.4 percent in 2008 and 6.7 percent in 2009.
- The use of Peabody down 13.8 percent in 2010, having been down 2.9 percent in 2008 and 2.3 percent in 2009.
- Overall use as down 2.4 percent in 2010 after reductions of 6.7 percent in 2009 and 3.2 in 2008.
- The majority of 2010 increases in the use of Framingham, Braintree and Woburn were the result of employee use. The 2010 reduction in use of the Peabody service came mainly from employees.

The increases in Logan Express use are less than half of the increase in passengers. We would appreciate Massport's perspective about the 2010 use levels in relation to passenger level increases. **B-8**

Table 5-8, *Ground Access Mode Share (All Passengers) by Survey Year*, shows that the total Non-HOV/Automobile (private automobile, taxi and rental car) shares were:
1999 – 69.3 percent **2004** – 69.7 percent **2007** – 72.3 percent and **2010** – 70.1 percent

Private automobile use has increased from 36.5 percent in 1999 to 70.1 percent in 2010, taxi use has decreased from 20.6 percent in 1999 to 18.8 percent in 2010 and rental car use has increased from 69.3 percent in 1999 to 70.1 percent in 2010.

Total HOV/Shared-Ride (unscheduled HOV, scheduled HOV, transit, courtesy shuttle and an unspecified "other") numbers were:
1999 – 8.9 percent **2004** – 30.3 percent **2007** – 27.8 percent and **2010** – 29.9 percent
We note that HOV use during the period from 2004-2010 was at its lowest during 2007, the year in which passengers levels reached an historic high.

Unscheduled HOV use has decreased from 8.9 percent in 1999 to 7.5 percent in 2010; it increased slightly in 2010 from 2007 numbers.

Scheduled HOV use decreased from 9.5 percent in 1999 to 8.2 percent in 2010, transit use has declined from 9.7 percent to 7.6 percent in 2010, Courtesy Shuttle use has increased from 2.1 percent in 1999 to 4.6 percent in 2010 and "Other" has increased from 0.5 percent in 1999 to 1.8% percent in 2010.

B-9 We ask that Massport explain the information and conclusion reached regarding limousine ridership. What is the method for estimating ridership (16 percent increase in 2010) and how was the conclusion reached that the 2010 Survey data revealed no increase in relative share?

It is important to know, in general, which data on ground transportation is estimated and which is based upon a measured method. In addition, definitions of scheduled and non-schedule HOVs and the 'other' category need to be clarified.

B-10 This department has requested several times that the Survey used by Massport be provided in the appropriate EDR or ESPR subsequent to its administration and that the response rate be provided. We ask that this be provided in interim information and in future filings with MEPA.

A preferred parking program for hybrid and alternative-fueled vehicles (AFVs) in the Spring of 2007. Designated parking spaces at the Airport's Central Garage, Terminal B garage, Terminal E surface lot, and Economy Parking. The new Logan Airport Parking Deck Project also provides preferred parking spaces for AFVs.

B-11 We request that Massport provide information on the marketing and utilization rate of these spaces.

Massport offers guaranteed parking through its Parking PASSport Gold program. 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. Parking PASSport Gold is offered in dedicated areas of the Terminal B and Central Parking garages, eliminating the need for a motorist to circle the garage looking for available spaces. First implemented in 2006, the Parking PASSport GOLD program had 4,565 customers as of December 31, 2010, compared to 3,631 at the end of 2009. Customers in the Parking PASSport programs account for roughly two percent of parking exits at Logan Airport.

B-12 While minimizing the time it takes for motorists to find a parking space is good for local air quality, this program may encourage air passengers to drive to Logan so it is not a measure designed to encourage HOV use.

We applaud Logan for the Cell Phone Waiting Lot.

Logan Airport Employee Transportation
Airport employee transportation has different ground access considerations than passenger transportation. Airport employees often have non-traditional and unpredictable working hours which are difficult to match to typical transit service hours. 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 which may extend a typical employee workday.

Massport provides off-airport employee parking in Chelsea, which is served by frequent shuttle bus service to the terminals; runs free employee shuttle buses between Airport Station and employment areas in the SWSA and South Cargo Area (SCA) locations; operates early morning Logan Express bus trips for early commuters; supports the Logan Transportation Management Association (TMA); creates and maintain a sidewalks to facilitate pedestrian access; and provides bicycle racks.

The Massachusetts Department of Transportation's (MassDOT) Office of Transportation Planning, through its Mass*RIDES* program, is the coordinator for the Logan TMA. Mass*RIDES*'s administrative support for the Logan TMA allows Massport to use its financial resources to support transportation demand management (TDM) services. Massport contributes $65,000 annually to the Logan TMA. Massport also provides space and equipment for the Logan TMA office (The Transportation Store) in Terminal C.

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. It works with airlines, rental car companies, cargo transport companies and other tenants at Logan Airport to encourage and offer commuting incentives to employees. Several companies offer a subsidy to employees using public transit or Logan Express to travel to work at the Airport. The TMA is open to all companies and their employees at Logan Airport; all employees are eligible to benefit from its services.

Benefits and services provided by the Logan TMA to Logan employees in 2010 included:

- East Boston early morning shuttle service (Sunrise Shuttle), a low-cost efficient transportation to airport employees who live in East Boston. It operates outside of MBTA service hours, between 3:00 AM and 6:00 AM, with half-hourly shuttles transporting employees between various East Boston locations and the terminals. The ridership level increased from 425 riders per month in 2009 to 636 per month in 2010.
- Computerized ride-matching services for participating in carpools and vanpools.
- Individualized commuter mobility programs for member organizations designed to decrease employee dependence on the automobile.
- Airport-wide and individual employer events, such as Transportation Awareness Day, to disseminate information about Logan TMA services.
- 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.

As stated earlier in these comments, we believe that the current and expected future situations with TMA membership and programs should be provided and that this Finding be considered Ongoing rather than Implemented. **B-13**

Noise

- The 2010 Day-Night Sound Level (DNL) contours are similar in size compared to 2009. The DNL 65 decibel (dB) contour remained the same in Revere and in most of Winthrop. The extent of the DNL 65 dB contour decreased slightly in the Point Shirley section of Winthrop due to the reduced number of departures from Runway 9 and due to the reduced number of aircraft arrivals over South Boston and East Boston. The geographic extent of the DNL 65 dB contour increased in East Boston near the Airport and out over Boston Harbor due to an increase in departures from Runway 15R.
- This *2010 EDR* reports on the findings of the Integrated Noise Model's (INM) results of the population impacted by airport related noise and used both the 2010 and 2000 Census data as a basis for comparison.
- Using the 2000 Census, the overall number of people exposed to values greater than DNL 65 dB decreased by 11 percent in 2010, compared to 2009. An estimated 3,870 people were exposed to levels greater than DNL 65 dB as depicted in the 2010 contour, compared to 4,335 in 2009. This is

the first time that the number of people exposed to the DNL 65 dB noise level has been fewer than 4,000 and that the number of people within the DNL 65 dB in Boston has dropped below 1,000 to 711 people.

- Using the 2000 Census, the total population exposed to noise levels greater than DNL 70 dB decreased in 2010 compared to 2009. In 2009, the total population greater than DNL 70 dB was 243, and in 2010 the number dropped to 198. There was a reduction of 40 people in Winthrop and a decrease of 5 people exposed to greater than DNL 70 dB in Boston, resulting in the drop in the total impacted population.
- Using the 2010 Census, the overall number of people exposed to DNL values greater than 65 dB decreased to 3,830 people, 40 people fewer than with the 2000 Census. Within the DNL 70 dB contour the number of people has dropped to 130, 68 fewer than with the 2000 Census. Due to the updated population and Census block boundaries of the 2010 Census, there were no people within the DNL 70 dB contour in the City of Boston.
- In 2010, Massport provided sound insulation to 83 homes, nearly half of which were in Chelsea. The focus of this 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 Sound Insulation program, 11,219 homes have been received sound insulation treatment in East Boston, South Boston, Winthrop, Revere, and Chelsea.

Methods used to reduce noise include:

- Residential sound insulation program, begun in 1986.
- RNAV flight tracks designed to avoid highly populated areas.
- Overwater visual approach at night to keep aircraft offshore as much as possible.
- Runway choices based upon dictated or permitted by availability, wind, weather, aircraft performance, demand, and air traffic control conditions.

B-14 This department receives phone calls from residents of East Boston who participated in the early sound insulation/room-of-choice program and finding that windows have reached their useful life, some because of the effects of vibration, and are no longer providing the original level of benefit. It may be that a limited lifespan was not a subject of consideration when the program was implemented. We ask that Massport discuss this issue.

We note that when PRAS was in place, runway use goals were not obtained and, although the aforementioned reasons for runway choices are clearly necessary factors, pilot preference not based upon the those factors is also a reason for runway use choices.

Noise Complaints

In 2010, Massport received a total of 3,761 noise complaints from 53 communities, a decrease of 35.9 percent from 2009, when the Noise Abatement Office received 5,869 complaints. A full listing of complaints by community shows that five communities had more than 100 complaints from an individual caller, and East Boston had more than 100 complaints from two callers. Among communities with more than 100 annual complaints, the greatest increases were Jamaica Plain (up from 93 in 2009 to 158 in 2010), Lynn (up from 154 to 339), Somerville (up from 325 to 385), and Weymouth (up from184 to 193). There were three communities that had an increase of at least 30 complaints but a total of less than 100: Milton (up from 54 in 2009 to 84 in 2010), Roslindale (up from 4 to 73) and South Boston (up from 26 to 59). Seven communities with more than 100 annual complaints in 2009 had a decrease in noise complaints for 2010: Cambridge (down from 471 in 2009 to 323 in 2010), Chelsea (down from 570 to 129), East Boston (down from 1,657 to 699), Marshfield (down from 228 to 13), Medford (down from 504 to 444), Nahant (down from 400 to 204), and Winthrop (down from 513 to 207).

B-15 ESPRs/EDRs include no information about noise complaints other than their numbers and the neighborhood or municipality of the complainants. It would be useful to know how complaints break down on these

parameters:

- arrival or departure;
- month;
- day of week;
- time of day;
- runway;
- type of aircraft; and
- the determination of aircraft compliance with prescribed flight tracks.

B-15 con't.

Air Quality/Emissions Reduction

Total emissions of volatile organic compounds (VOC) were 1,019 kilograms per day (kg/day), or 4 percent higher than 2009 levels, but still follow a long-term, downward trend decreasing by almost 78 percent since 1990. This increase is primarily due to the increase in landing and takeoff operations (LTOs) when compared to 2009.

Total emissions of oxides of nitrogen (NOX) were 3,989 kg/day, or less than 1 percent higher than 2009 levels. In 2010, total NOx emissions at Logan Airport (net total with reductions) were approximately 742 tons per year lower than Massport's 1999 Air Quality Initiative (AQI) benchmark. This represents a 32 percent decrease in NOx emissions since 1999.

Total emissions of carbon monoxide (CO) were 7,160 kg/day, or 10 percent lower than 2009 levels.

Mostly due to the decreased use of No. 6 fuel oil, total emissions of particulate matter (PM) PM10/PM2.5 associated with Logan Airport heating and cooling decreased in 2010 by approximately 10 percent to 64 kg/day compared to 2009 levels.
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 2010 continued to be well within the National Ambient Air Quality Standards (NAAQS) for NO2.

Massport's two-phased Air Quality Monitoring Study is collecting data on a variety of ambient air pollutants over a two year period and assessing air quality changes attributable to the operation of the new centerfield taxiway. The second phase of the Study concluded in 2011; after the centerfield taxiway became fully operational. The findings from this Study will be submitted to MassDEP in late 2011/early 2012 and also will be reported in the *2011 ESPR*.

2010 marks the fourth consecutive year in which Massport has voluntarily prepared a MEPA greenhouse gas (GHG) emissions inventory for the EDR. The 2010 GHG emission inventory was updated incorporating guidance developed by the Transportation Research Board's (TRB) Airport Cooperative Research Program (ACRP). The ACRP guidance was published in April 2009 for airport operators developing an airport-specific GHG emissions inventory.12 The 2010 inventory assigns emissions based on ownership or control (e.g., Massport, airlines and other airport tenants, and the general public). The vast majority of emission sources at Logan Airport are owned or controlled by the airlines, airport tenants, and the general public (through emissions from motor vehicles). Massport sources contribute 12 percent of the total GHG emissions for the Airport. Total Logan Airport GHG emissions in 2010 were slightly lower (0.4 percent) than 2009 levels.

We note that the Massachusetts Department of Public Health Study has not yet been released and will have data to supplement current knowledge.

Water Quality/Environmental Compliance and Management

- In 2010, there were 15 oil and hazardous material spills that required reporting to MassDEP, five of which involved a storm drainage system.

- One outfall sample out of a total of 19 samples at the Maverick Street Outfall and one outfall sample out of a total of 23 samples at the North Outfall exceeded the regulatory limits of the National Pollutant Discharge Elimination System (NPDES) Permit for the North, West, and Maverick Street Outfalls. These exceedances were reported during April and November of 2010, respectively, as required.
- Massport's Stormwater Pollution Prevention Program (SWPPP) addresses stormwater pollutants in general, and also addresses deicing and anti-icing chemical, potential bacteria, fuel and oil, and other sources of stormwater pollutants. The 2010 Annual Certificates of Compliance were submitted to the U.S. Environmental Protection Agency (EPA) and MassDEP on December 21, 2010, for Massport and each tenant co-permittee.

B-16 Massport has several significant landside projects underway. The Southwest Service Area Redevelopment Project and the Green Bus Depot Project in the North Service Area are both covered under EPA NPDES Construction General Permits (CGP) and associated Stormwater Pollution Prevention Plans (SWPPP). The Water Quality Monitoring Requirement section of the EDR does not reference the CGP's or the project's SWPPP's. As there is no information provided on construction phase monitoring, the stormwater outfalls serving the construction areas should be monitored weekly for typical constituents of construction site runoff, such as total suspended solids, pH, oil and grease. Area catch basins, stormwater infrastructure, erosion and sediment control Best Management Practices and dewatering systems should also be monitored weekly.

B-17 The Water Quality Monitoring Requirements of the EDR notes that there are no NPDES limitations for the Northwest Outfall. NPDES discharge limitations should be established as a portion of the property is transitioning from a construction laydown area to a bus depot with a fueling station and below grade fueling tanks. The Northwest Drainage Area also has several parking areas and uses considered Land Uses with Higher Potential Pollutant Loading, as defined under the State Stormwater Management Standards. More stringent NDPDES monitoring standards should be applied as with the North, West, Porter, and Maverick Street outfalls.

B-18 The Fuel Use and Spills in 2010 section indicates jet fuel spills accounted for the majority of fuel spilled by volume. Massport may consider the installation of fuel spill response kits in locations with the greatest opportunity for spills to occur, such as where fuel is being transferred from tanks and fuel lines to vehicles and jets. It is not clear from the EDR if under the SWPPP the 27 co-permittees are trained in spill management and are required to have spill containment material available. In instances where fuel is spilled and enters a waterway or wetland resource area, the local Conservation Commission should be informed immediately as spills have the potential to impact and alter resource areas.

B-19 The EDR does not reference the Water Quality Study (WQS) required under Massport's NDPES permit. The intent of the WQS is to increase the understanding of discharges from the airport's outfalls, determine if violations are present and assist in establishing water quality based pollutant limits in the future. The WQS also requires real time monitoring of outfalls during deicing episodes to assist in determining if supplemental BMP's are necessary under the SWPPP to better protect water quality. A discussion of the WQS, monitoring results and changes to effluent standards should be included in future EDRs/ESPRs.

Sustainability at Logan Airport

Massport has a dedicated Sustainability Program Manager with responsibility to coordinate and fulfill its sustainability commitment across all lines of business. Massport's activities and include, but are not limited to:

- benchmarking;
- LEED Plus for new construction with a goal to achieve at least LEED Silver certification;
- purchase of low emission ground transportation vehicles;
- offer recycling in terminal areas;
- environmentally preferred purchasing;
- retrofit or purchase heavy-duty equipment with diesel oxidation catalysts or particulate filters;
- install at the new ConRAC facility the infrastructure necessary to accommodate future plug-in stations for electric vehicles and other alternative fuel sources such as E-85 (ethanol);

- install efficient water systems, including water reclamation for vehicle wash water and use of stormwater for non-potable uses such as vehicle washing and landscaping irrigation at ConRAC;
- use of solar panels and solar trees;
- use of warm mix asphalt; and
- single-stream recycling dumpsters for paper cardboard, plastic, aluminum, and glass.

This department understands the many challenges facing airlines and airport proprietors and is aware of the effort required to prepare EDRs/ESPS. At the same time, what will likely be one and one-half years between updates reduces the chance that comments will address and make a difference in areas of concern. We would support the proposal so long as a brief update, including a response to our comments prepared and circulated addressing the following: **B-20**

- TDM - passengers and employees;
- efforts to maximize the use of Hanscom;
- water quality/environmental compliance and management;
- noise complaint information; and
- project and mitigation status.

Climate Change and Adaptation

We ask that Massport include in an interim filing a discussion of the potential impacts of climate change on Logan and the ways in which it will approach adaptation. The next EDR/ESPR should include a Climate Change and Adaptation chapter. **B-21**

Thank you for the opportunity to comment and for your consideration.

Sincerely,

Maura T. Zlody
Senior Environmental Policy Analyst

Logan 2010 EDR, 12.11.doc:DBG/MTZ.mtz

Comment #	Author	Topic	Comment	Response
B.1	Boston Environment Department	MEPA	Massport has asked that the next filing, a 2011 Environmental Status and Planning Report (ESPR), be submitted to MEPA in Spring 2013. This department would support an extension for a full report should a response to comments and requested information be provided by Spring 2012.	Massport published advance information in October 2012 to provide reviewers with a preview of the data reported on in the *2011 Logan Airport Environmental Status and Planning Report (2011 ESPR).* It is available on the website: http://www.massport.com/environment/Pages/Default.aspx. Currently, a visitor to Massport's environmental website could find information on green initiatives at Massport facilities, Massport's achievements in environmental efforts, Massport's environmental management policy, environmental reporting, and related links.
B.2	Boston Environment Department	Regional Transportation	In numerous filings with MEPA, Massport has cited its work on the NERASP Study and has referenced it as the basis for conclusions. We have requested several times that Massport provide the report as an Appendix and be specific about findings and their basis when the study is cited. We reiterate this request.	The *New England Regional Airport System Plan (NERASP)* is publically available from the Federal Aviation Administration (FAA) at the following website: http://www.faa.gov/airports/new_england/planning_capacity/airport_system_plan/. *Chapter 2, Activity Levels,* of this *2011 ESPR* includes more detailed information regarding the NERASP.
B.3	Boston Environment Department	Mitigation	Massport identifies these commitments as implemented but there is no information in the EDR regarding the current status of employer participation in the TMA or the current status of the TMA and its members. Given the challenges the TMA has encountered and its importance in maximizing non-auto commuting, we believe that an update of the current situation and expected future of TMA membership and programs should be provided and that this Finding be considered Ongoing rather than Implemented.	The Logan Transportation Management Association (Logan TMA) is described in *Chapter 5, Ground Access to and from Logan Airport.* Massport continually evaluates its employee programs, including the Logan TMA, and makes adjustments as necessary to fit the needs of participants.
B.4	Boston Environment Department	Air Quality	We applaud Massport for engaging MIT in studies of single-engine taxiing and pushback rate control. We understand that Massport will continue to survey airlines periodically about single-engine taxiing. The status of pushback rate control is not discussed; we would welcome an update and discussion.	Additional information regarding single-engine taxiing and pushback rate control is provided in *Chapter 7, Air Quality/ Emissions Reduction.*

Comment #	Author	Topic	Comment	Response
B.5	Boston Environment Department	Regional Transportation	Table 4.3, Share of Scheduled Domestic Departures – Logan Airport and the Ten Regional Airports, show Logan's numbers from 2005-2010 then group other airports – cumulative numbers are reported for Bradley, Manchester-Boston and T.F. Green with another set of cumulative numbers for Bangor, Burlington, Hanscom, Portland, Portsmouth, Tweed-New Haven and Worcester. There is no explanation for reporting cumulative data. Given their individual roles in regional transportation, data for each airport should be reported individually.	Cumulative totals were shown in Table 4-3 to simplify the data presentation in *Chapter 4, Regional Transportation,* of the *2010 Environmental Data Report (EDR)* . One cumulative total was shown for the largest of the regional airports (Bradley, Manchester-Boston, and T.F. Green) and a second cumulative total was shown for the remaining airports to show that large and small secondary airports have experienced a reduction in scheduled airline services. Data for each airport is presented individually in Appendix F. In the *2011 ESPR,* cumulative information is provided in *Chapter 4, Regional Transportation,* and individually in Appendix F.
B.6	Boston Environment Department	Regional Transportation	As we have previously requested, Massport should provide information in EDRs/ESPRs about the goals of each planning effort, the specific activities of each [cooperative metropolitan planning efforts] and details about the role that Massport has played in each.	The *2011 ESPR* describes Massport collaboration with other regional transportation organizations in planning for the region's transportation needs. See *Chapter 4, Regional Transportation.*
B.7	Boston Environment Department	Regional Transportation	Information on operations by Streamline and Linear Air should be provided, now and in EDRs/ESPRs, as should a description of Massport's efforts attract and retain niche commercial service at Hanscom.	A description of the role Hanscom Field, including activity levels, is provided in *Chapter 4, Regional Transportation.* Massport's efforts at Hanscom Field are the subject of a separate ESPR, the preparation of which is currently underway. The Boston Environment Department will be included in the Hanscom ESPR distribution.
B.8	Boston Environment Department	Ground Access	The increases in Logan Express use are less than half of the increase in passengers. We would appreciate Massport's perspective about the 2010 use levels in relation to passenger level increases.	Massport continuously monitors Logan Express ridership activity, and in response has recently made service and pricing changes in an attempt to capture more of the air passenger ground-access market. As detailed in *Chapter 5, Ground Access to and from Logan Airport,* Massport extended late night Logan Express service hours from Logan and added to its early morning service. In March 2012, Massport lowered the parking rate at the Logan Express sites. These changes have resulted in increased Logan Express passenger activity at rates higher than the changes in Logan Airport air passengers. Further enhancements are under consideration. Massport introduced a marketing/media campaign in the spring of 2012, to promote the use of Logan Express and public transit to Logan Airport. Further pricing incentives will be considered during peak periods.

Comment #	Author	Topic	Comment	Response
B.9	Boston Environment Department	Ground Access	We ask that Massport explain the information and conclusion reached regarding limousine ridership. What is the method for estimating ridership (16 percent increase in 2010) and how was the conclusion reached that the 2010 Survey data revealed no increase in relative share?	The method for estimating limousine ridership is based on the average passengers per vehicle, as determined from the 2010 survey responses, and the actual number of dispatched limos from the bus/limousine pool.
B.10	Boston Environment Department	Ground Access	This department has requested several times that the [2010 Logan Airport Air Passenger Survey] used by Massport be provided in the appropriate EDR or ESPR subsequent to its administration and that the response rate be provided. We ask that this be provided in interim information and in future filings with MEPA.	The *2010 EDR* featured the key results of the ground-access survey, as well the background, overview, and survey method. The results of the planned 2013 survey will similarly be included in the *2012/2013 EDR* . For more details and complete information about the survey, including the method, response rates, survey questionnaire, and additional results, please refer to its final report. A copy of 2010 survey final report and questionnaire are available on the Massport website under the Environmental Reporting section; once completed, the 2013 report will be available via the website, as well.
B.11	Boston Environment Department	Ground Access	We request that Massport provide information on the marketing and utilization rate of [the preferred parking program] spaces.	Massport offers guaranteed parking through its Parking PASSport Gold program. 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. On Tuesdays and Wednesdays (the peak occupancy days), these designated areas are filled close to capacity in approximately 30 to 35 weeks a year. In terms of marketing, Massport has not had an active, targeted marketing program in place for PASSport Gold since 2010. The program is now branded Lexus Parking PASSport Gold, and airport customers are exposed to the product through signs that are visible in many areas of the airport and via the Logan Airport website.
B.12	Boston Environment Department	Ground Access	While minimizing the time it takes for motorists to find a parking space is good for local air quality, [the Parking PASSport Gold Program] may encourage air passengers to drive to Logan so it is not a measure designed to encourage HOV use.	This program is one element of Massport's overall parking program and it appeals to a small segment of those who park with regularity. PASSport Gold customers are unlikely candidates for high occupancy vehicles (HOV)/shared-ride services. Most of these customers are regular fliers and frequent parkers, often traveling on business, and aren't passengers that formerly used (or would use) a HOV/shared-ride mode for their trip to the airport. PASSport Gold customers make up approximately 3 to 4 percent of parking activity at Logan Airport. Additional information is provided in *Chapter 5, Ground Access to and from Logan Airport.*

Comment #	Author	Topic	Comment	Response
B.13	Boston Environment Department	Mitigation	As stated earlier in these comments, we believe that the current and expected future situations with TMA membership and programs should be provided and that this Finding be considered Ongoing rather than Implemented.	The Logan TMA is described in *Chapter 5, Ground Access to and from Logan Airport.* Massport continually evaluates its employee programs, including the Logan TMA, and makes adjustments as necessary to fit the needs of participants.
B.14	Boston Environment Department	Noise	This department receives phone calls from residents of East Boston who participated in the early sound insulation/room-of-choice program and finding that windows have reached their useful life, some because of the effects of vibration, and are no longer providing the original level of benefit. It may be that a limited lifespan was not a subject of consideration when the program was implemented. We ask that Massport discuss this issue.	Massport was one of the first airports to provide sound insulation to affected residents. Massport has reached out to the FAA regarding the long-term effectiveness of the original technology. The FAA has not funded similar re-insulation of homes which were previously sound insulated with the original technologies. This is reflected in the FAA's August 17, 2012 Program Guidance Letter 12-09 which confirms that previously insulated homes are ineligible for sound insulation funding and that ongoing maintenance and replacement of sound insulating measures are residents' responsibility. To review the Program Guidance Letter, please visit: http://www.faa.gov/airports/aip/guidance_letters/ Massport is involved in assessing the ongoing benefits of the original technologies used for sound insulation. In conjunction with others, Massport submitted a problem statement to the Airport Cooperative Research Program (ACRP) regarding the long-term effectiveness of sound insulation programs including design criteria, materials, and installation standards. The problem statement was accepted, and is currently active in research. For more information on this ACRP research project, please visit: http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3032.
B.15	Boston Environment Department	Noise	ESPRs/EDRs include no information about noise complaints other than their numbers and the neighborhood or municipality of the complainants. It would be useful to know how complaints break down on these parameters: arrival or departure; month; day of week; time of day; runway; type of aircraft; and the determination of aircraft compliance with prescribed flight tracks.	In the Logan EDRs and ESPRs, Massport provides the noise complaint information as one of many sources of data that together provide an understanding of airport noise and its affects within the adjacent communities. In addition to noise compliant information, Massport provides runway use, noise monitoring results, Day-Night Sound Level (DNL), and cumulative noise index (CNI) to provide a complete picture of the airport noise environment. Specific information on noise complaints and their sources can be provided upon request by contacting the Noise Office at 617-561-3333.

Comment #	Author	Topic	Comment	Response
B.16	Boston Environment Department	Water Quality	The Water Quality Monitoring Requirement section of the EDR does not reference the CGP's or the project's SWPPP's. As there is no information provided on construction phase monitoring, the stormwater outfalls serving the construction areas should be monitored weekly for typical constituents of construction site runoff, such as total suspended solids, pH, oil and grease. Area catch basins, stormwater infrastructure, erosion and sediment control Best Management Practices and dewatering systems should also be monitored weekly.	Massport requires all of their contractors to monitor construction sites for erosion and sedimentation pathways to the stormwater outfalls and correct any breaches or issues on a regular basis. *Chapter 8, Water Quality/Environmental Compliance and Management,* describes additional measures which were undertaken at Logan Airport construction sites following exceedances in the monitoring reports submitted to the Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (MassDEP).
B.17	Boston Environment Department	Water Quality	More stringent NPDES monitoring standards should be applied as with the North, West, Porter, and Maverick Street outfalls.	Massport adheres to the monitoring requirements of the EPA that are conditions of the existing National Pollution Discharge Elimination System (NPDES) permit. Monitoring reports and exceedances are reported to the EPA and MassDEP within the time periods dictated in the permit. Additional information is provided in *Chapter 8, Water Quality/Environmental Compliance and Management,* and *Appendix J* . Reports are also posted on Massport's website.
B.18	Boston Environment Department	Water Quality	Massport may consider the installation of fuel spill response kits in locations with the greatest opportunity for spills to occur, such as where fuel is being transferred from tanks and fuel lines to vehicles and jets. It is not clear from the EDR if under the SWPPP the 27 co-permittees are trained in spill management and are required to have spill containment material available. In instances where fuel is spilled and enters a waterway or wetland resource area, the local Conservation Commission should be informed immediately as spills have the potential to impact and alter resource areas.	Massport staff and the co-permittees follow the training, prevention, monitoring, and reporting requirements of the Massachusetts Contingency Plan (MCP).
B.19	Boston Environment Department	Water Quality	The EDR does not reference the Water Quality Study (WQS) required under Massport's NDPES permit. The intent of the WQS is to increase the understanding of discharges from the airport's outfalls, determine if violations are present and assist in establishing water quality based pollutant limits in the future. The WQS also requires real time monitoring of outfalls during deicing episodes to assist in determining if supplemental BMP's are necessary under the SWPPP to better protect water quality. A discussion of the WQS, monitoring results and changes to effluent standards should be included in future EDRs/ESPRs.	The Water Quality Study (WQS) was required under the 2007 permit pursuant to Part 1.D (page 49-50 of 51). The study was completed and the report was transmitted to EPA and the DEP in September 2009. There is no ongoing requirement to continue the WQS. The 2009 Boston-Logan Water Quality Study found that deicer use at Logan Airport did not have a material environmental impact on Boston Harbor. Massport continues to monitoring effluent pursuant to permit requirements, and Massport and its co-permittees continue to implement the applicable best management practices (BMPs) pursuant to the Stormwater Pollution Prevention Plan (SWPPPs).

Comment #	Author	Topic	Comment	Response
B.20	Boston Environment Department	MEPA	We would support the proposal [to submit the ESPR in Spring 2013] so long as a brief update, including a response to our comments prepared and circulated addressing the following: TDM - passengers and employees; efforts to maximize the use of Hanscom; water quality/environmental compliance and management; noise compliant information; and project mitigation status.	Please see the response to Comment B.1.
B.21	Boston Environment Department	Sustainability	We ask that Massport include in an interim filing a discussion of the potential impacts of climate change on Logan and the ways in which it will approach adaptation. The next EDR/ESPR should include a Climate Change and Adaptation chapter.	Massport has actively participated in the state's effort on climate change adaptation planning. In September 2011, the Executive Office of Energy and Environmental Affairs, issued a report that documents state-wide efforts: http://www.mass.gov/eea/docs/eea/energy/cca/eea-climate-adaptation-report.pdf. Massport has included additional information on adaptation for climate change in recent filings. Climate change is being reviewed as part of a broad airport-wide overview. The next EDR will report on any new information that is generated by this study.

BOSTON
TRANSPORTATION
DEPARTMENT

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RECEIVED
DEC 15 2011
MEPA

December 7, 2011

The Honorable Richard K. Sullivan, Jr., Secretary
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, Massachusetts 02114

Re: Logan Airport 2010 Environmental Data Report (2010 EDR) – EOEA # 3247

Dear Secretary Sullivan:

The Boston Transportation Department has reviewed the above document and is pleased to submit the following comments for your review.

Activity Levels

BTD is once again pleased to see how the number of flights has increased minimally while the number of passengers using Logan has increased substantially. Since 2005, the average load factor at Logan has increased from 66.2 passengers per flight in 2005 to 77.8 passengers per flight in 2010. This airline trend continues in 2011. While Massport has minimal input regarding this issue, it is important from a noise abatement perspective, since if the load factor remains constant and passenger levels increase, obviously it would require more flights to accommodate future demand. We are also pleased to see how the number of cargo flights at Logan has decreased 4.74% from 2009 to 2010.

Southwest Service Area Redevelopment Program

C-1 BTD supported the downsizing of the CONRAC Project. The elimination of commercial parking from the project will decrease environmental impacts in the nearby neighborhood. Also, we believe the new and improved design of the structure will also contribute environmental benefits. However, it must be stated that Massport must work with the car rental companies upon completion of the project to ensure environmental impacts are kept to minimum. Since this type of airport operation operates twenty-four

C-2 seven, strict controls must be set in place to protect residents living in the abutting homes. BTD would like to suggest that Massport develop a hot line that residents could call in case of any disturbances that may occur during the evening or early morning hours.

THOMAS M. MENINO, Mayor

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Logan Runway Safety Area Improvements Project at Runways 33L & 22R (RSA)

The RSA for Runway 33L is near completion and during construction Logan became primarily a north/south airport. While this is understood because 33L had to be closed while work was going on, Massport should be more informative with communities that will experience a substantial increase in noise levels due to the construction. Whenever a runway is closed over a long period of time, Massport must be aware of the shift in impacts that coincide with the project. C-3

The construction of the RSA for Runway 22R should commence soon and BTD is hopeful that Massport will be more informative with the communities that could experience an increase in over-flights and therefore more noise. C-4

Also, many residents living in the Orient Heights neighborhood located directly behind the approach end of 22R are fearful that the new RSA could change the operation criteria currently governing approaches to 22R.

Over the last several years, the level of large commercial jets landing on 22R has increased dramatically. Currently, under Massport's own noise rules, arrivals on 22R are limited to aircraft with a maximum certified noise level of 78 DBA. Arrivals on 22R are prohibited from 11:00 PM to 6:00 AM. Since the removal of the Blast Fence on the approach end of 22R, the numbers of large aircraft exceeding this noise level have landed on 22R which has had a dramatic effect on the residents of Orient Heights. Massport must be more diligent in developing a dialogue with the FAA to make it clear this procedure in unacceptable from both a community and City of Boston perspective. BTD sincerely hopes this issue will be taken more seriously than in the past, residents of the Orient Heights neighborhood suffer enough with impacts from other operations, they should not be expected to suffer any more than they have to. C-5

In closing, BTD looks forward to be working with Massport on future developments with the hope of accommodating airport growth without inflicting additional impacts on neighboring residents.

Sincerely,

Robert D'Amico
Senior Planner

BOSTON TRANSPORTATION DEPARTMENT
ONE CITY HALL PLAZA/ROOM 721, BOSTON, MA 02201 • (617) 635-4680

Printed on recycled paper

Comment #	Author	Topic	Comment	Response
C.1	Boston Transportation Department	Airport Planning	BTD supported the downsizing of the CONRAC Project. The elimination of commercial parking from the project will decrease environmental impacts in the nearby neighborhood. Also, we believe the new and improved design of the structure will also contribute environmental benefits. However, it must be stated that Massport must work with the car rental companies upon completion of the project to ensure environmental impacts are kept to minimum.	The consolidated rental car (ConRAC) project is in itself a mitigation project that takes vehicles off the roadway system. In addition, a comprehensive series of operational measures will be deployed to reduce energy consumption, improve air quality, and reduce impacts to the surrounding neighborhood. Massport and the car rental companies are working cooperatively to prevent environmental impacts, such as air quality and noise effects, from occurring at the ConRAC facility. Further, once completed and fully operational, the ConRAC, Green Bus Depot, East Boston-Chelsea Bypass Road, and the Logan Airport Economy Parking Garage are expected 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. Refer to *Chapter 3, Airport Planning,* and *Chapter 9, Project Mitigation Tracking.*
C.2	Boston Transportation Department	Airport Planning	Since this type of airport operation operates twenty-four seven, strict controls must be set in place to protect residents living in the abutting homes. BTD would like to suggest that Massport develop a hot line that residents could call in case of any disturbances that may occur during the evening or early morning hours.	Neighbors of Logan Airport may contact the Airport with any concern regarding disturbances during the evening or early morning hours. Massport will evaluate the usefulness of a ConRAC hotline and implement if needed.
C.3	Boston Transportation Department	Noise	The RSA for Runway 33L is near completion and during construction Logan became primarily a north/south airport. While this is understood because 33L had to be closed while work was going on, Massport should be more informative with communities that will experience a substantial increase in noise levels due to the construction.	Prior to and during the Runway 33L construction, Massport completed outreach to the community regarding the runway closure. Outreach included notices in the local newspapers, community briefings, mailings to the Community Advisory Committee (CAC), and ongoing status briefings to the CAC.
C.4	Boston Transportation Department	Noise	The construction of the RSA for Runway 22R should commence soon and BTD is hopeful that Massport will be more informative with the communities that could experience an increase in over-flights and therefore more noise.	Construction of Runway 22R is not scheduled to begin until 2014. Massport will continue to make information available on potential noise and air traffic changes during construction, consistent with the informative approach used for the Runway 33L Runway Safety Area (RSA) construction project.

Comment #	Author	Topic	Comment	Response
C.5	Boston Transportation Department	Noise	Over the last several years, the level of large commercial jets landing on 22R has increased dramatically. Currently, under Massport's own noise rules, arrivals on 22R are limited to aircraft with a maximum certified noise level of 78 DBA. Arrivals on 22R are prohibited from 11:00 PM to 6:00AM. Since the removal of the Blast Fence on the approach end of 22R, the numbers of large aircraft exceeding this noise level have landed on 22R which has had a dramatic effect on the residents of Orient Heights. Massport must be more diligent in developing a dialogue with the FAA to make it clear this procedure in unacceptable from both a community and City of Boston perspective.	Massport is tracking this runway noise mitigation for Runway 22R arrivals and Runway 4L departures and sharing the information with the City of Boston and the FAA on a regular basis. For example, in 2011 there were eight jet arrivals on Runway 22R (out of an airport total of about 175,000 arrivals that year). There were no Runway 4L jet departures in 2011.

CITY OF CAMBRIDGE • EXECUTIVE DEPARTMENT

Robert W. Healy, City Manager *Richard C. Rossi, Deputy City Manager*

RECEIVED
DEC 09 2011
MEPA

December 8, 2011

Richard K. Sullivan, Secretary
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Re: EOEA #3247 Logan Airport 2010 EDR

Dear Secretary Sullivan:

The City of Cambridge is pleased to have the opportunity to submit comments on Massport's 2010 Logan Environmental Data Report (EDR).

D-1 The City of Cambridge continues to be greatly concerned about the continued, increased use of runway 33L which increased for both arrivals and departures in 2010. These increases began in 2007, continued in 2008 and 2009, and have resulted in significantly higher levels of noise and disturbance in all parts of the City. While departures on 33L rose 1%, arrivals rose by 5%, a very significant increase. This makes a combined 33% of Logan trips which now use 33L, more than the most recent high of 2007 at 30% and higher than anytime that the City is aware of. In the Secretary's certificate of Nov. 12, 2010, MassPort was directed to address the City of Cambridge's concerns and suggestions related to noise in this year's EDR and have failed to do so. I would therefore request that the Secretary deny a certificate for this EDR until MassPort has adequately fulfilled this directive.

D-2 Also pointed out in the City's comments of last year is the increase in low flying flights over the central and northern parts of the city. This continues to be a source of noise and disturbance for many in the City and should be addressed by MassPort and FAA. This may be partially related to flight tracks for non-jet departures shown in Figure 6-10, which shows significant activity over Cambridge.

In terms of ground transportation, Cambridge shares the Secretary's concern raised in last year's certificate related to increases in demand for parking at Logan which have not been

D-3 addressed in this EDR. MassPort should commit to firm goals related to mode splits for ground transportation and should consider reducing parking supply or other transportation demand management tools if goals are not achieved. This idea of setting benchmarks and goals is something that MassPort should consider for all of its environmental programs. As a

D-4 first step, MassPort should commit to complying with the Massachusetts Clean Energy and

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Climate Plan for 2020, although it is not one of the state agencies which has already committed to this plan.

D-4 con't.

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 if you have any questions in regard to these comments.

Very truly yours,

Robert W. Healy

Robert W. Healy
City Manager

Comment #	Author	Topic	Comment	Response
D.1	City of Cambridge	Activity Levels	The City of Cambridge continues to be greatly concerned about the continued, increased use of runway 33L which increased for both arrivals and departures in 2010.	The FAA (air traffic) assigns runway usage based on existing aircraft traffic and meteorological conditions. The increased use of Runway 33L during 2010 was due to air traffic, ground traffic, and weather conditions. *Chapter 6, Noise Abatement,* documents runway usage in 2010 and 2011. As part of the ongoing Boston Logan Airport Noise Study (BLANS), alternative flight track and runway use options are being evaluated.
D.2	City of Cambridge	Noise	Also pointed out in the City's comments of last year is the increase in low flying flights over the central and northern parts of the city. This continues to be a source of noise and disturbance for many in the City and should be addressed by Massport and FAA.	As in previous years, there are annual variations in runway use due to seasonal variation in wind and weather patterns, operational fleet mix, and FAA day to day operational decision making. This corridor is being reviewed as part of the BLANS.
D.3	City of Cambridge	Ground Access	Massport should commit to firm goals related to mode splits for ground transportation and should consider reducing parking supply or other transportation demand management tools if goals are not achieved.	Massport has a long-established HOV mode share goal of 35.2 percent at a 37.5 million air passenger level. Parking pricing, ground access services, and related policies, are all established with this goal in mind. For more detail about the goal and on the ways Massport encourages the use of alternative travel modes for airport access by passengers and employees, please refer to *Chapter 5, Ground Accestto and from Logan Airport.*
D.4	City of Cambridge	Sustainability	As a first step, Massport should commit to complying with the Massachusetts Clean Energy and Climate Plan for 2020, although it is not one of the state agencies which has already committed to this plan.	Massport implements a number of sustainability elements in individual projects as well as the overall operation of Logan Airport. Refer to *Chapter 1, Introduction/Executive Summary,* for more information. In 2010, Massport voluntarily committed to the Governor's "Leading by Example" Initiative and its efficiency, renewable and greenhouse gas reduction objectives for 2012 and 2020. However, Massport has not committed to complying with the Massachusetts Clean Energy and Climate Plan for 2020.

14 December 2011

Secretary Richard K. Sullivan, Jr.
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114
ATT: MEPA Office

RE: EOEA #3247- 2010
Environmental Data Report
Boston-Logan International Airport, Boston

Dear Secretary Sullivan:

The Boston Harbor Association, a non-profit, public interest organization founded in 1973 by the League of Women Voters and the Boston Shipping Association to promote a clean, alive, and accessible Boston Harbor, is in receipt of the 2010 Environmental Data Report for Boston-Logan International Airport, Boston. An environmental data report has been required annually since 1989 to discuss the cumulative environmental effects of Logan Airport's operations and activities.

As noted by the Massachusetts Port Authority, owner and operator of Logan Airport, improvements in a number of environmental areas were observed in 2010, with airlines operating more efficiently with more passengers per aircraft and cleaner and quieter planes. At the same time, due to continued global economic conditions, the number of passengers were considerably lower than the all-time peak of 28.1 million passengers in 2007, thereby having less ground-access impacts.

We have reviewed the 2010 Environmental Data Report, and our comments follow:

Cumulative Impacts of Massport Projects: In 2010, Massport filed environmental permits for a number of large-scale projects, including a.) Southwest Service Area Redevelopment Program to construct a new consolidated rental car facility; b.) Logan Airport Green Bus Depot; and c.) Boston-Logan International Airport Runway Safety Area Improvements Project. TBHA submitted detailed comment letters on these projects in 2010 as well as during the earlier permitting cycles of these projects. The first two projects are designed to replace and upgrade existing ground transportation uses and facilities, incorporate site improvements including roadway modifications and pedestrian and bicycle facilities, and to provide a consolidated facility for airport shuttle buses. The third project is designed to enhance the safety area at the ends of Runway 33L and Runway 22R.

Documents for the environmental permitting of each of these very large, multi-million dollar projects appear to only evaluate individual project impacts, and do not appear to consider cumulative impacts during overlapping construction periods nor any cumulative permanent impacts. We ask that the Environmental Status and Planning Report (ESPR) for 2011 be filed no later than March, 2013, and that the ESPR evaluate the cumulative environmental impacts of these and other on-going projects. We also ask that the ESPR provide an update on the completion status of the environmental mitigation measures vis a vis the completion of the related project, e.g., successful restoration or re-establishment of eelgrass at the ratio specified in the Secretary's Certificate and on a completion schedule consistent with the

E-1

E-2

E-2 con't. completion of the Boston-Logan International Airport Runway Safety Area Improvements Project.

Water Quality Impacts: The stormwater permit for the airport requires monthly grab samples from four outfalls. The Environmental Data Report notes that a few samples at Maverick Street Outfall and North Outfall exceeded permitted standards for total suspended solids. To address the April 2010 TSS exceedance at Maverick Street outfall, Massport inspected and cleaned the catch basins and manholes within the drainage areas. Massport is also requiring tenants located within the Maverick Street Outfall drainage area to conduct inspections and to clean out structures and replace filter inserts.

Regarding the tracking of bacteria sources, Massport is implementing a Stormwater Pollution Prevention Plan to investigate potential sources of bacteria, including the presence of animal waste such as bird waste. Last fall, Massport had a contractor collect stormwater samples to identify potential bird markers, human markers, and fluorescent whitening agents. Massport proposes to report the results of the lab analyses in the 2011 ESPR. While we believe it appropriate to include the detailed lab analyses in the 2011 ESPR to be completed by March, 2013, we suggest more immediate action in 2012 in the event of significant bacteria levels in the stormwater runoff.

E-3

Last winter, Massport requested permission to lift the ban on snow dumping into Boston Harbor because of significant snow amounts. We concur with Boston Mayor Thomas M. Menino that this would have been a unfortunate precedent, suggesting that, for cost reasons, quasi-public entities should be allowed to put potentially pollutant-laden and/or chemical-laden snow into Boston Harbor. We strongly request that the project proponent not attempt to seek such an exemption again, and we further request that if the agency petitions to have the ban on snow dumping lifted, city, state, and federal regulators should not approve it.

E-4

Open Spaces: Although not a traditional park/open space agency, Massport does an exceptional job of maintaining its public open spaces and parks, including those near Logan Airport. Bremen Street Park, next to Airport station on the MBTA Blue Line, is patrolled and well-maintained, and its playground area, spray fountain, and sitting areas were greatly enjoyed by thousands of local residents and their children in 2010. Navy Fuel Pier, an airport buffer area, is another well-designed, popular viewing area along Boston Harbor. Piers Park is considered by many to be a beautiful jewel along Boston Harbor, and continues to be both well-maintained and much-used by the local community. We ask that diligent, consistent maintenance continue at all of the airport-related and adjacent open spaces, buffer areas, and parks.

E-5

Table 3-5 of the 2010 EDR (page 3-19) noted the selection of a design consultant for the North Service Area Buffer/Neptune Road Buffer in May 2009. The narrative notes, however, that the community planning process did not begin until December, 2010. This segment is a key connection to the much-anticipated East Boston Greenway Extension project agreed to during Boston Conservation Commission deliberations on the Green Bus Depot project. We ask that additional information be provided regarding why there was an 18-month delay between selection of a design consultant and commencement of the community planning process in 2010, and how such a delay will be avoided in the community planning process for the East Boston Greenway Extension of the Green Bus Depot project.

E-6

In agreeing to support the delay of the filing of the 2011 Logan Airport ESPR until March, 2013 (rather

than the more traditional deadline of September, 2012), TBHA requests that an update on completion of the East Boston Greenway Extension, consistent with the completion date of the Green Bus Depot, be provided no later than September, 2012. E-7

HarborWalk Amenities: As part of the Southwest Service Area Redevelopment Project, the existing taxi pool located adjacent to the rental car facilities on Harborside Drive will be relocated. The taxi pool relocation will include the construction of a 3,500 square foot, single story building with rest room facilities for cab drivers. At the end of the four year construction period of the consolidated rental car facility, the taxi pool will then move back.

During the February, 2010 hearing by the Boston Conservation Commission on the taxi pool temporary relocation, the Conservation Commissioners asked about the post-four year usage of the single story building. Massport had not decided what, if any, use there would be for the building, and the Conservation Commission's Order of Conditions requested consideration of the building for a public use. Given the proximity of the building to Boston Harbor and to the HarborWalk near the Hyatt Harborside Hotel, we request additional information on the future public use of the building, particularly for educational exhibits, public information, or bicycle repair, rental, or storage, and to make the public rest rooms in the building available for use by the general public when the taxi pool is relocated. E-8

Environmental Sustainability: Massport prides itself on its environmental sustainability initiatives at Logan Airport, including a clean-fuel shuttle bus fleet operated within the airport, LEED Plus standards, energy-efficient operations, and a goal of zero use of potable water for irrigation. The Boston Harbor Association commends Massport for implementation of these measures.

The Boston Harbor Association further applauds Massport's stated commitment of supplementing its overall electricity use with renewable energy, including most recently with solar energy at Terminal B Garage, the Economy Garage, and Terminal A, and with micro-wind turbines on top of the Logan Office Center. We understand, though, that this constitutes less than 10% of total energy usage, and urge implementation of a more aggressive, less timid incorporation of renewable energy at Logan Airport. By contrast, the Massachusetts Water Resources Authority is implementing a number of on-going and new renewable energy programs to ensure that its Deer Island facility achieves 30% renewable energy usage by 2020, consistent with Governor Deval Patrick's Executive Order 484. E-9

Climate Change and Sea-Level Rise: In November, 2010, The Boston Harbor Association sponsored a two-day, first-ever "Boston Harbor Sea-Level Rise Forum." Tom Kinton, Executive Director of Massport, spoke eloquently about the need for the airport and other Massport facilities to be aware of the impacts of potential sea-level rise over the next 50-75 years. Mention was made of the fact that the Green Bus Depot facility, which is in a higher risk area for sea-level rise, was modified in several ways to elevate key infrastructure above future flood elevations.

Consistent with the planning for the Green Bus Depot, we ask that all EDR and all ESPR filings indicate how potential sea-level rise has been incorporated into the planning of new facilities. We urge that Massport take into account sea level rise over the life of its projects, and if necessary, to elevate building foundations to take into account possible changes in sea level. E-10

Regarding climate mitigation, we urge Massport to continue its efforts to incorporate green/cool roofs into E-11

E-11 con't. its projects, as well as to provide additional plantings, vegetation, and trees in its projects, consistent with Mayor Menino's climate action plan to have 100,000 new trees planted in Boston by 2020.

E-12 Miscellaneous: Please correct Table D-2, Distribution List, for the 2010 EDR as well as all future ESPR/EDR to include The Boston Harbor Association. We have been a consistent commenter on these documents, and wish to be kept on the distribution list.

Thank you for your consideration.

Sincerely,

Vivien Li
President
The Boston Harbor Association

Comment #	Author	Topic	Comment	Response
E.1	The Boston Harbor Association	Airport Planning	Documents for the environmental permitting of each of these very large, multi-million dollar projects appear to only evaluate individual project impacts, and do not appear to consider cumulative impacts during overlapping construction periods nor any cumulative permanent impacts. We ask that the Environmental Status and Planning Report (ESPR) for 2011 be filed no later than March, 2013, and that the ESPR evaluate the cumulative environmental impacts of these and other on-going projects.	An ESPR's primary purpose is to consider the cumulative impacts of airport operations, including new projects, through assessing the noise, air quality, ground access and water quality impacts each year and compare them to previous years. In addition, the *2011 ESPR* considers the cumulative effects of future airport operations in 2030 through assessing impacts associated with forecast increased passenger activity levels and aircraft operations. In addition, each completed and proposed project is described in *Chapter 3, Airport Planning* , and individual projects are also assessed in appropriate environmental filings. The *2011 ESPR* is being filed by Spring 2013.
E.2	The Boston Harbor Association	Mitigation	We also ask that the ESPR provide an update on the completion status of the environmental mitigation measures vis a vis the completion of the related project, e.g., successful restoration or re-establishment of eelgrass at the ratio specified in the Secretary's Certificate and on a completion schedule consistent with the completion of the Boston-Logan International Airport Runway Safety Area Improvements Project.	*Chapter 9, Project Mitigation Tracking,* provides descriptions of the status of ongoing projects at the airport as well as the status of the mitigation associated with those projects.
E.3	The Boston Harbor Association	Water Quality	While we believe it appropriate to include the detailed lab analyses in the 2011 ESPR to be completed by March, 2013, we suggest more immediate action in 2012 in the event of significant bacteria levels in the stormwater runoff.	As described in *Chapter 8, Water Quality/Environmental Compliance and Management,* the bacteria levels in stormwater runoff were not significant. Additional analysis is ongoing.
E.4	The Boston Harbor Association	Water Quality	We strongly request that the project proponent not attempt to seek [a snow dumping] exemption again, and we further request that if the agency petitions to have the ban on snow dumping lifted, city, state, and federal regulators should not approve it.	Massport is charged with the safe operation of Logan Airport. During the winter of 2010-2011, a large amount of snow accumulated and had to be removed from the airfield to ensure safe operation of the airport. Massport worked with the city, state, and federal regulators to develop a solution for the snow removal, and would cooperatively work with those regulators in the future should a large amount of snow need to be removed from the airfield to ensure continued safe operation of the airport.
E.5	The Boston Harbor Association	Airport Planning	We ask that diligent, consistent maintenance continue at all of the airport-related and adjacent open spaces, buffer areas, and parks.	Massport continues to apply operations and maintenance guidelines to all of the airport-related and adjacent open spaces, buffer areas, and parks under its jurisdiction.

Comment #	Author	Topic	Comment	Response
E.6	The Boston Harbor Association	Airport Planning	We ask that additional information be provided regarding why there was an 18-month delay between selection of a design consultant and commencement of the community planning process in 2010 [for the North Service Area/Neptune Road Buffer], and how such a delay will be avoided in the community planning process for the East Boston Greenway Extension of the Green Bus Depot project.	The Greenway Connector is on track with construction documents being finalized in 2012. Construction is scheduled to begin in the spring of 2013.
E.7	The Boston Harbor Association	Airport Planning	In agreeing to support the delay of the filing of the 2011 Logan Airport ESPR until March, 2013 (rather than the more traditional deadline of September, 2012), TBHA requests that an update on completion of the East Boston Greenway Extension, consistent with the completion date of the Green Bus Depot, be provided no later than September, 2012.	As described in *Chapter 3, Airport Planning,* the Green Bus Depot has been completed. Construction of the Greenway Connector, also described in *Chapter 3, Airport Planning,* will begin in early 2013. Please see the response to Comment E.6.
E.8	The Boston Harbor Association	Airport Planning	Given the proximity of the [single-story] building to Boston Harbor and to the HarborWalk near the Hyatt Harborside Hotel, we request additional information on the future public use of the building, particularly for educational exhibits, public information, or bicycle repair, rental, or storage, and to make the public rest rooms in the building available for use by the general public when the taxi pool is relocated.	There are no current plans for re-use of this building at this time.
E.9	The Boston Harbor Association	Sustainability	We understand, though, that [supplementing overall electricity use with renewable energy] constitutes less than 10% of total energy usage, and urge implementation of a more aggressive, less timid incorporation of renewable energy at Logan Airport.	In July of 2008, Massport began creating the Utility Master Plan for all Massport properties specifically to forecast utility load requirements, develop energy efficiency and renewable action plans and provide ongoing monitoring and reporting. In 2010, Massport voluntarily committed to the Governor's "Lead by Example" Initiative and its efficiency, renewable and greenhouse gas reduction objectives for 2012 and 2020.
E.10	The Boston Harbor Association	Sustainability	Consistent with the planning for the Green Bus Depot, we ask that all EDR and all ESPR filings indicate how potential sea-level rise has been incorporated into the planning of new facilities. We urge that Massport take into account sea level rise over the life of its projects, and if necessary, to elevate building foundations to take into account possible changes in sea level.	Massport is in the process of reviewing this issue and will also look at this in relationship to all ongoing and future Massport projects.
E.11	The Boston Harbor Association	Sustainability	Regarding climate mitigation, we urge Massport to continue its efforts to incorporate green/cool roofs into its projects, as well as to provide additional plantings, vegetation, and trees in its projects, consistent with Mayor Menino's climate action plan to have 100,000 new trees planted in Boston by 2020.	Massport continues to incorporate sustainability elements, including green/cool roofs and landscaping, in their projects. For more information on sustainability efforts, refer to *Chapter 1, Introduction/Executive Summary.*

Comment #	Author	Topic	Comment	Response
E.12	The Boston Harbor Association	MEPA	Please correct Table D-2, Distribution List, for the 2010 EDR as well as all future ESPR/EDR to include The Boston Harbor Association. We have been a consistent commenter on these documents, and wish to be kept on the distribution list.	The Boston Harbor Association is included on the Distribution List in *Appendix D* .

AIR, Inc.
c/o Aaron Toffler
34 Kimball Street
Needham, MA 02492

December 9, 2011

Secretary Richard K. Sullivan, Jr.
Attn: Anne Canaday
Executive Office of Energy and Environmental Affairs, MEPA Office
100 Cambridge Street, Suite 900
Boston, MA 02114-2524

Re: 2010 Environmental Data Report

Dear Ms. Canaday:

The following comments on the 2010 Logan Airport Environmental Data Report ("EDR") are being submitted on behalf of my client, Airport Impact Relief, Inc., a non-profit organization of East Boston and Winthrop residents:

1. Cumulative impact on Environmental Justice community:

   The 2010 EDR provides information on a great number of projects (East Boston/Chelsea bypass road, Logan Airport Parking Deck, NSA Roadway Corridor project, SWSA project, Logan Runway Safety Improvement project, Green Bus Depot) currently under construction on and around Massport's property. In the Certificate for the 2009 EDR, the Secretary specifically requires Massport to make assessment of the cumulative impacts of these projects a priority for the 2010 EDR.[1] In addition, because Logan Airport is located in an Environmental Justice community, such an analysis is required. However, such an analysis appears nowhere in the 2010 EDR. Massport should be required to undertake such an analysis and report the results not only to the State, but also directly to the community.

F-1

2. Enhanced outreach to Environmental Justice community:

   All of these projects are taking place in the context of an Environmental Justice community as identified by the Commonwealth of Massachusetts. As such, Massport is required to do enhanced outreach to the community so that all citizens that are impacted by the project have an opportunity to comment and participate in the public process. To date, that enhanced outreach has not occurred, either with respect to individual projects or this EDR. Massport needs to make the information in the EDR available to all of the residents of East Boston and Chelsea in appropriate media and language to ensure that the public has a right to comment on these projects. Massport's failure to do so thus far has resulted in a significant portion of the

F-2

[1] EDR Certificate, November 12, 2010 (EEA #3247).

community being left out of the public process in violation of the Commonwealth's Environmental Justice policy.

F-2 con't.

3. Air quality and public health impacts**.**
The community herein reiterates its request that Massport fund a study of the impact on the adjoining community of ultra-fine particulate matter as a result of its operations. Such a study could be implemented by the Massachusetts Department of Public Health as part of its ongoing study (which Massport has agreed to support) or it could be incorporated as part of the current Logan Air Quality Monitoring Study. The adverse health impacts of ultra-fine particulate matter are being recognized across the country. Although, as Massport correctly states, there are currently no regulatory standards with respect to ultra-fine particulates, this is not a sufficient reason for not measuring them. A recent study of the Santa Monica Airport found that elevated exposure to ultra-fine particles associated with aircraft operations and jet takeoffs were found in the area of the airport and said exposure has dramatic health impacts on the adjacent community.[2] A similar study should be done to evaluate the impacts of ultra-fine particulate matter from Logan Airport's operations on the local community. Clearly such a study is required by Section 154 of Chapter 25 of the Acts of 2009 (the Transportation Reform Act).[3] Massport should be required to undertake such a study.

F-3

F-4

Thank you for your attention to these matters. If you have any questions, please feel free to contact me at (617) 821-3497.

Very truly yours,

Aaron Toffler, Esq.

cc: Members of AIR, Inc.

[2] That study can be found at: http://home.earthlink.net/~craap/sitebuildercontent/sitebuilderfiles/SMOHIA.pdf

[3] Section 154 of Chapter 25 of the Acts of 2009 reads "Notwithstanding any general or special law to the contrary, the bureau of environmental health within the department of public health shall conduct a comprehensive baseline study of the health effects of particulate air pollution from surface and air transportation. The study shall focus on understanding the health impacts from fine **and ultrafine particulate** matter upon populations that are located within 500 feet of any roadway with 50,000 or more motor vehicle trips per day, or any rail line regularly used by diesel locomotives or within 1 mile of any airport with more than 500 enplanements per week as reported between January 1, 2007 and January 1, 2008 or within 1 mile of the port of the city of Boston; provided, however, that the study may include, but shall not be limited to, examining respiratory and cardiovascular disease and cancer incidence that may be affected by exposure to traffic-related particles. The following departments and agencies shall provide information to the bureau relevant to this study: the department of environmental protection; the office of planning and programming within the Massachusetts Department of Transportation, the division of aeronautics; and the central transportation planning staff of the Boston metropolitan planning organization. The bureau shall report its findings together with suggested legislation, if any, to the house and senate committees on ways and means not later than June 30, 2010."

Comment #	Author	Topic	Comment	Response
F.1	Aaron Toffler, Esq.	Airport Planning	In the Certificate for the 2009 EDR, the Secretary specifically requires Massport to make assessment of the cumulative impacts of these projects a priority for the 2010 EDR. In addition, because Logan Airport is located in an Environmental Justice community, such an analysis is required. However, such an analysis appears nowhere in the 2010 EDR. Massport should be required to undertake such an analysis and report the results not only to the State, but also directly to the community.	A key purpose of the annual EDRs and ESPRs are the assessment of cumulative impacts of Logan Airport operations, including air quality, noise, and ground transportation effects on neighboring communities, including those designated as Environmental Justice communities. Cumulative effects are also addressed in specific project filings under the National Environmental Policy Act (NEPA) and the Massachusetts Environmental Policy Act (MEPA). For example, the Airside Improvements Program EIS included a detailed Environmental Justice assessment of the proposed improvement program elements where significant impacts were identified Massport makes all of its environmental filings available on its website where the public can access those documents. When a public meeting or hearing is held, notice of the meeting is published in a variety of media sources throughout the community and language translators are available upon advance request.
F.2	Aaron Toffler, Esq.	MEPA	Massport needs to make the information in the EDR available to all of the residents of East Boston and Chelsea in appropriate media and language to ensure that the public has a right to comment on these projects. Massport's failure to do so thus far has resulted in a significant portion of the community being left out of the public process in violation of the Commonwealth's Environmental Justice policy.	Massport will publish bi-lingual meeting and project notices and will make the services of an interpreter available upon request for the *2011 ESPR* and future EDR and ESPR filings.
F.3	Aaron Toffler, Esq.	Air Quality	The community herein reiterates its request that Massport fund a study of the impact on the adjoining community of ultra-fine particulate matter as a result of its operations.	The Massachusetts Department of Transportation (MassDOT) is developing a response to the analysis called for in the Transportation Reform Act. Massport will fund up to $150,000 once the format and scope of MassDOT's study is developed.
F.4	Aaron Toffler, Esq.	Air Quality	A similar study should be done to evaluate the impacts of ultra-fine particulate matter from Logan Airport's operations on the local community. Clearly such a study is required by Section 154 of Chapter 25 of the Acts of 2009 (the Transportation Reform Act). Massport should be required to undertake such a study.	Please see the previous response to Comment F.3.

Stephen H. Kaiser
191 Hamilton St.
Cambridge Mass.
02139

To : Richard Sullivan, Secretary of Energy and Environmental Affairs
MEPA Review Unit, 100 Cambridge Street Room 900
Attention : Anne Canaday, MEPA Unit

From : Stephen H. Kaiser, PhD

2010 Environmental Data Report EEA # 3247

For several years I commented in the annual EDR reports by Massport, but for the past couple of years other priorities interfered. Thus I would like to catch up on my responses, especially to give some comparisons with past EDR volumes. (My home library includes paper versions of the 1996 EIR update and EDRs for 2000, 2001, 2005, 2006, 2007, and 2008, as well as CDs of the 2004 ESPR and EDRs for 2006, 2007 and 2008.

In my comments of February 5, 2007, I noted the special value of Figure 2-13 in the 2005 EDR. This graph of national enplanement data from 1970 to 2004 showed a linear rise in passengers with variations to account for key events such as deregulation, wars, airline mergers and the effects of 9/11. In terms of planning, economics, and environmental impacts of airline activity, it demonstrated both general growth trends and the sensitivity to political events. The last appearance of this national data was in the 2008 EDR.

Unfortunately, the basic concept of the annual enplanement data has been dropped in the last three reports. I urge that this data be updated and restored in the next Massport report. I did find the graphical data in Chapter 2 to be vastly improved and instantly informative of trend data. Stated another way, the figures were more useful than the tables, and both were better than the text. G-1

The trend data in the EDR covers a period from 2004 or 2005 through 2010 -- six or seven years. Our experience of continuity with EDRs since 1997 suggests that the trend line can be extended next year from 1997 through 2011, which would be fifteen years. Massport has the data and has already been utilizing the graphical capabilities of computers.

The downside of additional data is that it makes any tables of numbers more difficult to comprehend. The common educational result for both citizens and Massport personnel is to increase math phobia or the phenomenon of eyes-glazing-over. The solution may be to continue the shorter-term data in the tables, but use the graphical figures to show the long-term trends.

Figure 2.1 illustrates peak Logan activity as year 2007, and a sudden drop thereafter. This result occurs well before the stock market crash of fall 2008 and the time when the alleged expert economists tell us the recession began. Such revelations suggest that it might be wiser to use MassPort data on passenger activity to forecast future economic conditions, rather than rely on economic statisticians on Wall Street or in Washington.

Figure 2-2 shows the annual passengers by the top five airlines at Logan over the period 2005 to 2010. The graphical nature of the data shows the trends -- it captures the decline of American Airlines and the rapid growth of JetBlue. American Airlines dropped from #2 at Logan to bankruptcy in only one year.

G-2

My concern with the text is that undue emphasis is on a single-year-to-year comparison. The larger context of the trends are lost, and the results are scrunched into a narrow window that sounds like company reports designed for Wall Street speculators, for whom short term profits and dividends are the primary concerns. To avoid these distortions, I urge than single year-to-year comparisons be dropped unless they highlight the beginning of a major change in trends.

SUSTAINABILITY

The discussion of sustainability on page 1-11 and following is better than most essays on the topic, but the reader can still get a feeling of inundation, vagueness and public relations. So many other sustainability studies have been vague, mushy and lacking in specifics, and much of the time a sustainability presentation feels like a double dose of PowerPoint.

I would welcome an effort by Massport to give “sustainability” greater practical meaning and significance. The best example is energy efficiency, as I will describe below.

ESPR SCHEDULE and ECONOMIC VARIABLES

G-3

I urge that the ESPR report not be delayed any further. It would be wise to avoid putting pressure on MEPA to change prior commitments and related decisions. The office is already encumbered with a steady stream of waiver requests, which have been granted at the rate of one a week for the last 5 years. I think the credibility of both MEPA and MassPort would be enhanced if Massport adhered to the original schedule of the 2011 report being an ESPR.

Massport has offered a justification for delaying the ESPR in order to revise the forecasts contained in the original 2004 ESPR. It would seem that the Authority is hoping for another growth year that would establish a more recent trend line towards growth. Such an assumption may be unjustified, and instead MassPort may need to contemplate alternate scenarios for the future.

From today's perspective, the general economic situation could take a path downward in the coming year. General trends toward more extensive electronic communications could support a general shift towards fewer flights and passengers in the foreseeable future. Such a shift in outlook is not easy for any organization. The example of the U.S. Postal Service provides an indication of the need to make adjustments for both expected and unexpected situations, especially if those changes may be unwelcome. The automobile manufacturers are facing the likelihood of lower auto sales because teenagers' dreams are now focused on electronic gadgetry and not on vehicles. Airline could find that passengers may prefer electronic gadgets to airport security checks -- to an alternative of being stranded on the tarmac for three hours or more.

The EDR indicates evidence of a “continued downturn in worldwide aviation activity” -- a recognition of a changing market and the need for Massport to make the necessary adjustments.

> **“As indicated in the 2009 EDR, several factors influenced Massport’s request to defer the next Logan Airport ESPR to reflect analysis of calendar year 2011. The primary factor is the continued downturn in worldwide aviation activity, which has led Massport to develop updated passenger and operations forecasts. .... The new forecasts use 2010 as the base year and develop and project aviation activity forward for calendar year 2030. The new forecasts will provide the basis of the ESPR’s modeled assessment of air quality, noise and other factors out to 2030.”**
>
> **(EDR Submission letter, Oct. 15, 2011)**

I would anticipate that the new forecasts could be internally controversial for Massport, because of the likelihood of dealing with a decline or contraction in operations and services. No bureaucracy anywhere likes to see its future through a reduction lens. Progress and optimism are tied into planning and growth. The realities of the future may hold a whole new experience for Massport planners.

G-4

The best solution may be to present two scenarios in the 2011 ESPR. One would present a scenario of tradition growth and recovery, somewhat less optimistic than in 2004. The second scenario would suggest a long-term contraction of airline services worldwide and at Logan.

The result could create a dramatic turnaround in impacts and perspectives. In 2007, FAA was warning of gridlock in the skies. My comment at the time ruminated on the implications of increased and decreased growth. Less airline activity could mean less noise, reduced emissions, less energy usage, motor vehicle congestion, less pressure for airport expansion outside of Logan. In other words, reduced activity at Logan would translate into lesser environmental impacts from airport operations. Reduced environmental impact is one of the objectives of MEPA!!

One objection from Massport could be the possibility that a two-scenario approach would increase the cost and complexity of the overall analysis. It need not if the growth scenario were modeled by CTPS in a fairly conventional manner, while the contraction model would simply be a linear extrapolation of the percentage changes of the growth model.

In my February 2007 comment (almost five years old), I asked,

> "Does growth go on forever? Or could plane ridership becomes like our magazines and newspapers, who in 2006 suddenly realized that they were in virtual free-fall for readers and advertising revenues? The print press has been predominant almost since Gutenberg, but its current decline reminds me of the railroads in the 1960s. How long before the travel industry is similarly afflicted?"

These words were written before the 2008 stick market crash and before the past two years of Eurozone financial crisis.

The economic crisis in Europe has been going on now for two years and shows no signs of permanent resolution. Even Germany may be in trouble for bank credit ratings and inability to sell bonds. New troubled countries may join the ranks of Greece, Spain, Italy, Ireland, Belgium, Iceland and other smaller nations whose economic security is perilous. I would suggest to Massport that a future of declining activity is more likely than a future of traditional growth.

INTERCITY RAIL and BUS ALTERNATIVES

I searched the text of the EDR for any mention of "railroad." I found one instance, a reference to Ross Capon of the National Association of Railroad Passengers. There is no discussion of the implications of Northeast Corridor rail service activities, for better or for worse in the report. Amtrak seems not to exist. G-5

Similarly, intercity bus operations appear not to be included, except for the briefest mention on page 5-21. In addition to the extensive and intensive bus competition for Boston to New York City, private bus lines such as Concord Trailways operate to bring in passengers from the northern New England coastal area, with some buses having direct connections to Logan.

NOISE CONTROLS

Massport, the Mass Aeronautics Commission, and the Federal Aeronautics Administration all serve a key function in dealing with one of the most intractable problems in modern society -- noise. Remarkably, the EPA has virtually no involvement in noise issues -- ever since the Reagan Administration abolished the noise office at EPA in the early 1980s. The state Department of Environmental Protection (and its predecessor agency DEQE) had virtually no involvement in noise issues, until someone realized the possibility of seeing noise as a form of air pollution. However, DEP regulations on mobile source noise emissions (car, bus, truck, motorcycle, snowmobile, train, plane) are virtually non-existent.

Interestingly, noise problems are generally handled by local airports, Federal and state airport agencies, the U.S. Congress and state Legislatures, and local noise control officials. Government environmental officials are virtually entirely out of the loop.

For noise problems at airports, the Massport and MAC take on primary roles for setting the standards, explaining them to the public and airline officials, and applying enforcement. To this extent, Massport gets to evaluate itself on its own regulations and compliance with them. I have never been happy with this monopoly, but the alternative is to rely on other state agencies who have no regulations or staff. Thus we must continue to work with Massport as best we can.

Noise is logarithmic in nature, and that throws 99% of the populace into bewilderment. The EDR makes no effort to clarify this difficult measurement system, to give examples and make the

whole aggravating situation meaningful to people. I worry that the decibel experts have intentionally or otherwise created a system that spreads bewilderment and a loss of confidence among members of the public. With Massport's responsibilities in the noise arena, I think it is incumbent on the staff to prepare a noise explanation that makes sense, and to try it out on other Massport staff who are not decibel experts, to see whether they "get it."

G-6

The noise issue is significant, because historians agree that the high point, the high water line of the modern environmental movement was in 1971 when Congress was persuaded not to invest in a Supersonic Jet Transport or SST. It was a stunning defeat for industry hopefuls like Boeing, and I believe contributed to the later stifling of noise regulation at all levels of government.

G-7

Stated bluntly : the noise section of the ESPR must be clear and fundamental, and produce readers who have a clearly improved understanding of noise problems.

ENERGY CONSERVATION

In the past two to three years, private and state efforts at energy conservation have shown stunning results. For example, the total energy budget of the MWRA has been reduced over two years by 20%, which I considered a remarkable achievement when I first heard of it.

Within the past year I learned of a private business initiative made by the EF company in Cambridge at North Point. In a purely voluntary effort, EF building officials achieved a 50 percent reduction in annual total energy use. Reduction in the use of electrical energy was even slightly higher at 60 percent. Meanwhile, state agencies have combined in an innovative energy program to work voluntarily with private entities to help reduce their energy use and practice energy conservation. The program has the potential to be widely popular, because businesses also reap the benefit of reduced energy costs, while the state agencies meet their goals for energy conservation and reduced carbon emissions. DEP and DOER have actively worked together with initial goals of 20 percent reductions in energy use. These were quickly achieved. Goals of 30 percent reductions were surpassed, and now goals of 50 percent energy savings are the norm.

I also have a friend, trained as an MIT physicist, who has been able to achieve a 50 percent reduction in electrical use by his Cambridge condo. In terms of achievable energy reductions, the figure of 50 percent keeps popping up. I attribute much of the success of these programs to the voluntary nature of the exchange and the benefits to businesses in terms of cost savings.

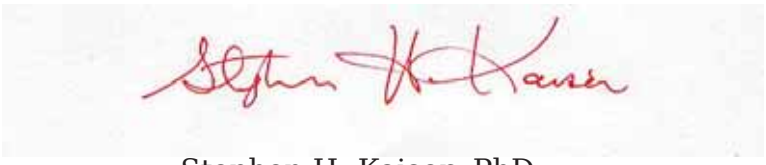
I am not aware of any government agency entering into similar voluntary agreements with DEP and DOER to seek improved energy efficiency. Such action would seem like a good initiative during the coming year. From the report, I was not able to get a sense for the overall Massport goals and projected benefits, but here again I suggest we begin with a goal of 50 percent energy savings by MassPort at Logan. The EDR reminds us that Massport is a relatively small user of all energy at Logan, mainly for heating and lighting.

The EDF refers to the Energy Management Plan for MassPort, but I could not get a sense for the goals and effectiveness of this program. The 2011 report should seek to give a summary and context for the energy programs at Logan. The EDR refers top new solar panels on the roof of the Terminal B Garage, producing 166,000 kW of electricity a year, or approximately 5% of the garage's total annual electric power consumption. The figure should be kilowatt-hours, which is energy produced. This figure implies that the Massport element of energy use at Logan each year is 3,320,000 kWHr or 3.2 MWHr. However, I could not find text or figures in the report which showed total electricity and other energy use. Thus I could get no sense for either the extent of Massport energy use or the effectiveness of its various energy programs. G-8 G-9

The $55.7 million renovation of the garage includes installation of LED lighting. The claim of a 49 percent reduction in energy consumption is offered. This reduction is close to the stunning 50 percent reduction from other specific energy conservation programs. The Massport program needs to be clarified and placed in context of both overall energy use and measured savings. G-10

If Massport could work with DEP and DOER on an energy conservations program, the results could benefit the public beyond just Logan Airport. Other state agencies would have a role model to follow to engage in the same type of energy conservation program throughout the agency. The MBTA is the largest single user of electrical energy in the entire Commonwealth, and its energy savings could become very significant.

Sincerely,



Stephen H. Kaiser, PhD

cc. Stewart Dalzell, Massport
Jackie Wilkins, Massport

Comment #	Author	Topic	Comment	Response
G.1	Stephen Kaiser	Activity Levels	Unfortunately, the basic concept of the annual enplanement data has been dropped in the last three reports. I urge that this data be updated and restored in the next Massport report.	Annual enplanement data is provided every year in *Chapter 2, Activity Levels.* The chapter also provides a discussion of some of the uncertainties affecting passengers and airlines in the United States.
G.2	Stephen Kaiser	Activity Levels	My concern with the text is that undue emphasis is on a single-year-to-year comparison. The larger context of trends are lost, and the results are scrunched into a narrow window that sounds like company reports designed for Wall Street speculators, for whom short term profits and dividends are the primary concerns. To avoid these distortions, I urge that single-year-to-year comparisons be dropped unless they highlight the beginning of a major change in trends.	As stated in *Chapter 1, Introduction/Executive Summary,* the purpose of the EDRs is to provide year-to-year comparisons. The purpose of the ESPRs is evaluate trends which are occurring as well as to provide passenger activity levels and aircraft operations forecasts. Although EDRs report year-to-year comparisons, historical data from past years is presented as well in the appendices. This ESPR also predicts future trends with the inclusion of operations and passenger activity levels in 2030.
G.3	Stephen Kaiser	MEPA	I urge that the ESPR report not be delayed any further. It would be wise to avoid putting pressure on MEPA to change prior commitments and related decisions.	The *2011 ESPR* will be submitted to MEPA in Spring 2013 consistent with the deadline required in the Secretary's Certificate on the *2010 EDR.*
G.4	Stephen Kaiser	Activity Levels	The best solution may be to present two scenarios in the 2011 ESPR. One would present a scenario of traditional growth and recovery, somewhat less optimistic than in 2004. The second scenario would suggest a long-term contraction of airline services worldwide and at Logan.	The 2011 existing conditions provides information related to a no-growth scenario. The 2030 forecasts looks at potential long-term growth analysis.
G.5	Stephen Kaiser	Regional Transportation	I searched the text of the EDR for any mention of "railroad." I found one instance, a reference to Ross Capon of the National Association of Railroad Passengers. There is no discussion of the implications of Northeast Corridor rail service activities, for better or for worse in the airport.	*Chapter 4, Regional Transportation,* of the *2010 EDR* included a discussion on the Northeast Corridor rail service activities. The *2011 ESPR* also includes a discussion on rail service in *Chapter 4, Regional Transportation.*
G.6	Stephen Kaiser	Noise	With Massport's responsibilities in the noise arena, I think it is incumbent on the staff to prepare a noise explanation that makes sense, and to try it out on other Massport staff who are not decibel experts, to see whether they "get it."	Massport reviews all sections in an effort to make the document user-friendly. This *2011 ESPR* includes an introduction to noise terminology and acoustics in Appendix H to assist the reader with the noise analysis terminology.
G.7	Stephen Kaiser	Noise	Stated bluntly: the noise section of the ESPR must be clear and fundamental, and produce readers who have a clearly improved understanding of noise problems.	*Chapter 6, Noise Abatement,* provides a detailed description of the noise environment at Logan Airport, including the methodology used to model noise impacts.
G.8	Stephen Kaiser	Sustainability	The 2011 report should seek to give a summary and context for the energy programs at Logan.	A summary and context of the energy programs is provided in *Chapter 1, I ntroduction/Executive Summary.*

Comment #	Author	Topic	Comment	Response
G.9	Stephen Kaiser	Sustainability	The EDR refers to new solar panels on the roof of the Terminal B Garage, producing 166,000 kW of electricity a year, or approximately 5% of the garage's total annual electric power consumption. The figure should be kilowatt-hours, which is energy produced. This figure implies that the Massport element of energy use at Logan each year is 3,320,000 kWhr or 3.2 MWHr. However, I could not find text or figures in the report which showed total electricity and other energy use. Thus I could get no sense for either the extent of Massport energy use or the effectiveness of its various energy programs.	*Chapter 1, Introduction/Executive Summary,* provides an update on the Terminal B solar panel electricity generation. The Terminal B garage solar panels generated 238,000 kilowatt-hours (kWh) of electricity in fiscal year 2011 based on Massport tracking of these data. This is approximately 22 percent of total annual electricity consumption for the garage.
G.10	Stephen Kaiser	Sustainability	The $55.7 million renovation of the [Terminal B] garage includes installation of LED lighting. The claim of a 49 percent reduction in energy consumption is offered. This reduction is close to the stunning 50 percent reduction for other specific energy conservation programs. The Massport program needs to be clarified and placed in context of both overall energy use and measured savings.	*Chapter 1, Introduction/Executive Summary,* of the *2010 EDR* states that the installation of motion-detecting LED light fixtures use approximately 50 percent less electricity than the former lighting, which is an accurate statement.

Ennis, Tom

From: Hansen, Janeen
Sent: Friday, December 09, 2011 11:33 AM
To: Ennis, Tom
Subject: FW: Massport Logan 2010 EDR, EOEA #3247
Attachments: 19FR4602 MSA CAB 1954.pdf

FYI

From: Darryl Pomicter [mailto:dpomic@aol.com]
Sent: Friday, December 09, 2011 11:31 AM
To: anne.canaday@state.ma.us
Cc: Leo, Flavio; Dalzell, Stewart; Hansen, Janeen; 'BOS CAC'; info@bhcivic.org
Subject: Massport Logan 2010 EDR, EOEA #3247

Hello Anne,

Hoping for support from you and Secretary Sullivan, I repeat, expand, and detail my comments at the MEPA consultation session at Massport on November 16, 2011:

H-1 1. Massport's ESDR and EDR should be improved based on the BONS and BLANS Noise Abatement Study now being completed as a cooperative effort of the FAA, Massport, and the Logan CAC in mitigation for the Logan Airside Improvements Planning Project, EOEA #10458. Next year's "big picture" format ESDR is very appropriate to incorporate from the long Noise Abatement Study, as it is completing—to ensure ongoing monitoring, reporting and enforcement for compliance as agreed. Many of the comments below reflect learnings from that study. Others can be gained from reviewing the recent Phase II, Level 2 Screening Analysis and other documents from the BLANS website:

H-2 http://www.bostonoverflightnoisestudy.com/docs/BLANS_Level_2_Screening__FINAL_Full%20Document.pdf. And, a meeting with Massport and Logan CAC representatives would be beneficial.

H-3 The ESDR and EDR should be issued as quickly as possible in the following year, to maintain timeliness and relevance, both to avoid being out-of-date information and to enable prompt performance improvement when necessary. It seems that early September EDR and December ESDR should be manageable; not more than a year later (Introductory Letter and Appendix C).

H-4 2. Massport's 2010 EDR is a dense and complicated document, overall graphically well done and consistent. However, it needs improvements to allow and ease comprehension and use:

H-5 a. Maps need the BOSTON VORTAC from which flight distances are measured, and Logan perimeter shown (including from the most basic, Figure 6-4). Dimensions are frequently to 0.1 mile, with more than 2 miles across Logan and the BOS VOR radio beacon at the southeast side (before the Runway 27 and 33L thresholds). Three miles from Logan DME may be less than a 1 mile from Logan perimeter. Tables such as 6-8 & 6-9 include "Distance from Logan Airport" which seems to be DME rather than perimeter, but it is not clear from where.

H-6

H-7 b. Maps need Boston Communities and surrounding Cities names and boundaries—to ease correlation and improve understanding by people from below.

H-8 c. The Noise Model description and all modeled noise levels graphics (including Tables 6-6, 6-7, 6-9 & 6-13 and Figures 6-13—6-15 and Tables H-7 & H-13) need to note clearly that the noise model, is calibrated with actual measurements, but is not actual measurements. Model noise levels need to note that the model and results do not include local VFR plane and helicopter flights, controlled by the Logan Tower, but not arriving or departing Logan. And, based on field measurements, they have been estimated to possibly double (+3dB) the noise model levels for the most affected communities. The small percentages of Logan

H-8 con't. departures and arrivals which are not modeled directly from radar data should be detailed—general across categories or specific sub-categories (6-8—6-9, H-2 & H-11)?

H-9 d. Passengers, Operations, and Passengers/Operation should be shown for all airlines, including Cape Air—for which operations and passengers are currently not shown, even though it is a "Dominant Passenger Carrier" (Figure 2-5, Table 6-11, and Appendix E). Passengers/Operation should receive more detail and focus as a basic measure of efficient use of Massport and FAA facilities, noise, and emissions.

H-10 3. Massport should use current Internet tools to ease communications and increase review, discussion, and understanding:

H-11 a. Google Earth overlays should be made available and maintained to allow viewing the information, with respect to satellite photos ground conditions. A screenshot example from BLANS is below, comparable to Figures 6-6 to 6-16.

H-12 b. Massport should provide live online access at meetings to their website: http://www.massport.com/environment/environmental_reporting/Pages/EnvironmentalReporting.aspx, to linked documents including ESDR and EDR, and to Google Earth with KML overlays.

H-13 c. Massport's website should maintain links to their ESDRs and EDRs. The link to the most recent Logan Environmental Status and Planning Report remains broken, opening only the Table of Contents: http://www.massport.com/environment/environmental_reporting/Documents/TableOfContents.pdf—despite Massport's D.4 Response in Appendix B: "The links have been tested for accuracy."

H-14 d. Massport's Online Noise Complaint system should be updated to current technology, including recognize and partially input repeat users' contact details, email complaint with receipt acknowledgement, and respond by email—in less than the currrent many weeks: http://www.massport.com/environment/environmental_reporting/Noise%20Abatement/NoiseMonitor.aspx.

H-15 e. Massport's Airport Monitor system should be upgraded to current technology: http://www.massport.com/environment/environmental_reporting/Noise%20Abatement/AirportMonitor.aspx

H-16 4. Massport should fulfill the Logan Airside Improvements Planning Project (EOEA #10458) Mitigation Measure for 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—actively and ongoing. Massport now claims (Table 9-5) "Implemented", completed; but there has never been a Program developed or implemented. Several letters and voluntary surveys, years apart and simply informing, are not a program. Reporting that most already do some is not a Program. Expressing generally in favor of: "It is our hope that the current level of implementation will continue or be expanded" (Appendix M) is not the Program proposed and committed "to maximize...by all tenant airlines". A Program should be continuous, informing goals and progress to attain those goals (and appropriate adjustments)—tracking and sharing progress and lack of progress, to encourage all to improve. [Program: a plan of action to accomplish a specified end; a plan or schedule of activities, procedures, etc., to be followed.] The Program, in addition to single engine procedures to decrease emissions, should include single engine away from neighboring communities, toward centerfield to decrease noise effects.

H-17 5. Massport should work with the FAA to address noise complaints, including reporting response actions. Massport adds details to complaints and forwards a copy to the FAA and by mail to the complainer—after many weeks. Significant simplification editing of the complaint is common, and non-compliance of any kind is never acknowledged. Massport reports "Tracking of noise complaints" as a continuing element of their noise abatement program. But, there is no ongoing tracking. There is normally no response from the FAA. With thousands of complaints (personally dozens), no acknowledgement of violation or non-compliance and no corrective enforcement action is known. Complaints decrease from individuals and communities over time because there is no

H-18 change, not because the problems decrease (H-18—H-19). Massport should expand its current Flight Track Monitoring and reporting to include gross deviations from course and altitude standards, propeller and turboprop aircraft, and at least quarterly reporting—to aid and pressure the FAAA for enforcement, improved compliance, and decreased noise and emissions (H-28—H-29). Massport's relevant D.2 response in Appendix B is missing.

H-19 6. Massport should work with the FAA to improve compliance with the FAA's Minimum Safe Altitudes to increase safety and decrease noise and emissions: http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=1c954411758b2f627dbe5c8d3e6da7e0&rgn=div8&view=text&node=14:2.0.1.3.10.2.4.10&idno=14. "Except when necessary for takeoff or landing," "Over any congested area of a city, town, or settlement, or over any open air assembly of persons, an altitude of 1,000 feet above the highest obstacle within a horizontal radius of 2,000 feet of the aircraft." Massport's relevant D.6 response in Appendix B is missing.

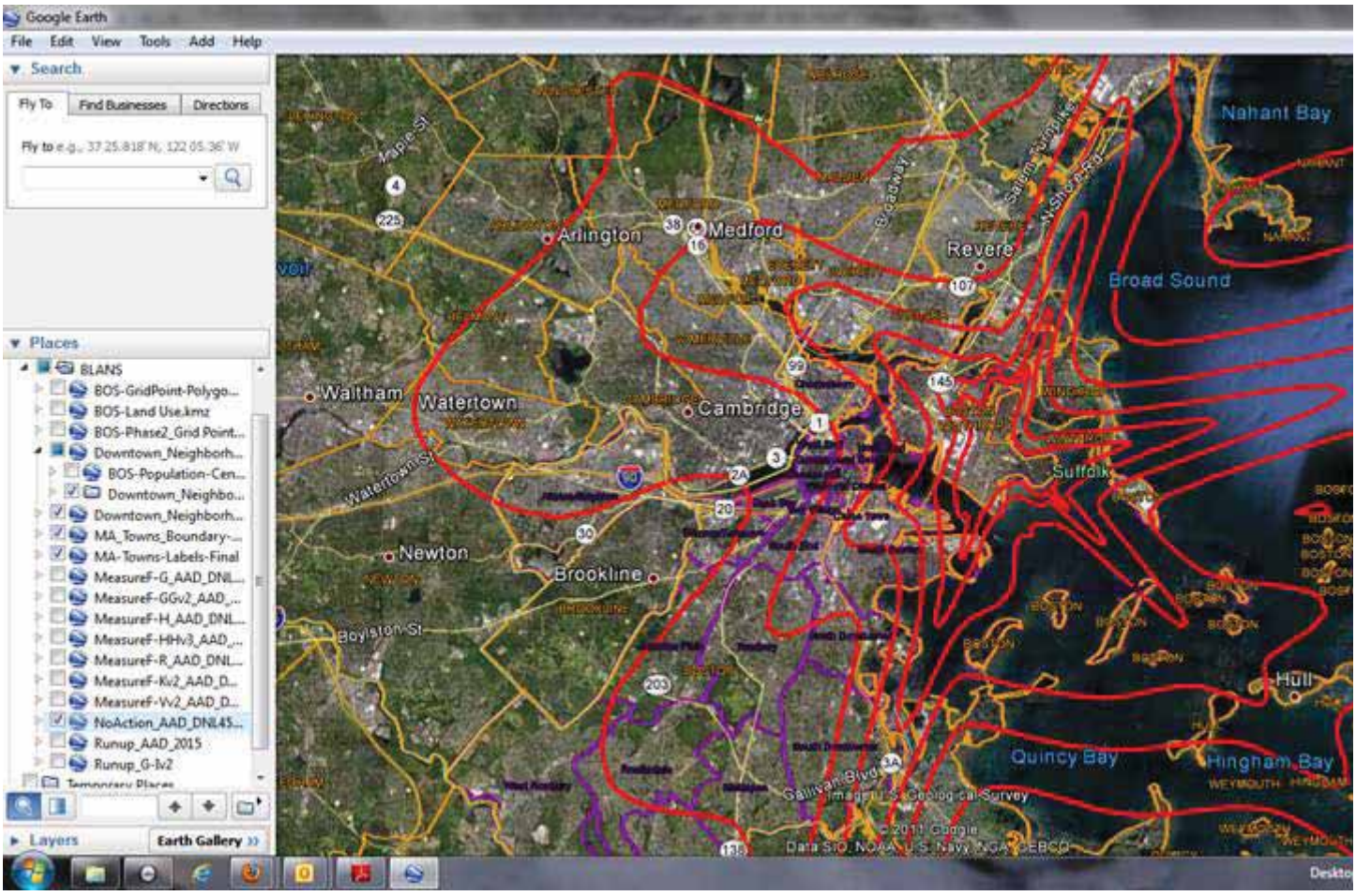
a. Currently, propeller and turboprop airplanes at Logan turn hard immediately after takeoff to clear the runway of the slower aircraft and allow a faster jet to proceed—24/7, even when there is no following takeoff (compare Figures 6-6 and 6-8 with 6-10). From Runway 22R, they are sometimes even less than 500ft over the already very heavily impacted Jeffries Point Neighborhood, East Boston, and commonly less than the minimum 1,000 feet higher within 2,000 feet of the Downtown Boston 600ft towers (an example Massport Noise Complaint, 1200ft Downtown Boston screenshot below). And, they continue 500-1,000ft lower than if in compliance, multiplying the noise at lower altitudes. (This noisy and needless, non-safety compliant procedure is standard for Cape Air, with more than 10% of Logan operations and less than 1% of Logan passengers.) Even the "good practice" of minimum 400 feet before turning, following other regulations, is not respected.
b. The FAA's position is that "until the aircraft completes its climb out (and is in the enroute phase of flight) the route and altitude flown is "necessary for takeoff" and, therefore, there is no violation."
c. The underlying, cited FAA Interpretations do not support that position; they are counter to it (base 1954 CAB Interpretation attached): "To achieve the proper high level of safety, it is vital that every pilot, consistently with sound and conservative operating practices, take full advantage of the performance capabilities of his aircraft so as to spend as little time as possible at altitudes below the minimums established for cruising flight. The "when necessary" language used in current § 60.17 achieves this result simply and directly. It prohibits low altitude flying-except when a departure from the otherwise applicable minimum is necessary for landing or taking off. It prohibits unnecessary low flying during the execution of those maneuvers. At every point along the proper flight path for approach to landing or climb after takeoff, an unnecessary dip would place the pilot in potential violation of this regulation." "It is a rule based on the standard of necessity, and applies during every instant that the airplane climbs after take-off and throughout its approach to land." Straight ahead, maximum climb, with minimum turn to minimize non-compliant flying and time is needed to satisfy the requirement. Hard turns at low altitudes, decreasing climb and increasing flying and time at lower altitude—choosing greater route distance and time non-compliant, rather than compliance sooner without turn—is certainly counter to the requirement. The FAA Pilot/Controller Glossary does not define "Takeoff" directly; it defines "CLIMBOUT- That portion of flight operation between takeoff and the initial cruising altitude." http://www.faa.gov/air_traffic/publications/atpubs/PCG/C.HTM. The excepted Takeoff is before Climbout, and Climbout is before En Route—Takeoff does not extend to En Route.
d. (The Runway 27 jet departures turn from 270 to 235 at 2.2 DME and 760 MSL, also not in compliance with the Minimum Safe Altitudes, diverting substantial noise to (economically less advantaged) Roxbury and Roslindale (H-29). Since historically more than 40% still miss the first gate turn, despite attempts to improve, it seems delaying the turn to more than 1,000 feet should be considered, including Minimum Safe Altitudes compliance (H-35).) H-20
e. (Massport monitors forecast operations, with peak periods of about 80-90 for only several hours, weekdays, and several months—30-50% excess capacity with the 120 capacity (Appendix K). Logan has had a safety incursion history in the top four nationally, much

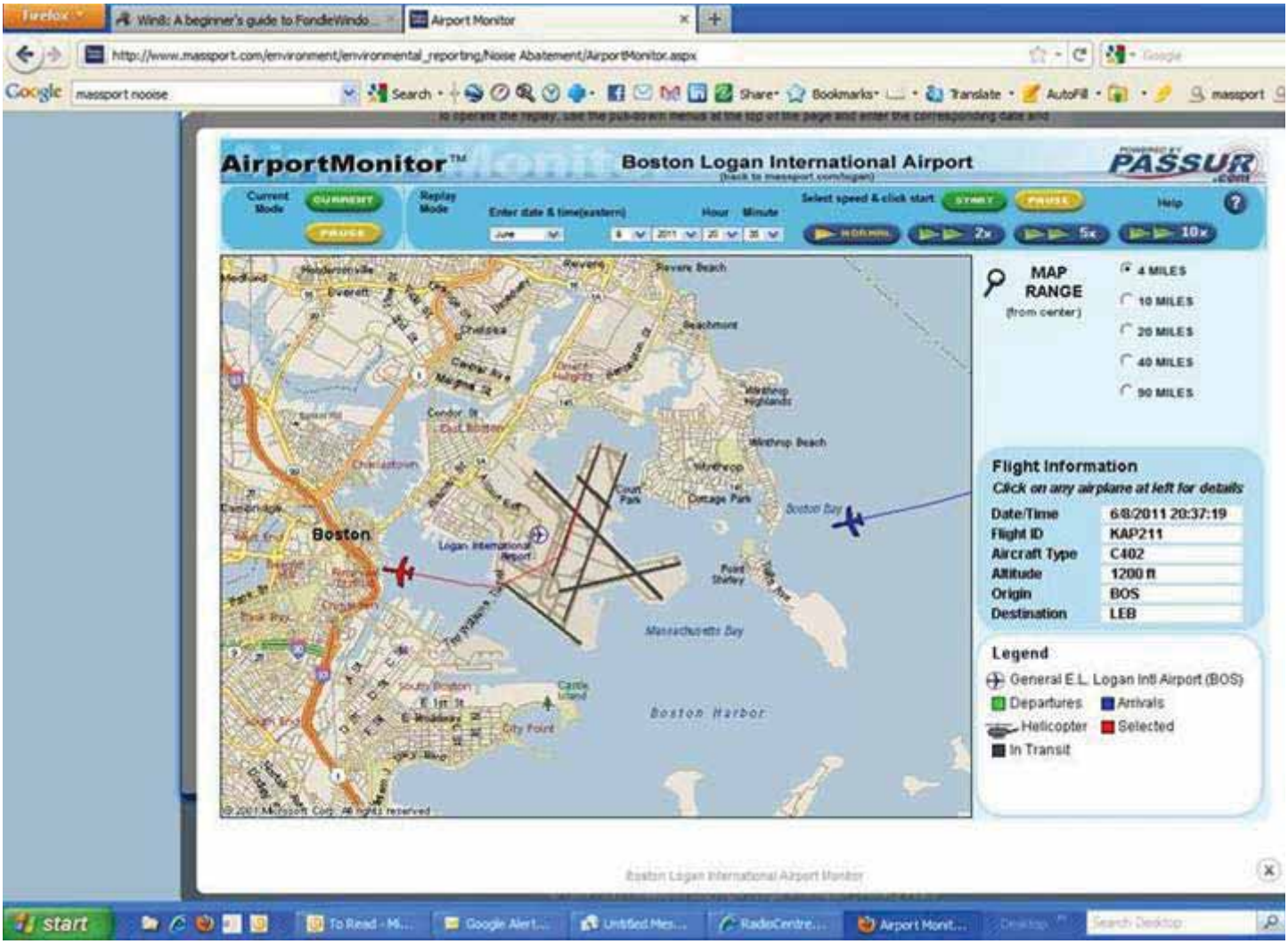
greater than it should be with passengers 19th and operations 21st—they need to slow down to increase safety and decrease noise, which will not decrease actual throughput.)

Thank you for your help. I would be happy to discuss my comments further.

Sincerely

Darryl Pomicter
136 Myrtle St
Boston, MA 02114-4447
email: dpomic@aol.com
cell: (617) 755-0151
home: (617) 227-1153





Richard K. Sullivan, Jr., Secretary
Executive Office of Energy and Environmental Affairs
Attention: Anne Canaday, MEPA Office, EEA #3247
100 Cambridge Street, Suite 900
Boston, MA 02114

From: Darryl Pomicter [mailto:dpomic@aol.com]
Sent: Saturday, November 10, 2012 4:57 PM
To: Terry.English@faa.gov; Leo, Flavio; 'Sandra Kunz'; 'jerry falbo'; 'declan boland'; 'wig zamore'; 'ralph dormitzer'; 'GARY BANKS'; [redacted] 'costello larry'; 'D'Amico, Bob'; [redacted] alex.geourntas@cityofboston.gov; 'Ron Hardaway'; [redacted] 'Lyman Will'; [redacted] rmaguire@norwoodma.gov; 'Terry McAteer'; 'Paul Meleedy'; [redacted] 'morrison dick'; [redacted] 'parker, michael'; [redacted] smith pam'; 'John Stewart'; 'william sweeney'; 'mona thaler'; 'thaler mona'; 'thaler mona'; 'JONATHAN WALZER'; [redacted] 'bill deignan'; [redacted] 'patti fine'; [redacted] mlindstrom@cityofmelrose.org; [redacted] alan wright'; bryan.glascock@cityofboston.gov; [redacted] maura.zlody@cityofboston.gov
Cc: 'John Williams'; 'Rob Adams'; Dalzell, Stewart; anne.canaday@state.ma.us; mayor@cityofboston.gov; 'BOS PMT'
Subject: Logan Departures and Arrivals--by Runway End & PRAS

Folks

Attached is a spreadsheet with analysis of Logan Departures and Arrivals by Runway. The goal is to give a clearer view of who is affected, how much, relative to others, and changing over years. The 1990-2010 data is from Massport's 2010 Environmental Data Report, Table H-12, Summary of Jet Aircraft Runway Use – 1990-2010 and Table 6-5, Effective Jet Aircraft Use in Comparison to PRAS Goals: http://www.massport.com/environment/environmental_reporting/Documents/EDR/2010EDR_Part_1_Main.pdf. The earlier PRAS data is from Massport's 1989 ENPRAS Interim Report, PRASSUM File and 2008 EDR. [Massport notes 1991 Runway Use unavailable, and I haven't found 1989.]

Massport and the FAA typically list Runway Use, Departures and Arrivals by Runway Direction. Since Departures and Arrivals are both into the wind, in the same direction they operate at the opposite ends of the Runway. Departures from a Runway are over a totally different area and community of people than Arrivals to that Runway—around the opposite end, miles away. The PRAS goals agreed in 1982 (but never achieved) are annual Runway End utilization percentages for Departures and Arrivals. (PRAS has not operated since the FAA upgraded their systems in 2004.)

So, I have arranged the Departures from each Runway End with the Arrivals to the same Runway End—over the same area and community of people—and added totals. (Each physical runway has two names: the direction (and position) from one end and the direction (and position) from the opposite end, 180 degrees apart—for example, Runway 22 Right and Runway 4 Left.) The first sheet is the actual use and the second sheet is the effective use, with 10X nighttime adjustment for PRAS.

Also, I have added multi-year averages for 2007-2010 with full-year operation of the new Runway 14-32; the prior years 2001-2006; the longer period 1990-2006, and PRAS 1984-1989. There are significant changes in multi-year averages, which change relatively slowly (and are not as large as some shorter period observations and comparisons).

Comparing Jet Departures and Arrivals from each Runway End (and realizing that Departures are generally noisier than Arrivals) shows clearly (consistent with the Google Earth noise contours, and very different than Runway Direction percentages) that:

1. Runway 22 Left Departures with Runway 4 Right Arrivals and Runway 22 Right Departures with Runway 4 Left Arrivals over South Boston, Dorchester, Milton, Quincy, and adjacent, and Runway 9 Departures with Runway 27 Arrivals over Winthrop are the very greatest problems—each with more than 30%.
2. Runway 4 Right Departures with Runway 22 Left Arrivals over East Boston, Winthrop, Revere, Lynn, and adjacent; Runway 33 Left Departures with Runway 15 Right Arrivals over East Boston, Chelsea, Charlestown, Medford, Everett, Somerville, and adjacent; and Runway 15 Right Departures with Runway 33 Left Arrivals over the Outer Harbor, Hull, Hingham, Cohasset, and adjacent are the next rank—each with about 10%).
3. Runway 27 Departures with zero (never used) Runway 9 Arrivals over South Boston, Chinatown, Financial District, South End, Roxbury, and adjacent is the third rank—with about 5%). And, the new Runway 14 Departures with Runway 32 Arrivals over the Outer Harbor and Hull is very small (and with no large jets)—about 1%.

From 2007-2010, with the opening of the new Runway 14-32,

1. The greatest problems, Runway 22 Right Departures with Runway 4 Left Arrivals and Runway 9 Departures with Runway 27 Arrivals both increased, while Runway 22 Left Departures with Runway 4 Right Arrivals decreased.
2. In the second rank, Runway 4 Right Departures with Runway 22 Left Arrivals and Runway 33 Left Departures with Runway 15 Right Arrivals both increased, while Runway 15 Right Departures with Runway 33 Left Arrivals decreased (despite being a primary PRAS goal to maximize these, over water—to agreed goals more than triple, to be top rank).
3. In the third rank, Runway 27 Departures with zero Runway 9 Arrivals decreased.
4. The PRAS Runway End utilization goals agreed in 1982 have never been achieved, never close—even with the change from all aircraft to only jets (<85%) in the implementation of ENPRAS in the '90s. The PRAS computer program is not even operating since 2004. The Long-Term Goal (after "Reduce the annual average total noise impact…"): "Maximize the use of runway 15R for over water departures and 33L for over water arrivals." seems to be lost—with the greatest consequent increase to Runway 9 Departures and Runway 27 Arrivals over Winthrop (a greatest problem with more than 30% actual use). (PRAS excerpts below.)

H-21 This does not discount any of the difficulties we suffer—noise, air quality, and other—but rather tries to see them more clearly and scale them, realizing some have it even worse than others. This is intended to show more clearly who is getting hammered—how much, relative to others, and changes over time. Hopefully, we can use it to help decrease negative effects and distribute them more equitably over time. Runway End utilization is the basis of PRAS, and it should be reported clearly—and be part of revamping, updating, reassessing, superseding PRAS as provided in the ROD.

Non-jet, turboprop and piston prop are not currently included. They are currently about 15% of the total (about 18% as large as the jets). 2010 EDR: Table 2-2 Logan Airport Aircraft Operations**. (**And, that seems likely to increase significantly as turboprops compete with increased efficiency and larger sizes to replace some of the about 20% regional jets—which replaced non-jets around 2000-2002.) The FAA turns the non-jets early, before the end of the Runway—to decrease their standard 3 miles minimum separation (and sometimes 5) to "1 mile if courses diverge immediately after departure" "by 15 degrees or more". FAA Order 7110.65R

Air Traffic Control, 5-5-4 Minima and 5-8-3 Radar Departures: www.faa.gov/documentlibrary/media/order/atc.pdf. (They turn very early and very low over already very heavily impacted nearby communities. They don't wait until the end of the runway (as the decreased minimum is drawn), or follow the FAA's Minimum 400 Feet Before Turning standards, or consider whether there is any following aircraft or not (to benefit from the increased Efficiency and decreased Safety). And, they don't comply with the FAA's Minimum Safe Altitudes 1,000 higher than within 2,000 feet, except when necessary.)

(Also, Helicopters and Non-Logan arriving or departing planes are not included; which as much as double reported noise in the most-affected Downtown, Inner-City neighborhoods.)

I'm copying Massport, FAA, and Massachusetts Department of Environmental Protection. I request Massport include this Runway End utilization view with totals in their annual EDR, starting with their 5-year 2011 Environmental Status and Planning Report (delayed from 2009, for delivery in 2013). It should be included for both the actual use and the effective use for PRAS, which includes 10X nighttime. For Massport and the FAA, I think it is very important to manage and report clearly the total activity (turbojet, turboprop, and piston prop) by Runway End use (actual and effective)—including as part of revamping, updating, reassessing, superseding PRAS as provided in the ROD—to more clearly see the absolute and relative effects over time on Communities, and to more equitably decrease and distribute them. **H-22**

Sincerely,

Darryl

Darryl Pomicter
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home: (617) 227-1153

PS I've been checking my spreadsheet for errors; but, of course, some remaining is possible. Please advise. Massport's 2010 EDR reports 2000 Arrivals 4R as 50%, which I have corrected to 40% to be consistent and total 100%.) **H-23**

PPS

PRAS Goals and Compliance

The goals for the automated PRAS at Logan were established by the advisory committee to the development of the original computerized development in 1980-83. The advisory committee was composed of representatives from Massport, the FAA, airlines, and 12 neighboring communities. It concluded that the PRAS should provide an equitable distribution of aircraft noise over the long-term (i.e. annually), as well as short-term relief from excessive operations over certain neighborhoods.

Long-Term Goals

The PRAS advisory committee agreed that the long-term goals should:

* Reduce the annual average total noise impact from Logan operations on the population residing in affected communities, without significantly increasing the impact on any populated area within the day-night sound level (Ldn) contour of 65dB; and

* Maximize the use of runway 15R for over water departures and 33L for over water arrivals.

To quantify the long-term noise goals, the committee reached a consensus on annual runway end use percentages in terms of equivalent jet operations. Equivalent operations include all daytime (7 am to 10 pm) jet flights, plus nighttime (10 pm to 7 am) jet operations multiplied by a factor of ten. This is consistent with the methodology for computing Ldn, in which 10 dB are added to nighttime operations. The agreed annual runway end use goals are shown in Table 1.

Table I. Logan Runway Utilization Goals for PRAS.

Runway Operation	Effective Utilization
Arr 04	21.2
Arr 15	8.4
Arr 22	6.5
Arr 27	21.7
Arr 33	42.3
Dep 04	5.6
Dep 09	13.3
Dep 15	23.3
Dep 22	28.0
Dep 27	17.9
Dep 33	11.9

THIRD: The Government shall use the data provided through the PRAS to assist in the Government's decision making in selecting the runways to be used for aircraft landing and departing Logan International Airport. Nothing herein shall be construed to alter the requirement that all decisions as to use of the navigable airspace, including selection, shall remain the sole responsibility of the Government to the extent required under the Federal Aviation Act as amended and other applicable provisions of law.

B. Flight Track data for all in-flight activity described in Paragraph A above, 24 hours a day, 7 days a week for Commercial and General Aviation aircraft. Data shall not include military operations, aircraft incidents, or any other information deemed sensitive at the sole discretion of the FAA.

Traffic Data. The forecast traffic demand will be entered in two forms. The normal demand profile of arrivals and departures by time of day and day of week will be provided by Massport and/or the FAA. These profiles will be updated on a monthly or seasonal basis from the airline schedules and MPA estimates of non-scheduled and general aviation activity. The profiles will be generated off-line and input from diskette or remotely via a communications link. The data will include expected turbojet and non-turbojet operations by 15-minute intervals, and perhaps an adjustment factor for prevailing weather conditions.

Noise History. In order to determine the performance of ENPRAS, the Area Supervisor may call up a window showing the noise history. This display will show the current noise values by runway end: per cent runway end use over the past 12 months, annual runway end use goals, dwell and persistence. More detailed historical data may also be requested, including summary tables of runway end usage for the calendar year. Other historical displays may be included during the system implementation, based on needs expressed by the FAA and/or Massport.

Comment #	Author	Topic	Comment	Response
H.1	Darryl Pomicter	Noise	Massport's ESPR and EDR should be improved based on the BONS and BLANS Noise Abatement Study now being completed as a cooperative effort of the FAA, Massport, and the Logan CAC in mitigation for the Logan Airside Improvements Planning Project, EOEA #10458.	The status of the Boston Overflight Noise Study (BONS) and BLANS are reported in the *2011 ESPR*. For updated information on this study, see the website: http://www.bostonoverflight.com/phase2_documents.aspx#Level1Report.
H.2	Darryl Pomicter	Noise	And, a meeting with Massport and Logan CAC representatives would be beneficial.	There will be a public meeting on the 2011 ESPR where the public and the CAC can attend and provide feedback to Massport and the MEPA office.
H.3	Darryl Pomicter	MEPA	The ESDR and EDR should be issued as quickly as possible in the following year, to maintain timeliness and relevance, both to avoid being out-of-date information and to enable prompt performance improvement when necessary. It seems that early September EDR and December ESPR should be manageable; not more than a year later (Introductory Letter and Appendix C).	Massport maintains the schedule approved by the MEPA Office for the submittal of EDRs and ESPRs. As noted in the *2010 EDR* , the *2011 ESPR* will be submitted in Spring 2013 to accommodate incorporating the most recently available information from the updated operations and passenger forecasts and key airport planning efforts.
H.4	Darryl Pomicter	General	Massport's 2010 EDR is a dense and complicated document, overall graphically well done and consistent. However, it needs improvements to allow and ease comprehension and use.	Massport continually works to improve the text, maps, and graphics in all of their filings, including the EDRs and ESPRs. This includes developing new ways to present data in a easily understood and graphically pleasing fashion. For example, neighborhood names have been added to a number of graphics to help orient the reader.
H.5	Darryl Pomicter	Noise	Maps need the BOSTON VORTAC from which flight distances are measured, and Logan perimeter shown (including from the most basic, Figure 6-4).	The distances from Logan Airport in Tables 6-8 and 6-9 are from the Airport Reference Point (ARP) which is marked on Figure 6-4 and Figure 6-16. The ARP is the geographic center of the runway ends and is commonly used as the geographic location of an airport.
H.6	Darryl Pomicter	Noise	Tables such as 6-8 & 6-9 include "Distance from Logan Airport" which seems to be DME rather than perimeter, but it is not clear from where.	The distance is from the airport reference point. This is noted in *Chapter 6, Noise Abatement,* of this *2011 ESPR* .
H.7	Darryl Pomicter	General	Maps need Boston Communities and surrounding Cities names and boundaries—to ease correlation and improve understanding by people from below.	Please see the response to Comment H.4.

Comment #	Author	Topic	Comment	Response
H.8	Darryl Pomicter	Noise	The Noise Model description and all modeled noise levels graphics (including Tables 6-6, 6-7, 6-9 & 6-13 and Figures 6-13—6-15 and Tables H-7 & H-13) need to note clearly that the noise model, is calibrated with actual measurements, but is not actual measurements. Model noise levels need to note that the model and results do not include local VFR plane and helicopter flights, controlled by the Logan Tower, but not arriving or departing Logan. And, based on field measurements, they have been estimated to possibly double (+3dB) the noise model levels for the most affected communities. The small percentages of Logan departures and arrivals which are not modeled directly from radar data should be detailed— general across categories or specific sub-categories (6-8—6-9, H-2 & H-11)?	The INM model is not calibrated by actual noise measurements at Massport. The modeling includes only those aircraft operations that land or depart from Logan Airport. Massport has not undertaken any field measurements which show a possible doubling of noise levels due to local VFR (visual flight rules) plane or helicopter traffic. All of the departures and arrivals from Logan Airport are modeled directly from the radar data. This information is then used as a basis for scaling the operations on the available radar tracks. Commercial operations are scaled by airline and general aviation operations are scaled to the total general aviation count.
H.9	Darryl Pomicter	Activity Levels	Passengers, Operations, and Passengers/Operation should be shown for all airlines, including Cape Air—for which operations and passengers are currently not shown, even though it is a "Dominant Passenger Carrier" (Figure 2-5, Table 6-11, and Appendix E). Passengers/Operation should receive more detail and focus as a basic measure of efficient use of Massport and FAA facilities, noise, and emissions.	The efficiency of Logan Airport in terms of the number of passengers per aircraft operation has increased significantly. In 2000, Logan Airport accommodated an average 56.8 passengers per aircraft operation. Since then, airlines have retired many small turboprops and regional jets and are operating flights with more passengers onboard. As a result, the average number of passengers per aircraft operation has risen by 38 percent to 78 percent. Cape Air continues to operate 9-seat aircraft which are ideally suited to serving the Cape and Island markets with seasonal traffic fluctuations. See *Chapter 2, Activity Levels,* for a discussion of the average number of passengers per aircraft operation.
H.10	Darryl Pomicter	General	Massport should use current Internet tools to ease communications and increase review, discussion, and understanding.	Massport's website provides a number of resources that ease communications and increase review, discussion, and understanding. The website provides links to recently filed environmental documents. Detailed information is provided on environmental reporting to help the layperson understand the meaning of environmental reporting for noise, water quality, and air quality. The website also provides tips on how to travel in an environmentally friendly way. The website URL is: http://www.massport.com/environment/Pages/Default.aspx.
H.11	Darryl Pomicter	General	Google Earth overlays should be made available and maintained to allow viewing the information, with respect to satellite photos ground conditions. A screenshot example from BLANS is below, comparable to Figures 6-6 to 6-16.	Massport has been expanding the use of satellite photos as the technology evolves. Please see Figures 6-6 to 6-14.

Comment #	Author	Topic	Comment	Response
H.12	Darryl Pomicter	General	Massport should provide live online access at meetings to their website, to linked documents including ESPR and EDR, and to Google Earth with KML overlays.	Massport will have an electronic copy of the ESPR at the public meeting.
H.13	Darryl Pomicter	General	Massport's website should maintain links to their ESDRs and EDRs. The link to the most recent Logan Environmental Status and Planning Report remains broken, opening only the Table of Contents—despite Massport's D.4 Response in Appendix B: "The links have been tested for accuracy."	The Massport website has accurate links. Unfortunately, due to size restrictions, the only portion of the *2004 ESPR* that could be linked on the website is the Table of Contents. CDs are available on request. More recent environmental filings include the entire reports and links are posted on Massport's website.
H.14	Darryl Pomicter	Noise	Massport's Online Noise Complaint system should be updated to current technology, including recognize and partially input repeat users' contact details, email complaint with receipt acknowledgement, and respond by email—in less than the current many weeks.	Thank you for your input. Massport is continually improving its information sharing with interested citizens including the opportunity to submit information via email and the Airport Monitor system.
H.15	Darryl Pomicter	Noise	Massport's Airport Monitor system should be upgraded to current technology.	The Airport Monitor system is an important tool used by citizens every day. Opportunities to upgrade the system will be considered in the future.
H.16	Darryl Pomicter	Mitigation	Massport should fulfill the Logan Airside Improvements Planning Project (EOEA #10458) Mitigation Measure for 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—actively and ongoing. Massport now claims (Table 9-5) "Implemented", completed; but there has never been a Program developed or implemented.	Massport continues to work with FAA and the BLANS team on voluntary single engine taxiing measures. Massport continues to encourage its use and, based on recent surveys, airlines are deploying this strategy on a voluntary basis where possible. In 2011, Massport issued a memorandum to air carriers encouraging the use of single engine taxiing when consistent with safety which was attached to the *2010 EDR* .
H.17	Darryl Pomicter	Noise	Massport should work with the FAA to address noise complaints, including reporting response actions.	Massport works cooperatively with the FAA on a number of issues, including addressing noise complaints and response actions.
H.18	Darryl Pomicter	Noise	Massport should expand its current Flight Track Monitoring and reporting to include gross deviations from course and altitude standards, propeller and turboprop aircraft, and at least quarterly reporting—to aid and pressure the FAA for enforcement, improved compliance, and decreased noise and emissions (H-28—H-29). Massport's relevant D.2 response in Appendix B is missing.	Massport provides extensive data in the EDRs and ESPRs including noise monitoring results, flight tracks, and emissions. Massport also provides specific analyses when requested. This information forms the basis for dialogues with the FAA and communities. Unfortunately, the D.2 response in Appendix B of the *2010 EDR* was accidentally omitted. The response to D.2 is as follows: *Massport and the FAA work cooperatively to address and to respond to noise complaints.*

Comment #	Author	Topic	Comment	Response
H.19	Darryl Pomicter	Noise	Massport should work with the FAA to improve compliance with the FAA's Minimum Safe Altitudes to increase safety and decrease noise and emissions "Except when necessary for takeoff or landing," "Over any congested area of a city, town, or settlement, or over any open air assembly of persons, an altitude of 1,000 feet above the highest obstacle within a horizontal radius of 2,000 feet of the aircraft." Massport's relevant D.6 response in Appendix B is missing.	Massport provides information to the FAA when requested and continues to work with the FAA on low altitude aircraft over Boston and the neighboring communities. Unfortunately, the D.6 response in Appendix B of the 2010 EDR was accidentally omitted. The response to D.6 is as follows: *The FAA advises pilots on which runways to use and when. The FAA (Air Traffic Control) is also responsible for safe flight procedures and directs aircraft to fly in a safe and efficient manner. Massport works with the FAA to maintain a safe and efficient Airport.*
H.20	Darryl Pomicter	Noise	Since historically more than 40% still miss the first gate turn, despite attempts to improve, it seems delaying the turn to more than 1,000 feet should be considered, including Minimum Safe Altitudes compliance (H-35)	Since March of 2011, the Runway 27 procedure has been improved and more than 70 percent of the departures are passing through the first gate.
H.21	Darryl Pomicter	Noise	This does not discount any of the difficulties we suffer—noise, air quality, and other—but rather tries to see them more clearly and scale them, realizing some have it even worse than others. This is intended to show more clearly who is getting hammered—how much, relative to others, and changes over time. Hopefully, we can use it to help decrease negative effects and distribute them more equitably over time. Runway End utilization is the basis of PRAS, and it should be reported clearly—and be part of revamping, updating, reassessing, superseding PRAS as provided in the ROD.	Massport, the FAA, and the CAC will begin discussions on runway use measures as part of the final phase of the noise study to the extent that new reporting requirements are developed. The ESPRs and EDRs would report on these measures.
H.22	Darryl Pomicter	Noise	I'm copying Massport, FAA, and Massachusetts Department of Environmental Protection. I request Massport include this Runway End utilization view with totals in their annual EDR, starting with their 5-year 2011 Environmental Status and Planning Report (delayed from 2009, for delivery in 2013). It should be included for both the actual use and the effective use for PRAS, which includes 10X nighttime. For Massport and the FAA, I think it is very important to manage and report clearly the total activity (turbojet, turboprop, and piston prop) by Runway End use (actual and effective)—including as part of revamping, updating, reassessing, superseding PRAS as provided in the ROD—to more clearly see the absolute and relative effects over time on Communities, and to more equitably decrease and distribute them.	Please see the response to Comment H.21.
H.23	Darryl Pomicter	Noise	I've been checking my spreadsheet for errors; but, of course, some remaining is possible. Please advise. Massport's 2010 EDR reports 2000 Arrivals 4R as 50%, which I have corrected to 40% to be consistent and total 100%.)	Please see the response to Comment H.21.

Nancy S. Timmerman, P.E.
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December 9, 2010

The Honorable Richard K. Sullivan, Jr., Secretary
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Subject: EOEA #3247-Logan Airport 2010 Environmental Data Report (EDR)

Dear Secretary Sullivan:

These comments are being transmitted by email.

I have reviewed the 2010 Environmental Data Report (EDR), EOEA #3247 and offer the following comments and questions, with particular reference to the Noise section (6).

On page 6-4, there is a nice write-up on noise metrics. The definition for decibel is not the general one, which is simply 20 times the common logarithm of a ratio of the sound pressure of interest to a reference pressure. The reference pressure for noise or communities, 20 micro-Pascals, is what the paragraph tried to describe. Further, although

I-1 A-weighted levels are referenced under DNL, it is not defined. If this section is included in future documents, A-weighting should be defined.

I-2 On page 6-8, it appears that the number of traces (360,402) is greater than the number of operations (352,644). Please explain this discrepancy.

I-3 The footnotes to Table 6-1 on page 6-12 are incorrect (i.e., there is no note 5).

I-4 What is the basis for the noise comparison in Figure 6-2 on page 6-14 (is it CNI)?

I-5 On page 6-18, Runway 9/27 is included in the N/S. It is, however, by definition, an east/west runway (heading close to 90 degrees and 270 degrees). The 14/32 and 15/33 runways are more northwesterly/southeasterly. This section should be reworked.

I-6 On page 6-21, the conclusion might be that the airport is getting closer to achieving the PRAS goals without having the PRAS operational. How do you account for this?

In Figure 6-6, there are a number of jet departure tracks from Runway 22R visible which are flying over the City. Does Massport work with the FAA to eliminate such behavior? I-7

A comparison on Figures 6-7 and 6-9 implies that commercial jets have more extreme dispersion on arrival than the regional jets. Why is this so? I-8

On page 6-35, it would be more useful to omit the 80+ DNL column, and instead introduce a 60+ DNL column. I-9

On page 6-41, in Table 6-9, the measured versus modeled results appear to have an incorrect sign. When the measured values are higher than the modeled, the sign of the result should be positive. I-10

On page 6-42, it appears that the airport knows what operation it was that was Stage 2 at night in 2010. Was the operator of that operation prosecuted under the Noise Rules? I-11

On page 6-51, you note that the new system has a way to correlate complaints with flight paths. How is this information being used? Do you contact the carriers and/or the FAA? I-12

On page 6-54, Northwest's operations in the years prior to merging with Delta should have been reported in Table 6-14, for completeness. I-13

In the next Environmental Status and Planning Report (ESPR), Massport and its consultants should provide a discussion of likely speech and sleep interference from the jet arrivals and departures from Boston-Logan International Airport. Time above (TA), which is reported in Tables 6-13 and -14, can be used to get a measure of the problem. I-14

Thank you for giving me the opportunity to comment on this report.

Sincerely,

Nancy S. Timmerman, P.E.

cc: J. Hansen, Massport
S. Dalzell, Massport
Letter to MEPA Office/EOEA #3247--2010EDR

Comment #	Author	Topic	Comment	Response
I.1	Nancy S. Timmerman	Noise	Further, although A-weighted levels are referenced under DNL, it is not defined. If this section is included in future documents, A-weighting should be defined.	The definition of A-weighting has been provided in *Chapter 6, Noise Abatement.*
I.2	Nancy S. Timmerman	Noise	On page 6-8, it appears that the number of traces (360,402) is greater than the number of operations (352,644). Please explain this discrepancy.	The greater number of traces is due to partial or broken tracks and tracks that flew close to the airport but did not land or depart the airport. These are assigned to Logan Airport, but do not have runway assignments. In 2011, 349,397 tracks had aircraft information and runway assignments.
I.3	Nancy S. Timmerman	Noise	The footnotes to Table 6-1 on page 6-12 are incorrect (i.e., there is no note 5).	The footnotes to Table 6-1 in the *2010 EDR* were incorrect as noted in the comment. The footnotes in the similar table in the *2011 ESPR* are correct.
I.4	Nancy S. Timmerman	Noise	What is the basis for the noise comparison in Figure 6-2 on page 6-14 (is it CNI)?	This is based on the CNI analysis and will be noted in the *2011 ESPR* .
I.5	Nancy S. Timmerman	Noise	On page 6-18, Runway 9/27 is included in the N/S. It is, however, by definition, an east/west runway (heading close to 90 degrees and 270 degrees). The 14/32 and 15/33 runways are more northwesterly/southeasterly. This section should be reworked.	Runway 9-27 is included with the North/South flow analysis due to the runway configurations that utilize the runway. North flow typically includes arrivals to Runways 4L-4R and departures from Runways 4R or 9. South flow typically includes arrivals to 22L and 27 with departures from Runways 22L-22R.
I.6	Nancy S. Timmerman	Noise	On page 6-21, the conclusion might be that the airport is getting closer to achieving the PRAS goals without having the PRAS operational. How do you account for this?	Even without the Preferential Runway Advisory System (PRAS) operational, the FAA and Massport work to keep overflights over non-sensitive areas whenever practicable and to distribute overflights over sensitive areas so that no one area is highly exposed.
I.7	Nancy S. Timmerman	Noise	In Figure 6-6, there are a number of jet departure tracks from Runway 22R visible which are flying over the City. Does Massport work with the FAA to eliminate such behavior?	The majority of the tracks shown flying over the City are at higher altitudes; these flights departed the airport using their normal procedure and then passed over the city. These flights are not typical and were deviated by the FAA due to weather or operational reasons.
I.8	Nancy S. Timmerman	Noise	A comparison on Figures 6-7 and 6-9 implies that commercial jets have more extreme dispersion on arrival than the regional jets. Why is this so?	The dispersion is similar for both types of aircraft, however there are more commercial jets so the dispersion for commercial jets appears more prevalent in the graphic. In addition, Regional Jets also use the west downwind and the commercial jets typically use just the east downwind.
I.9	Nancy S. Timmerman	Noise	On page 6-35, it would be more useful to omit the 80+ DNL column, and instead introduce a 60+ DNL column.	The 80+ dB column had been included for historical reasons. The 60 dB results are reported in *Appendix H* .
I.10	Nancy S. Timmerman	Noise	On page 6-41, in Table 6-9, the measured versus modeled results appear to have an incorrect sign. When the measured values are higher than the modeled, the sign of the result should be positive.	Thank you for noting this. The signs should be reversed with the title. The *2011 ESPR* clarifies the comparison of measured versus modeled results.

Comment #	Author	Topic	Comment	Response
I.11	Nancy S. Timmerman	Noise	On page 6-42, it appears that the airport knows what operation it was that was Stage 2 at night in 2010. Was the operator of that operation prosecuted under the Noise Rules?	The flight was discussed with the operator and the aircraft type was a replacement for another aircraft that was experiencing issues.
I.12	Nancy S. Timmerman	Noise	On page 6-51, you note that the new system has a way to correlate complaints with flight paths. How is this information being used? Do you contact the carriers and/or the FAA?	The new system allows the flight that caused the complaint to be linked for follow up by Massport staff. Yes, carriers and/or FAA are contacted to help resolve the issue.
I.13	Nancy S. Timmerman	Noise	On page 6-54, Northwest's operations in the years prior to merging with Delta should have been reported in Table 6-14, for completeness.	Comment noted and this is being presented in the *2011 ESPR* .
I.14	Nancy S. Timmerman	Noise	In the next Environmental Status and Planning Report (ESPR), Massport and its consultants should provide a discussion of likely speech and sleep interference from the jet arrivals and departures from Boston-Logan International Airport. Time above (TA), which is reported in Tables 6-13 and -14, can be used to get a measure of the problem.	Comment noted. The *2011 ESPR* follows the Secretary's Certificate.

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C

Proposed Scope for the 2012/2013 EDR

PROJECT NAME:	*Logan Airport 2012/2013 Environmental Data Report*
PROJECT LOCATION:	East Boston, Massachusetts
EOEEA NUMBER:	3247
PROJECT PROPONENT:	Massachusetts Port Authority (Massport)

Massport respectfully submits this proposed scope for a combined *Logan Airport 2012/2013 Environmental Data Report (EDR)* for public review and comment. This combined 2012/2013 EDR would follow the *2011 Environmental Status and Planning Report (ESPR),* which was filed in the spring of 2013. Due to the timing of the filings, this *2012/2013 EDR* will be submitted to the Executive Office of Energy and Environmental Affairs (EOEEA) in October 2014. Massport will continue 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. Massport will continue to provide interim updates on key environmental topics on the Massport website (http//www.massport.com/environment/pages/default.aspx).

Purpose of the *Logan Airport 2012 /2013 EDR*

The *2012/2013 EDR* will provide an update on conditions at Logan Airport for calendar year 2012 and 2013. The EDR will continue to serve as a background/context against which projects at Logan Airport can be evaluated. It also will report on the cumulative effects of Logan Airport operations and activities, compared to previous years, as appropriate.

The EDR complements the project-specific Environmental Notification Forms (ENFs) and, if necessary, Environmental Impacts Reports (EIRs) to help focus the review processes and to ensure that segmented project review does not occur in the context of Massachusetts Environmental Policy Act (MEPA) review of projects at Logan Airport.

Contents of the *2012/2013 EDR*

Generally, the *2012/2013 EDR* will follow the format of the *2010 EDR*, presenting an overview of the role of Logan Airport in the regional planning context. The *2012/2013 EDR* will 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 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.

The technical studies in the *2012/2013 EDR* will 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. Each chapter's contents are described below.

1. Introduction/Executive Summary

This chapter of the *2012/2013 EDR* will include:

- Overview of Logan Airport and place it in its environmental, geographic, and regulatory context
- Overview of the EDR/ESPR cycle
- Summary of passenger activity levels and 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
- Description of the organization of the *2012/2013 EDR*

2. Activity Levels

A primary purpose of this chapter will be to report on airport activity levels for 2012/2013, 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
- Report on national aviation trends in 2012/2013 and compare to trends at Logan Airport

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:

- Roadway Corridor Project
- Airport Parking
- Terminal Area
- Airside Area
- Service and Cargo Areas
- Airport Buffers and Landscaping

The status of long-range planning activities also will be provided. The chapter will 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.

4. Regional Transportation

The *2012/2013 EDR* will 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
- 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
- Report on metropolitan and regional rail initiatives and ridership

5. Ground Access to and from Logan Airport

The chapter will 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
- Results of the 2013 Logan Airport Passenger Survey

This chapter also will 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
- Strategies for enhancing services and increasing employee membership in the Logan Airport TMA.

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 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
- Flight tracks

The chapter will 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 RealContours™ and RealProfiles™, 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 RealContours™ and RealProfiles™
- 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
- Flight track monitoring noise quarterly reports

The chapter will 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.

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 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 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)

- Nitrogen dioxide (NO_2) monitoring
- NO_x emissions by airline

This chapter will 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
- The status of Logan Airport air quality studies undertaken by Massport or others, as available

This chapter will include an inventory of greenhouse gas (GHG) emissions from Logan Airport in 2012 and 2013. 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 EOEEA 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 2012 and 2013 GHG emissions inventory will be compared to the 2011 results.

This chapter will also include an update on Massport's efforts to encourage the use of single engine taxiing under safe conditions.

8. Water Quality/Environmental Compliance and Management

This chapter will 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
- Fuel spill prevention

The chapter will also present a discussion of the following topics:

- Future stormwater management improvements (if any)
- Future MCP and tank management activities

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
- 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 will update the status of Massport's mitigation commitments and also will 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 *2011 ESPR*. Individual responses to items raised in the Secretary's Certificate on the *2011 ESPR* and comments in reviewers' letters will be provided. A distribution list for the *2012/2013 EDR* (indicating those receiving documents or CDs) will be provided. The document will also contain copies of any MEPA Certificates issued for projects at Logan Airport in 2012 and 2013.

Supporting Technical Documentation

Supporting technical appendices will be provided as necessary.

D

Distribution

This *2011 Environmental Status and Planning Report* (*2011 ESPR*) 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 *2010 EDR*, and community groups concerned with airport activities.

The *2011 ESPR* is also available on Massport's website at www.massport.com and electronically on compact disc (CD). Limited CD or printed copies of the *2011 ESPR* may be requested from Lisa Carisella, Massport, Suite 200S, Logan Office Center, One Harborside Drive, East Boston, MA 02128, telephone (617) 568-3507, e-mail: lcarisella@massport.com. Printed and electronic copies of this report are available for review at the following public libraries:

Table D-1 Libraries

	Library	Address		Library	Address
P,C	Boston Public Library Main Branch	666 Boylston Street Boston, MA 02117	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	276 Meridian Street East Boston, MA 02128
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P,C	Somerville Public Library	79 Highland Ave. Somerville, MA 02143	P,C	Cambridge Main Library	449 Broadway Cambridge, MA 02138

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Some parties listed in Table D-2 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.

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- 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 – 2012 Peak Period Pricing Monitoring Report
- Appendix L – Demonstration of Reduced Airport Congestion through Pushback Rate Control
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E

Activity Levels

This appendix provides detailed tables in support of *Chapter 2, Activity Levels*:

- Table E-1 Logan Airport Historic 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
- Logan Activity Forecast Methodology and Assumptions

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Table E-1 Logan Airport Historic Air Passenger and Operations Data

Year	Operations	Air Passengers	Year	Operations	Air Passengers
1980	258,167	14,722,363	1996	456,226	25,134,826
1981	251,961	14,827,684	1997	482,542	25,567,888
1982	244,468	15,867,722	1998	507,449	26,526,708
1983	288,956	17,848,797	1999	494,816	27,052,078
1984	318,959	19,417,971	2000	487,996	27,726,833
1985	349,518	20,448,424	2001	463,125	24,474,930
1986	363,995	21,862,718	2002	392,079	22,696,141
1987	414,968	23,369,002	2003	373,304	22,791,169
1988	407,479	23,732,959	2004	405,258	26,142,516
1989	388,797	22,272,860	2005	409,066	27,087,905
1990	424,568	22,878,191	2006	406,119	27,725,443
1991	430,403	21,450,143	2007	399,537	28,102,455
1992	474,378	22,723,138	2008	371,604	26,102,651
1993	493,093	23,579,726	2009	345,306	25,512,086
1994	458,623	24,468,178	2010	352,643	27,428,962
1995	466,327	24,192,095	2011	368,987	28,907,938

Table E-2 Logan Airport Changes in Domestic Passenger Operations by Carrier

Airline	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2010-2011 Change	2010-2011 Percent Change
Scheduled Jet Carriers	**233,993**	**208,703**	**179,388**	**162,252**	**193,599**	**190,991**	**199,281**	**198,879**	**189,739**	**184,181**	**203,081**	**209,377**	**6,296**	**3.1%**
AirTran Airlines	3,090	3,168	6,464	8,650	12,618	14,580	19,761	18,685	14,665	13,645	13,672	12,869	(803)	(5.9%)
Alaska Airlines	-	-	543	1,086	1,111	1,088	1,097	1,423	1,969	1,818	1,733	1,757	24.0	1.38%
America West Airlines	5,116	3,675	3,285	3,709	5,922	4,467	4,220	2,874	-	-	-	-	-	-
American Airlines	30,821	34,028	30,765	28,692	32,578	27,712	24,631	23,589	22,827	22,766	21,313	18,943	(2,370)	(11.1%)
American Trans Air	1,448	2,171	1,894	2,200	2,342	2,294	-	-	-	-	-	-	-	-
Continental Airlines	16,894	17,097	14,161	13,603	13,575	13,546	13,972	14,090	13,930	11,823	10,869	11,074	205.0	1.89%
Delta Subtotal	52,954	47,810	41,745	36,034	37,209	36,388	31,880	30,913	28,892	24,349	28,980	25,429	(3,551)	(12.3%)
Delta Air Lines Mainline	*22,031*	*19,181*	*20,874*	*15,866*	*15,279*	*14,317*	*18,472*	*21,799*	*19,977*	*17,170*	*21,926*	*19,633*	*(2293.0)*	*(10.5%)*
Delta Express	*13,746*	*13,497*	*9,952*	*5,233*	-	-	-	-	-	-	-	-	-	-
Delta Shuttle	*17,177*	*15,132*	*10,919*	*9,414*	*10,237*	*9,588*	*9,000*	*9,114*	*8,915*	*7,179*	*7,054*	*5,796*	*(1258.0)*	*(17.8%)*
Delta Song	-	-	-	*5,521*	*11,693*	*12,483*	*4,408*	-	-	-	-	-	-	-
Frontier Airlines	1,052	1,162	796	-	-	-	-	-	-	74	1,094	-	(1094.0)	(100.0%)
Independence Air	-	-	-	-	5,533	4,676	45	-	-	-	-	-	-	-
JetBlue	-	-	-	-	9,080	15,069	31,993	34,933	36,887	38,146	49,981	60,745	10764.0	21.54%
Midway Airlines	4,096	2,850	728	-	-	-	-	-	-	-	-	-	-	-
Midwest Airlines	3,726	3,211	2,872	2,373	2,851	3,570	4,287	4,672	4,070	1,649	1,961	2,786	825.0	42.07%
Northwest Airlines	13,147	12,065	11,172	10,588	11,242	9,685	8,652	8,368	7,931	7,745		-	-	-
Southwest Airlines	-	-	-	-	-	-	-	-	-	2,602	13,727	17,413	3686.0	26.85%
Spirit Airlines	-	-	-	-	-	-	683	1,796	1,902	1,942	3,023	3,054	31.0	1.03%
Sun Country Airlines	723	470	8	-	-	-	-	-	-	254	313	509	196.0	62.62%
Trans World Airlines	6,280	4,246	-	-	-	-	-	-	-	-	-	-	-	-
United Airlines	28,092	25,428	22,184	19,619	20,975	18,304	21,153	20,140	18,568	17,531	16,314	15,351	(963.0)	(5.9%)
US Airways	66,554	51,322	42,771	35,698	38,563	39,612	36,907	37,396	38,098	36,466	36,678	36,421	(257.0)	(0.7%)
Virgin America	-	-	-	-	-	-	-	-	-	3,371	3,394	3,026	(368.0)	(10.8%)
Regional/Commuter Carriers	**160,041**	**167,631**	**137,037**	**134,108**	**130,272**	**137,203**	**130,298**	**124,014**	**112,881**	**107,615**	**94,535**	**89,586**	**(4949.0)**	**(5.2%)**
America West Express	1,267	2,203	2,438	1,332	-	-	-	-	-	-	-	-	-	-
American Airlines Subtotal	-	-	-	235	1,533	-	-	-	-	-	-	-	-	-
Chautauqua Airlines (American Airlines)	-	-	-	*235*	*1,533*	-	-	-	-	-	-	-	-	-
American Eagle Airlines	62,140	58,334	48,077	42,847	42,173	37,394	31,227	23,638	19,561	18,665	15,291	6,669	(8622.0)	(56.4%)
Cape Air	31,026	26,882	25,928	26,728	24,816	25,018	27,278	26,546	33,806	36,670	35,899	35,940	41.0	0.11%
Continental Connection Subtotal	-	-	-	-	-	-	-	-	23	1,289	1,809	1,199	(610.0)	(33.7%)
Colgan Air (Continental Connection)	-	-	-	-	-	-	-	-	*23*	*1,289*	*1,809*	*1,199*	*(610.0)*	*(33.7%)*
Continental Express Subtotal	-	15,220	2,234	4,186	6,256	12,544	8,297	2,843	152	106	529	902	373.0	70.51%
Atlantic SE (Continental Express)	-	-	-	-	-	-	-	-	-	-	-	*134*	*134.0*	-
Chautauqua Airlines (Continental Express)	-	-	-	-	-	-	-	-	*152*	*106*	*529*	*719*	*190.0*	*35.92%*
Commutair (Continental Express)	-	*15,220*	*2,234*	*4,186*	*6,256*	*12,544*	*8,297*	*2,843*	-	-	-	-	-	-
Trans States Airlines (Continental Express)	-	-	-	-	-	-	-	-	-	-	-	*49*	*49*	-

Table E-2 Logan Airport Changes in Domestic Passenger Operations by Carrier

Airline	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2010-2011 Change	2010-2011 Percent Change
Delta Connection Subtotal	15,438	18,222	25,467	30,796	25,454	26,557	28,223	37,750	27,453	21,095	18,445	23,243	4,798	26.0%
ACJet (Delta Connection)	*2,258*	*17,275*	*22,745*	*20,201*	*7,244*	-	-	-	-	-	-	-	-	-
Atlantic SE (Delta Connection)	-	-	*124*	*698*	*362*	-	-	*182*	*118*	*162*	*943*	*4,948*	*4,005*	*424.7%*
Big Sky Airlines (Delta Connection)	-	-	-	-	-	-	-	*6,929*	*173*	-	-	-	-	-
Chautauqua Airlines (Delta Connection)	-	-	-	*1,000*	*2,116*	*1,938*	*1,882*	*2,187*	*2,309*	*1,811*	*1,794*	*2,230*	*436*	*24.3%*
Comair Airlines (Delta Connection)	*520*	*947*	*2,598*	*8,897*	*15,732*	*24,619*	*26,341*	*27,196*	*23,130*	*16,576*	*10,255*	*7,857*	*(2,398)*	*(23.4%)*
Compass Airlines (Delta Connection)	-	-	-	-	-	-	-	-	-	-	*1,053*	*1,577*	*524*	*49.8%*
Freedom Airlines (Delta Connection)	-	-	-	-	-	-	-	*610*	*1,467*	*16*	-	-	-	-
Mesaba Airlines (Delta Connection)	-	-	-	-	-	-	-	-	-	-	*1,078*	*3,117*	*2,039*	*189.1%*
Pinnacle Airlines (Delta Connection)	-	-	-	-	-	-	-	-	*117*	*124*	*1,278*	*1,507*	*229*	*17.9%*
Shuttle America (Delta Connection)	-	-	-	-	-	-	-	*646*	*139*	*2,406*	*2,044*	*2,007*	*(37)*	*(1.8%)*
Trans States Airlines (Delta Connection)	*12,660*	-	-	-	-	-	-	-	-	-	-	-	-	-
MidAtlantic Express	-	-	-	-	380	-	-	-	-	-	-	-	-	-
Midwest/Republic	-	-	-	-	-	-	-	-	244	1,729	258	-	(258)	(100.0%)
Northwest Airlink Subtotal	-	-	-	-	1,300	5,034	3,912	3,547	3,839	4,601	-	-	-	-
Compass Airlines (Northwest Airlink)	-	-	-	-	-	-	-	-	*1,631*	*2,384*	-	-	-	-
Pinnacle Airlines (Northwest Airlink)	-	-	-	-	*1,300*	*5,034*	*3,912*	*3,547*	*2,208*	*2,217*	-	-	-	-
United Express Subtotal	-	-	-	1,038	2,036	3,178	4,416	2,832	1,587	1,618	2,802	2,763	(39)	(1.4%)
ACJet (United Express)	-	-	-	*1,038*	*1,038*	-	-	-	-	-	-	-	-	-
Air Wisconsin (United Express)	-	-	-	-	*801*	*1,699*	-	-	-	-	-	-	-	-
Atlantic SE (United Express)	-	-	-	-	-	-	-	-	-	-	*574*	*6*	*(568)*	*(99.0%)*
Chautauqua Airlines (United Express)	-	-	-	-	-	*103*	-	*484*	*598*	*642*	-	-	-	-
Mesa Airlines (United Express)	-	-	-	-	*145*	*1,376*	*3,806*	*2,348*	*989*	*797*	*434*	*258*	*(176)*	*(40.6%)*
Shuttle America (United Express)	-	-	-	-	-	-	-	-	-	*179*	*1,561*	*1,941*	*380*	*24.3%*
Trans States Airlines (United Express)	-	-	-	-	*52*	-	*610*	-	-	-	*233*	*558*	*325*	*139.5%*
US Airways Express Subtotal	50,170	46,770	32,893	26,946	25,920	27,478	26,945	26,858	26,216	21,842	19,502	18,870	(632)	(3.2%)
Air Wisconsin (US Airways Express)	-	-	-	-	-	*174*	*1,381*	*7,289*	*7,551*	*7,590*	*6,266*	*6,499*	*233*	*3.7%*
Allegheny (US Airways Express)	*9,537*	*13,274*	*7,728*	*3,877*	*1,789*	-	-	-	-	-	-	-	-	-
Chautauqua Airlines (US Airways Express)	*0*	*12,493*	*11,888*	*8,650*	*8,899*	*7,852*	*8,954*	*3,117*	*907*	*1,597*	*3*	-	*(3)*	*(100.0%)*
Colgan Air (US Airways Express)	*11,390*	*17,612*	*13,277*	*12,806*	*11,546*	*12,583*	*13,088*	*14,004*	*11,906*	*8,368*	*9,256*	*8,302*	*(954)*	*(10.3%)*
Commutair (US Airways Express)	*25,774*	-	-	-	-	-	-	-	-	-	-	-	-	-
Mesa Airlines (US Airways Express)	*3,469*	-	-	*564*	*401*	*4*	*16*	*72*	-	-	-	-	-	-
MidAtlantic Express (US Airways Express)	-	-	-	-	-	*150*	*130*	*40*	-	-	-	-	-	-
Piedmont Airlines (US Airways Express)	-	-	-	-	*1,529*	*3,165*	*2,870*	*1,496*	*1,327*	*1,117*	*963*	*1,325*	*362*	*37.6%*
PSA (US Airways Express)	-	-	-	-	-	*526*	*246*	*109*	*2*	*2*	*2*	*5*	*3*	*150.0%*
Republic (US Airways Express)	-	-	-	-	-	*46*	*260*	*731*	*4,523*	*3,168*	*3,012*	*2,739*	*(273)*	*(9.1%)*
Trans States Airlines (US Airways Express)	-	*3,391*	-	*1,049*	*1,756*	*2,978*	-	-	-	-	-	-	-	-
												-	-	-
Non-Scheduled Operations (Incl. Charter)	**1,008**	**769**	**609**	**467**	**423**	**325**	**369**	**570**	**582**	**412**	**501**	**507**	**6**	**1.2%**
Total Domestic Operations	**395,042**	**377,103**	**317,034**	**296,827**	**324,294**	**328,519**	**329,948**	**323,463**	**303,202**	**292,208**	**298,117**	**299,470**	**1,353**	**0.5%**

Note: Excludes general aviation and all-cargo operations.
Source: Massport

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	2010-2011 Change	2010-2011 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**	**22,965**	**2,194**	**10.6%**
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	33	3.0%
Aeromexico	-	-	-	-	649	534	210	131	-	-	-	-	-	-
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	230	5.9%
Air France	1,046	1,118	1,250	1,306	1,362	1,334	1,207	957	902	911	995	1,013	18	1.8%
Air Jamaica	-	443	617	610	662	349	-	-	-	-	-	-	-	-
Air One	-	-	-	-	-	-	-	-	140	-	-	-	-	-
Alitalia	729	707	724	690	894	986	810	886	667	638	624	604	(20)	(3.2%)
American Airlines	4,657	5,097	5,237	5,415	5,175	4,672	4,824	4,700	4,115	3,167	2,422	2,149	(273)	(11.3%)
Astraeus	-	-	-	-	-	-	-	-	-	-	-	100	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	79	3.8%
Canadian Airlines	417	-	-	-	-	-	-	-	-	-	-	-	-	-
Delta Air Lines	733	1,345	1,022	724	736	749	851	829	848	781	1,614	3,280	1,666	103.2%
Finnair	-	-	-	-	-	44	49	66	48	47	-	-	-	-
FlyGlobespan	-	-	-	-	-	-	-	225	-	-	-	-	-	-
Iberia Airlines	-	-	-	-	-	-	-	304	466	500	435	445	10	2.3%
Icelandair	726	696	834	882	892	811	807	869	821	777	816	928	112	13.7%
JetBlue	-	-	-	-	-	-	555	1,363	1,839	2,293	2,262	3,165	903	39.9%
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	77	4.6%
Northwest Airlines	744	729	738	732	730	727	734	1,081	1,438	1,154	61	-	(61)	(1)
Olympic Airways	256	166	-	-	-	-	-	-	-	-	-	-	-	-
Sabena	724	596	-	-	-	-	-	-	-	-	-	-	-	-
SATA International Airlines	-	-	-	-	-	315	334	393	360	372	403	400	(3)	(0)
SWISS International	926	1,152	728	718	714	704	708	727	722	664	720	725	5	0.7%
TACA	-	-	-	220	363	327	236					-	-	-
TACV - Cabo Verde	-	-	-	53	157	154	139	165	154	210	240	236	(4)	(0)
TAP - Air Portugal	200	-	-	-	-	-	-	-	-	-	-	-	-	-
Trans World Airlines	-	1,283	-	-	-	-	-	-	-	-	-	-	-	-
United Airlines	728	840	722	-	-	-	-	-	-	-	-	-	-	-
US Airways	-	-	-	732	2,048	1,607	1,208	1,133	1,155	1,722	667	49	(618)	(1)
VG Airlines	-	-	164	-	-	-	-	-	-	-	-	-	-	-
Virgin Atlantic Airways	721	722	727	724	860	724	727	732	730	735	707	721	14	2.0%
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**	**(341)**	**(2.7%)**
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	(262)	(3.7%)
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	(274)	(11.0%)
Delta Connection Subtotal	2,531	2,945	4,365	4,458	3,418	3,355	2,534	3,663	981	865	81	1	(80)	(98.8%)
ACJet (Delta Connection)	-	*2,746*	*4,365*	*4,458*	*1,688*	-	-	-	-	-	-	-	-	-
Big Sky Airlines (Delta Connection)	-	-	-	-	-	-	-	*1,468*	-	-	-	-	-	-
Comair Airlines (Delta Connection)	*2,531*	*199*	-	-	*1,730*	*3,355*	*2,534*	*2,195*	*981*	*865*	*81*	*1*	*(80)*	*(1)*
Porter Airlines	-	-	-	-	-	-	-	-	-	615	2,868	3,143	275	9.6%
Non-Scheduled Operations	**2,141**	**1,892**	**1,184**	**1,313**	**1,467**	**1,068**	**727**	**527**	**375**	**320**	**305**	**300**	**(5)**	**(0)**
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**	**35,418**	**1,848**	**5.5%**

Note: Excludes general aviation and all-cargo operations.
Source: Massport

Table E-4 Logan Airport Scheduled Passenger Departures by Destination

Destination Airport	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2010-2011 Change	2010-2011 Percent Change
Domestic		**210,068**	**203,552**	**160,351**	**148,451**	**165,106**	**163,684**	**164,985**	**163,366**	**152,511**	**146,993**	**149,962**	**152,303**	**2,341**	**1.6%**
New York La Guardia	LGA	11,872	11,608	11,733	13,311	13,709	13,350	12,608	12,579	12,321	11,574	11,705	11,489	(216)	(1.8%)
Washington National	DCA	8,474	9,899	8,198	9,809	10,572	10,680	9,574	9,594	9,267	9,597	9,419	9,793	374	4.0%
Philadelphia	PHL	11,785	10,454	8,947	8,881	8,942	7,014	7,095	6,442	6,986	5,960	6,548	7,985	1,437	22.0%
Chicago O'Hare	ORD	10,063	9,388	8,228	8,019	8,446	7,412	7,244	7,422	7,152	7,092	7,403	7,635	232	3.1%
Baltimore	BWI	1,773	3,278	5,054	5,217	5,281	5,029	6,757	5,820	4,921	4,999	7,053	6,755	(298)	(4.2%)
New York J F Kennedy	JFK	9,899	6,500	5,621	4,435	4,070	4,985	8,832	8,473	7,925	8,103	7,054	5,969	(1,085)	(15.4%)
Atlanta	ATL	7,110	6,471	4,959	4,868	5,194	6,003	5,735	5,777	6,002	6,104	5,548	5,569	21	0.4%
New York Newark	EWR	5,206	8,484	7,244	6,818	5,612	5,626	5,590	4,278	4,004	3,717	3,666	4,608	942	25.7%
Charlotte	CLT	2,758	2,859	2,955	2,872	2,928	3,288	3,168	3,434	3,586	3,703	4,180	3,976	(204)	(4.9%)
Washington Dulles	IAD	8,625	4,486	2,438	2,293	6,201	6,139	6,792	5,417	4,519	4,386	4,625	3,910	(715)	(15.5%)
San Francisco	SFO	3,526	3,298	2,574	2,334	3,083	2,591	2,178	2,619	2,658	3,370	3,711	3,884	173	4.7%
Orlando	MCO	4,914	4,349	3,237	2,050	3,673	3,517	3,077	3,673	3,422	3,094	3,179	3,580	401	12.6%
Nantucket	ACK	5,022	4,646	4,386	3,469	4,406	3,452	3,624	3,501	3,844	3,336	3,884	3,382	(503)	(12.9%)
Pittsburgh	PIT	3,086	3,541	2,944	1,981	2,139	2,021	2,059	2,183	2,471	2,213	2,312	3,179	867	37.5%
Los Angeles	LAX	3,647	3,724	2,862	2,032	3,374	2,655	2,667	2,798	2,295	3,259	3,382	3,164	(218)	(6.5%)
Raleigh/Durham	RDU	3,775	4,622	4,376	3,609	4,106	4,110	4,050	4,322	4,062	4,232	3,259	2,867	(392)	(12.0%)
Martha's Vineyard	MVY	3,863	3,334	2,984	2,667	3,304	2,231	2,614	2,557	2,771	2,670	3,218	2,829	(389)	(12.1%)
Dallas/Fort Worth	DFW	5,002	4,742	4,102	3,817	4,362	3,544	3,442	3,155	3,069	2,917	2,938	2,781	(158)	(5.4%)
Denver	DEN	2,628	2,632	2,289	1,504	2,304	1,990	2,446	2,514	2,092	1,825	2,812	2,640	(172)	(6.1%)
Miami	MIA	2,068	1,864	1,913	2,024	2,183	2,072	2,099	1,946	2,196	2,190	2,238	2,555	317	14.2%
Fort Lauderdale/Hollywood	FLL	3,327	3,049	1,845	1,851	2,691	3,065	2,607	2,610	2,811	1,972	2,370	2,517	147	6.2%
Detroit	DTW	2,937	2,778	2,512	2,664	2,907	2,827	2,887	2,850	2,397	2,322	2,353	2,437	85	3.6%
Buffalo	BUF	950	1,320	1,391	1,282	1,329	1,226	2,101	2,994	2,395	2,327	2,181	2,183	1	0.1%
Albany	ALB	3,433	3,532	1,253	1,084	1,387	1,073	660	1,254	533	711	647	2,180	1,533	236.8%
Provincetown	PVC	2,023	2,054	1,687	1,794	2,169	1,659	2,066	2,277	2,495	1,767	2,410	2,086	(325)	(13.5%)
Minneapolis	MSP	3,078	3,033	2,532	2,238	2,009	1,791	1,696	1,678	1,730	1,878	1,927	2,031	104	5.4%
Milwaukee	MKE	1,189	1,166	1,153	1,350	1,839	2,182	1,668	1,695	1,735	1,889	2,213	1,941	(273)	(12.3%)
Phoenix	PHX	1,386	1,089	944	962	792	944	1,325	1,277	1,072	1,230	1,348	1,895	547	40.6%
Chicago Midway	MDW	868	1,080	975	1,157	1,198	1,339	1,131	1,086	363	834	1,756	1,751	(5)	(0.3%)
Houston Intercontinental	IAH	1,995	2,091	1,734	1,665	1,569	1,752	1,856	1,913	1,809	1,749	1,717	1,697	(20)	(1.2%)
Fort Myers	RSW	949	1,034	778	844	1,064	1,525	1,610	1,693	1,675	1,485	1,587	1,620	33	2.1%
Richmond	RIC	1,537	2,542	1,912	1,856	1,678	1,404	1,557	1,599	1,499	1,387	1,431	1,525	95	6.6%
Lebanon	LEB	-	256	-	-	-	-	-	-	366	2,190	1,734	1,460	(274)	(15.8%)
West Palm Beach	PBI	1,674	1,758	912	1,079	1,348	1,126	1,486	1,479	1,714	1,518	1,450	1,380	(70)	(4.8%)
Cleveland	CLE	2,797	1,699	1,395	1,243	1,263	1,260	1,313	1,387	1,460	1,377	1,369	1,326	(43)	(3.1%)
Cincinnati	CVG	2,235	2,555	2,633	2,591	2,724	2,637	2,012	2,012	2,010	1,876	1,364	1,308	(56)	(4.1%)
Rockland	RKD	1,152	1,164	1,126	1,074	1,360	1,374	1,356	1,268	899	1,279	1,301	1,279	(22)	(1.7%)
Tampa	TPA	2,502	2,128	1,158	1,133	1,743	1,946	1,776	1,819	1,752	1,464	1,246	1,255	9	0.7%
Augusta	AUG	584	591	630	599	392	621	600	617	658	991	1,000	1,187	187	18.8%

Table E-4 Logan Airport Scheduled Passenger Departures by Destination

Destination Airport	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2010-2011 Change	2010-2011 Percent Change
Saranac Lake	SLK	-	-	-	27	275	800	939	544	1,021	1,095	1,174	1,157	(17)	(1.5%)
Rutland	RUT	1,259	1,016	978	930	627	643	626	704	1,098	1,095	1,095	1,148	53	4.9%
Columbus	CMH	2,708	2,958	2,356	2,270	2,083	2,114	1,792	1,828	1,555	1,269	972	1,048	75	7.8%
Hyannis	HYA	2,274	2,041	1,810	1,442	1,852	1,059	995	1,177	966	1,095	1,165	1,047	(118)	(10.1%)
Bar Harbor	BHB	1,196	1,148	1,280	1,220	1,374	1,154	1,179	1,176	1,122	744	815	1,030	215	26.4%
Memphis	MEM	972	1,004	621	365	702	1,034	1,051	1,007	893	984	1,048	1,029	(18)	(1.7%)
Seattle/Tacoma	SEA	458	448	550	989	999	610	914	975	998	927	1,001	993	(9)	(0.9%)
Presque Isle	PQI	1,835	1,714	1,204	1,232	1,028	1,017	1,017	1,004	993	991	991	991	-	0.0%
Indianapolis	IND	765	1,096	1,012	969	1,142	2,076	1,860	1,833	1,821	1,813	1,121	977	(144)	(12.8%)
Syracuse	SYR	3,876	3,424	1,404	1,369	1,337	1,762	1,143	1,121	972	991	991	964	(26)	(2.7%)
Las Vegas	LAS	1,098	844	750	1,109	1,474	1,679	1,761	1,725	1,399	1,060	756	904	148	19.6%
Plattsburgh International	PBG	-	-	-	-	-	-	-	27	969	1,095	1,025	899	(127)	(12.3%)
Rochester	ROC	3,644	2,433	1,242	991	985	1,181	1,563	1,264	1,115	1,109	908	886	(22)	(2.4%)
St. Louis	STL	2,187	2,256	1,825	1,660	1,678	1,461	1,520	1,089	876	857	934	713	(221)	(23.7%)
Harrisburg	MDT	1,307	1,034	991	917	932	886	742	685	728	630	551	574	22	4.0%
Newport News	PHF	-	-	-	-	428	671	949	945	723	660	549	549	-	0.0%
Jacksonville	JAX	-	424	-	-	-	428	721	712	666	348	365	544	179	49.0%
Kansas City	MCI	597	556	304	64	-	241	514	715	637	287	313	536	223	71.2%
San Diego	SAN	366	566	266	330	306	365	365	549	610	592	571	535	(35)	(6.2%)
Norfolk	ORF	838	1,073	1,052	1,039	1,347	1,032	704	647	256	-	-	511	511	-
Akron/Canton	CAK	-	-	-	-	428	730	726	575	458	488	475	488	13	2.8%
Portland	PDX	-	-	-	-	-	-	-	122	366	365	352	440	88	25.0%
Salt Lake City	SLC	1,094	1,095	1,091	846	728	730	708	721	710	704	669	438	(231)	(34.5%)
Austin	AUS	-	171	-	-	-	-	352	365	366	365	365	365	-	0.0%
Myrtle Beach	MYR	105	104	95	118	135	265	267	730	627	457	365	365	-	0.0%
Atlantic City Pomona Field	ACY	-	106	-	134	17	-	-	-	-	245	536	326	(210)	(39.1%)
New Orleans	MSY	-	-	-	61	244	191	-	4	254	339	348	304	(44)	(12.6%)
Long Beach	LGB	-	-	-	-	692	853	840	813	737	647	459	296	(163)	(35.5%)
San Jose	SJC	842	1,034	623	669	406	245	365	365	248		232	292	60	25.8%
Sarasota/Bradenton	SRQ	-	-	-	-	-	30	34	8	26	21	82	242	160	194.3%
Oakland	OAK	-	-	-	-	490	853	813	518	511	488	195	105	(90)	(46.0%)
Allentown/Bethlehem	ABE	780	617	591	150	-	626	777	417	103	-	-	-	-	-
Bangor	BGR	6,644	5,537	4,885	3,706	3,195	2,946	2,529	2,447	1,092	555	-	-	-	-
Binghamton	BGM	-	131	-	-	-	-	-	-	-	-	-	-	-	-
Burlington	BTV	5,913	6,724	2,141	1,582	1,098	1,632	930	452	120	-	-	-	-	-
Charleston	CHS	-	-	-	-	13	61	288	382	178	92	-	-	-	-
Columbia	CAE	-	304	153	90	-	-	-	-	-	-	-	-	-	-
Dayton	DAY	-	-	-	-	-	-	96	270	-	-	-	-	-	-
Elmira/Corning	ELM	441	1,097	78	-	-	-	-	-	-	-	-	-	-	-
Greensboro	GSO	415	995	729	678	1,177	1,120	656	600	178	-	-	-	-	-

Table E-4 Logan Airport Scheduled Passenger Departures by Destination

Destination Airport	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2010-2011 Change	2010-2011 Percent Change
Hartford	BDL	-	360	-	-	-	-	-	-	-	-	-	-	-	-
Islip	ISP	4,222	3,694	1,555	1,056	1,042	1,581	1,190	1,030	649	-	-	-	-	-
Ithaca	ITH	872	790	207	-	-	-	-	-	-	-	-	-	-	-
Louisville	SDF	-	-	-	-	-	-	-	122	86	-	-	-	-	-
Manchester	MHT	-	-	-	-	-	-	-	-	73	-	-	-	-	-
Massena	MSS	-	-	-	-	-	-	-	-	29	-	-	-	-	-
Nashville	BNA	642	1,025	678	-	-	-	319	422	158	-	-	-	-	-
Plattsburgh	PLB	-	-	-	-	-	-	-	26	-	-	-	-	-	-
Portland (ME)	PWM	6,267	5,943	3,953	2,107	1,569	1,394	-	4	-	-	-	-	-	-
Providence	PVD	91	51	-	-	-	-	-	-	-	-	-	-	-	-
Savannah	SAV	-	-	-	-	43	78	279	348	143	-	-	-	-	-
Trenton	TTN	-	-	-	-	-	-	62	943	154	-	-	-	-	-
Watertown	ART	-	-	-	-	-	-	-	707	154	-	-	-	-	-
Westchester County	HPN	6,065	4,379	2,311	1,857	1,908	2,256	2,046	1,233	741	-	-	-	-	-
Wilkes-Barre Scranton	AVP	584	261	-	-	-	420	-	-	-	-	-	-	-	-
International		**23,711**	**24,304**	**20,131**	**19,786**	**19,970**	**19,837**	**18,628**	**20,014**	**18,343**	**17,792**	**18,764**	**19,641**	**877**	**4.7%**
Toronto	YYZ	3,691	4,232	3,761	3,532	3,693	3,876	4,054	4,235	4,218	3,685	3,603	3,737	134	3.7%
London Heathrow	LHR	2,187	2,190	2,395	2,199	2,174	2,133	2,151	2,151	2,126	2,204	2,331	2,833	501	21.5%
Montreal Dorval	YUL	3,401	4,238	3,172	2,946	1,891	2,578	1,835	1,959	2,021	1,863	2,008	2,021	13	0.6%
Toronto Island Apt	YTZ	-	-	-	-	-	-	-	-	-	370	1,535	1,687	151	9.9%
San Juan	SJU	1,750	1,604	1,242	1,351	1,515	1,237	1,290	1,413	1,244	1,024	1,294	1,130	(163)	(12.6%)
Paris De Gaulle	CDG	898	1,004	949	845	868	853	788	671	634	632	710	946	236	33.2%
Halifax	YHZ	3,210	2,385	2,073	2,459	2,271	1,891	1,605	1,622	1,164	1,091	852	744	(108)	(12.7%)
Ottawa	YOW	2,575	2,025	935	907	928	864	875	931	945	878	744	696	(48)	(6.5%)
Amsterdam	AMS	366	365	365	365	366	365	365	549	719	569	457	553	96	21.0%
Frankfurt	FRA	580	579	553	539	563	575	545	549	580	541	548	544	(4)	(0.8%)
Bermuda	BDA	550	549	549	689	580	518	514	685	656	506	532	540	8	1.6%
Reykjavik Keflavik Apt	KEF	393	361	348	344	353	361	361	418	414	396	404	531	127	31.4%
Dublin	DUB	223	279	26	214	113			231	314	313	348	457	109	31.2%
Aruba	AUA	9	182	174	169	274	338	282	304	344	475	407	426	19	4.7%
Zurich	ZRH	523	618	391	353	357	356	361	361	366	335	365	365	-	0.0%
Munich	MUC	-	-	193	235	214	210	214	214	266	335	313	335	22	7.0%
Rome Leonardo Da Vinci-Fiu	FCO	-	-	-	-	88	135	79	79	258	326	313	314	0	0.1%
Santo Domingo	SDQ	-	62	136	200	192	174	161	170	87	144	305	275	(30)	(9.8%)
Cancun	CUN	-	44	-	104	305	207	70	209	287	326	307	270	(38)	(12.3%)
Madrid	MAD	-	-	-	-				157	219	248	218	231	13	6.0%
Ponta Delgada	PDL	30	-	-	-	61	39	110	148	127	170	165	170	4	2.7%
Nassau	NAS	-	113	-	-	69	100	428	211	234	185	180	134	(46)	(25.8%)

Table E-4 Logan Airport Scheduled Passenger Departures by Destination

Destination Airport	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2010-2011 Change	2010-2011 Percent Change
Praia	RAI	-	-	-	-	-	9	78	83	74	109	121	122	0	0.4%
Shannon	SNN	366	365	562	374	436	737	795	383	366	339	213	118	(95)	(44.7%)
Saint Thomas	STT	78	199	121	134	104	108	116	99	82	121	125	117	(9)	(6.8%)
Santiago	STI	-	-	-	-	-	-		31				92	92	-
Punta Cana	PUJ	-	-	-	-	-	-	17	13	13	164	95	92	(4)	(4.0%)
Montego Bay	MBJ	-	295	313	291	514	238	39	47	43	103	126	52	(74)	(58.7%)
Saint Maarten	SXM		-	-	-	-	-				61	39	43	4	10.9%
Lisbon	LIS	44	-	-	-	-	-	26	35	31	26	26	26	-	0.0%
Providenciales	PLS	4	22	22	30	43	43	47	39	17	100	39	26	(12)	(31.9%)
Terceira	TER	44	-	-	-	-	-	13	17	17	17	17	17	-	0.0%
Athens	ATH	74	30	-	-	-	-	-	-	-	-	-	-	-	-
Brussels	BRU	362	365	119	-	-	-	-	-	-	-	-	-	-	-
Charlottetown	YYG	-	-	-	-	-	-	-	62	92	83	-	-	-	-
Connaught	NOC	-	-	-	-	-	-	-	44	-	-	-	-	-	-
Fredericton	YFC	-	-	-	306	732	686	365	579	62	-	-	-	-	-
Freeport	FPO	-	-	-	17	-	-	-	-	-	-	-	-	-	-
Gander	YQX	-	-	4	-	-	-	-	-	-	-	-	-	-	-
Glasgow	GLA	-	-	-	-	-	-	-	79	-	-	-	-	-	-
Grand Cayman	GCM	-	-	-	-	-	31	43	13	44	26	17	-	(17)	(100.0%)
Helsinki	HEL	-	-	-	-	-	-	-	-	26	26	-	-	-	-
Ilha Do Sal	SID	-	-	-	13	22	56	-	-	-	-	-	-	-	-
Las Palmas	LPA	-	-	-	-	-	-	-	13	-	-	-	-	-	-
Lerwick Sumburgh Apt	LSI	-	-	-	-	31	-	-	-	-	-	-	-	-	-
London Gatwick	LGW	362	518	147	-	-	-	-	-	-	-	-	-	-	-
Manchester	MAN	26	-	-	-	184	241	244	214	-	-	-	-	-	-
Mexico City	MEX	-	-	-	-	331	234	52	17	-	-	-	-	-	-
Milan Malpensa	MXP	366	365	365	361	362	343	335	361	192	-	-	-	-	-
Nykoping	NYO	-	-	-	-	-	31	-	-	-	-	-	-	-	-
Port Au Prince	PAP	-	-	22	62	56	-	-	-	-	-	-	-	-	-
Puerto Plata	POP	4	17	-	-	-	-	-	-	-	-	-	-	-	-
Quebec	YQB	1,229	935	813	486	-	30	214	579	62	-	-	-	-	-
San Salvador	SAL	-	-	79	165	187	178	130	-	-	-	-	-	-	-
Sao Vicente	VXE	-	-	-	-	-	-	-	-	-	-	4	-	(4)	(100.0%)
Stockholm Arlanda	ARN	-	-	-	-	-	-	-	26	39	-	-	-	-	-
Vancouver	YVR	366	365	304	95	92	62	-	-	-	-	-	-	-	-
Total Scheduled Carrier Operation		**233,779**	**227,856**	**180,482**	**168,237**	**185,076**	**183,520**	**183,612**	**183,380**	**170,854**	**164,784**	**168,726**	**171,945**	**3,219**	**1.9%**

Source: OAG Schedules.

Logan Airport Activity Forecast Methodology and Assumptions

Introduction

The Massachusetts Port Authority (Massport) developed high-level strategic planning forecasts for Logan Airport, Worcester Regional Airport and Hanscom Field in 2011. These forecasts serve as the basis for Massport's airport and ground transportation planning initiatives and analyses of future environmental impacts. The base year for the forecasts was 2010 and the forecast years were 2015, 2020 and 2030. Three forecast scenarios were developed for Logan Airport: Low, Moderate and High. The scope of the strategic planning forecast for Logan Airport included projections of passengers (domestic and international), cargo and aircraft operations (scheduled passenger, all cargo, charter and general aviation [GA]). The Moderate forecast scenario prepared for Logan Airport serves as the basis for the planning, ground traffic and environmental impacts analyses in the *2011 Environmental Status and Planning Report* (*2011 ESPR*). Based on the 2030 Moderate forecast scenario, derivative forecasts were developed to support the air quality, noise, and vehicle miles traveled (VMT) analyses for the *2011 ESPR*. The derivative forecasts include the aircraft fleet mix, average daily operations by aircraft type and stage length, and peak month, busy day, activity.

Summary

The following table is a summary of the 2011 actual and 2030 forecast Logan Airport passengers, cargo, and aircraft operations. Logan Airport's total enplaning plus deplaning passengers are forecast to increase by 1.7 percent annually and to reach 39.8 million in 2030. Logan Airport's domestic cargo is forecast to increase by 2.6 percent annually, slightly faster than the local Massachusetts economy, which is forecast to increase at approximately 2.1 percent per year.

Table E-5 Actual and Forecast Logan Airport Passengers, Cargo, and Aircraft Operations, 2011 and 2030

Category	2011 Actual	2030 Forecast	Average Annual Growth (2011-2030)
Passengers	28,907,938	39,831,471	1.7%
Cargo (pounds)	529,212,783	866,880,603	2.6%
Operations (Passengers)	334,487	438,764	31%
Operations (All-Cargo)	6,270	7,636	21.8%
Operations (GA)	28,230	26,908	(0.3%)

Source: Massport
Note: Numbers in parenthesis () indicate negative number.

Massport Planning Forecasts for Logan Airport

Passengers

The region's economic growth is the primary driver of future air passenger growth at Logan Airport. The Airport serves the seventh largest metropolitan area in the nation. Residents of the Boston metropolitan area have above average incomes and a high propensity for personal and business-related airline travel. Since no airline maintains a connecting hub operation at the Airport, Logan Airport is principally an origin-destination airport. Future passenger levels are therefore largely determined by underlying market demand and are not dependent on airline connecting passengers that transfer from one flight to another.

The price of airline travel, which is inversely related to passenger growth, is another factor that affects passenger demand over the long-term. Real increases in the price of travel airline (i.e., adjusted for inflation) tend to dampen growth in airport passenger levels. Conversely, price reductions may lead to passenger growth as lower prices entice more people to travel. In the current and foreseeable future operating climate, the price of airline travel is strongly linked to fuel prices.

Historically, changes in air service levels and airfares at the closest regional airports, T.F. Green Airport and Manchester-Boston Regional Airport, have also had an impact on traffic levels at Logan Airport. From 1995 to 2002, Logan Airport's share of regional passengers began declining when Southwest Airlines introduced new non-stop services and lower airfares into the T.F. Green and Manchester markets, in 1996 and 1998, respectively. Traffic at Logan Airport grew more slowly than traffic at the regional airports, and Logan Airport's share of the combined three airport market declined from 89 percent in 1995 to 72 percent in 2002. During this period, Logan Airport had very limited services from low-cost carriers (LCCs) and a distinct fare disadvantage in many markets compared to T.F. Green Airport and Manchester-Boston Regional Airport, coupled with the Central Artery/Tunnel project, which hampered Logan Airport's accessibility for many passengers in the region. However, the major portions of Central Artery/Tunnel project were completed in 2004 and LCC services grew rapidly at Logan Airport after the entry of JetBlue Airways in 2004. Following the run-up in fuel prices and the 2008/2009 economic recession, airlines began sharply curtailing services at smaller secondary airports, including T.F. Green Airport and Manchester-Boston Regional Airport. As a result Logan Airport's passenger share climbed from a low of 72 percent to 81 percent in 2011. Over the forecast period, Logan Airport's percent share of the combined passengers at the three airports is assumed to increase slightly over the short-term to approximately 84 percent and then remain stable over the remainder of the forecast period.

The underlying forecast assumptions for long-term economic growth and changes in fuel prices and airline fares are summarized in Table E-6. Total personal income for Massachusetts is assumed to increase at an average annual rate of 2.1 percent (excluding the effects of inflation) through 2030. The price of crude oil, the chief raw input for jet fuel, is forecast to increase to $123 per barrel in 2030, which in turn is assumed to increase the price of airline travel (measured in terms of airline yield, or ticket revenue per passenger mile flown) by 0.5 percent per year (excluding the effects of inflation).

Table E-6 Passenger Forecast Assumptions	
Input	**Assumption**
Massachusetts Personal Income[1]	2.1%
2030 Price of Oil per Barrel[2]	$123
Real Airline Yields[3]	0.5%

Source: ICF SH&E
1 Massachusetts personal income is adjusted for inflation and represents the average annual change 2010 to 2030.
2 In 2009 dollars.
3 Average annual change 2010 to 2030.

Logan Airport's total enplaning plus deplaning passengers are forecast to increase by 1.7 percent annually and to reach 39.8 million in 2030. Domestic passengers are forecast to grow by 1.4 percent per year, while international passengers are forecast to grow at a faster pace of 3.5 percent per year. Although international passenger traffic is forecast to grow more rapidly, domestic passengers represent more than 80 percent of the Airport's forecast passengers in 2030.

Europe, one of Logan Airport's most mature international market segments, is forecast to grow at 2.9 percent per year. Passenger travel to and from Canada, another mature market, is forecast to remain relatively flat over the forecast period. Above average annual growth of 6.1 percent is forecast for the Caribbean market. More than a half million passengers are forecast for Asia and Latin America as a result of projected new nonstop services.

GA passenger traffic, which declined sharply during the 2008/2009 economic recession, and began a robust recovery in 2011, is forecast to remain relatively stable over the forecast period at approximately 108,000 annual passengers.

Table E-7 Actual and Forecast Logan Airport Passengers, Moderate Scenario, 2011 and 2030

Passengers	2011	2030	Average Annual Growth (2011 -2030)
Scheduled/Charter			
Domestic	**24,831,068**	**32,137,828**	**1.4%**
International			
Europe/ Middle East	2,939,226	5,087,299	2.9%
Canada	573,660	568,805	0.0%
Bermuda/ Caribbean	447,650	1,390,216	6.1%
Asia/Pacific	0	409,877	-
Central/South America	1,918	129,769	24.8%
Subtotal International	3,962,454	7,585,965	3.5%
Total Scheduled/Charter	28,793,522	39,723,793	1.7%
General Aviation	**114,416**	**107,678**	**(0.3%)**
Total Passengers	**28,907,938**	**39,831,471**	**1.7%**

Source: Massport
Notes: Massport's forecast planning range is 35.2 million passengers in the Low scenario and 44.4 million passengers in the High scenario.
Numbers in parenthesis () indicate negative number.

Cargo

Cargo shipments handled at Logan Airport consist of heavy freight and express/small packages. The domestic market accounts for three-quarters of the cargo shipments at Logan Airport. Domestic cargo growth is closely tied to local and national economic growth. At Logan Airport, domestic cargo is forecast to increase by 2.6 percent annually, slightly faster than the local Massachusetts economy, which is forecast to increase at approximately 2.1 percent per year. Approximately 83 percent of the domestic cargo at Logan Airport is carried by all-cargo airlines, primarily FedEx and United Parcel Service (UPS). Over the forecast period, the share of Logan Airport's cargo that is carried in all-cargo aircraft is assumed to increase to 86 percent in 2030, consistent with the Federal Aviation Administration's (FAA) assumption that all-cargo airlines will increase their share of the national domestic cargo market over the next twenty years. International cargo, which accounts for 24 percent of Logan Airport's cargo shipments, is primarily carried in the belly compartments of international passenger aircraft and is a key contributor to the profitability of long-haul international passenger services. Future growth in international cargo is assumed to increase in proportion to the growth in international wide-body aircraft capacity at Logan Airport.

The total volume of cargo at Logan Airport is forecast to increase by 2.6 percent per year from 529 million pounds in 2011 to 867 million pounds in 2030. International belly is forecast to grow the fastest at 3.2 percent per year primarily as a result of growth in wide-body belly capacity resulting from new, long-haul services. The Express/All-Cargo segment, which is dominated by FedEx and UPS, is projected to increase by 2.6 percent a year. Domestic belly, the smallest segment of Logan Airport's cargo market, is forecast to increase by just 1.6 percent per year.

Table E-8 Actual and Forecast Logan Airport Express/Freight (in pounds), 2011 and 2030

Type	2011	2030	Average Annual Growth (2011 -2030)
Domestic Belly	63,411,658	85,886,483	1.6%
International Belly	124,703,017	228,401,997	3.2%
Express All-Cargo	341,098,108	552,592,123	2.6%
Total	**529,212,783**	**866,880,603**	**2.6%**

Source: Massport
Note: Massport's forecast planning range is 816 million pounds in the Low scenario and 927 million pounds in the High scenario.

Aircraft Operations

In 2011, Logan Airport accommodated 28.9 million passengers, approximately 4 percent more passengers than in 2000, but with 119,000 fewer aircraft operations. The decline in aircraft operations over the last decade resulted from sharp reductions in the number of small aircraft flights (i.e., turboprops with 19 to 40 seats and regional jets [RJ] with less than 50 seats), increasing aircraft load factors, and fewer GA flights. These factors, however, are not expected to continue over the forecast period. Future declines in small aircraft flights (less than 50 seats) will not be as significant, airline consolidation and high fuel prices will encourage the use of larger aircraft, load factors are high and will only increase slightly, and GA has rebounded from the steep declines resulting from the 2008/2009 economic recession, and is expected to remain stable. (See aircraft fleet forecast section below and Figure E-1 for anticipated changes in the airline fleet mix between 2011 and 2030).

Average load factor and aircraft size assumptions are summarized in Table E-9. The average load factor for the North American market, the dominant market segment at Logan Airport, is assumed to increase slightly from 77 percent in 2011 to 79 percent in 2030. Similarly, average aircraft size for North America is assumed to increase from 104 to 105 seats over the forecast period.

Table E-9 Average Load Factors and Average Aircraft Size, 2011 and 2030

	Average Load Factors		Average Seats per Operation	
Region	**2011**	**2030**	**2011**	**2030**
North America	77%	79%	104	105
Europe	78%	82%	252	269
Asia	0%	80%	-	223
Latin America	-	79%	-	154

Source: ICF SH&E

As shown in Table E-10, Logan Airport's total aircraft operations are forecast to increase at an average annual rate of 1.3 percent from 2011 to 2030. Passenger operations with jet aircraft (less than 100 seats) will increase the fastest at 1.8 percent per year. RJ operations will remain relatively flat growing by just 0.3 percent per year. Non-jets will increase by 1.2 percent per year as larger turboprops are added to airline fleets. All-cargo operations are forecast to grow at 1.0 per year, more slowly than the forecast growth in cargo shipments (2.6 percent per year) as a result of cargo airlines sifting their fleets to higher capacity aircraft types. GA is forecast to remain relatively constant with a slight decline of 0.3 percent per year.

Table E-10 Actual and Forecast Logan Airport Aircraft Operations, 2011 and 2030

Operations	**2011**	**2030**	**Average Annual Growth (2011 -2030)**
Passenger			
Jet[1]	223,083	312,727	1.8%
Regional Jet[2]	61,704	65,480	0.3%
Non-Jet	49,700	61,982	1.2%
Subtotal	334,487	440,189	1.5%
All-Cargo	**6,270**	**7,636**	**1.0%**
General Aviation	**28,230**	**26,908**	**(0.3%)**
Total	**368,987**	**474,734**	**1.3%**

Source: Massport
Notes: Massport's forecast planning range is 418,000 operations in the Low scenario and 533,000 operations in the High scenario.
Numbers in parenthesis () indicate negative number.
1 Jets are aircraft with 100 or more seats.
2 Regional jets are aircraft with less than 100 seats.

Derivative Forecasts

Derivative forecasts based on the 2030 strategic planning forecasts were developed to support the air quality, noise and VMT analyses for the *2011 ESPR*. The derivative forecasts include:

- Annual operations by aircraft type (to support air quality modeling);
- Average daily arriving and departing flights by aircraft type and stage length (to support noise modeling); and
- Peak month, busy day, arriving and departing origin-destination passengers by hour (to support VMT modeling).

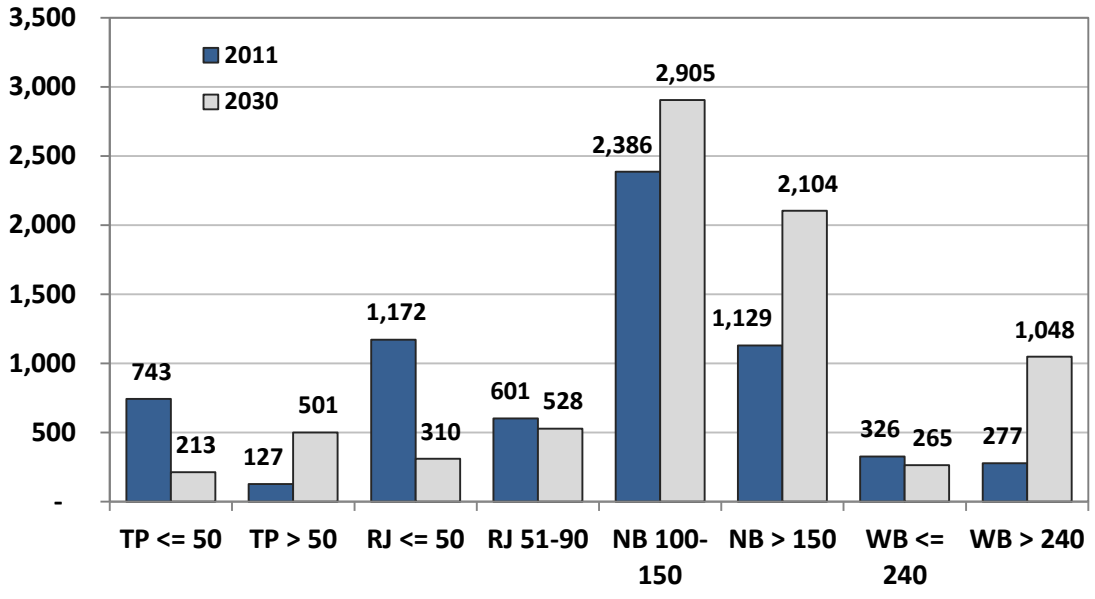
Aircraft Fleet Forecast

The 2030 operations forecast by specific aircraft type is based on anticipated changes in airline aircraft fleets from the ICF SH&E Maintenance Repair Overhaul (MRO) Model. The MRO Model contains a detailed worldwide airline fleet forecast which considers the current airline fleet, projected worldwide passenger and cargo demand, aircraft retirements, aircraft deliveries, conversions of passenger aircraft into all-cargo aircraft, and the introduction of new aircraft models.

Passenger Airlines

The actual 2011 and projected 2030 aircraft fleet mix for North American passenger airlines is shown in Figure E-1. The number of active small turboprops and RJs (less than 50 seats) in the North American fleet is expected to decline significantly from 1,915 aircraft in 2011 to 523 in 2030, as smaller aircraft and RJs continue to fall out of favor under high fuel price conditions. Some of the demand served by these smaller aircraft will be accommodated with larger turboprops (more than 50 seats), which are expected to increase by approximately 374 aircraft by 2030. Large RJs (51 to 90 seats) will fall only slightly from approximately 600 aircraft in 2011 to 528 in 2030. Small narrow-body jets, which account for 35 percent of the 2011 fleet, will increase by approximately 500 aircraft by 2030. The greatest increase in the North America passenger airline fleet will be in larger capacity aircraft, specifically large narrow-bodies (over 150 seats) and large wide-bodies (over 240 seats). The number of large narrow-bodies in the fleet will nearly double from approximately 1,100 in 2011 to 2,100 in 2030. The number of large wide-bodies (over 240 seats) will increase more than threefold from 277 in 2011 to more than 1,000 in 2030. Growth in the large wide-body category will be driven by growth in the long-haul international market, particularly international services at large United States (U.S.) airline connecting hub airports. Similar fleet mix trends are expected for European-based airlines, which dominate the international market at Logan Airport, with significant growth in small and large wide-body aircraft.

Figure E-1 Actual and Forecast North American Passenger Airline Aircraft Fleet, 2011 and 2030



Source: ICF SH&E, MRO Fleet Forecast, 2012 to 2031

Several new aircraft models that will enter the worldwide commercial aircraft fleet are assumed to be introduced into passenger airline service at Logan Airport over the forecast period. The next generation Boeing 737 aircraft, the 737 MAX 7/8/9s, will largely replace the 737-300/400/500s by 2030. Other new narrow-body

types include the Airbus 319 Neo (new engine option), Airbus 320 Neo and Bombardier C-Series 300. New wide-body models that are forecast to enter the Logan Airport fleet include the Boeing Dreamliner (787-8 and 787-9), Boeing 747-800 and Airbus 350. The new Airbus 380, which is classified as a very large aircraft with over 500 seats, is not projected to operate regularly at Logan Airport, although the Airport is classified as a diversion point for aircraft that need to make an emergency landing.

Table E-11 summarizes the existing 2011 and forecast 2030 aircraft fleet mix for scheduled passenger airlines at Logan Airport. Over the forecast period, it is assumed that Cape Air will continue to serve Cape Cod and Massachusetts Island markets, as well as small Essential Air Service markets, from Logan Airport with small piston powered aircraft (9 seats) as this is the ideal size aircraft for serving the seasonal Cape and Island markets and is critical to the carrier's business model. As such, Cape Air's piston operations are assumed to remain relatively constant over the forecast period.

Operations in small turboprops and RJs (with 50 or fewer seats) are forecast to decline, reflecting the decline in the number of small turboprops and regional jets in airline fleets. Overall, the percentage of operations with aircraft having 50 or fewer seats is forecast to decline from 22 percent in 2011 to 14 percent in 2030.

Activity in larger turboprops (over 50 seats) is forecast to increase as airlines add more of these types to their fleets. Increases are also projected for small and large narrow-bodies with a notable shift to large narrow-bodies (over 150 seats). In 2030, the large narrow-body category will account for approximately 20 percent of scheduled airline operations compared to 15 percent in 2011. Increases in wide-body aircraft operations are also projected to support growth in international air travel demand. Strong growth in the small wide-body category (240 or fewer seats), reflects the introduction of the Boeing 787 Dreamliner aircraft which are expected to open up new air services for Logan Airport to markets in Asia and the Middle East. The Dreamliner has an ideal seating capacity and operating capability for serving long-haul markets from Logan Airport.

Table E-11 Scheduled Passenger Airline Operations by Aircraft Category, Actual 2011 and Forecast 2030

Aircraft Category	Actual 2011 Operations	Percent of Total	Forecast 2030 Operations	Percent of Total	Percent Change (2011-2030)
Pistons	35,747	11%	35,989	8%	1%
TP <= 50 Seats	10,053	3%	8,497	2%	(15%)
TP > 50 Seats	4,335	1%	17,495	4%	304%
RJ <= 50 Seats	27,795	8%	17,495	4%	(37%)
RJ > 50 Seats	77,751	23%	47,986	11%	(38%)
NB <= 150 Seats	118,672	35%	199,940	46%	68%
NB > 150 Seats	49,184	15%	87,244	20%	77%
WB <= 240 Seats	2,146	1%	10,155	2%	373%
WB > 240 Seats	8,804	3%	13,963	3%	59%
Total	**334,487**	**100%**	**438,764**	**100%**	**31%**

Source: Massport and ICF SH&E.
Notes: Numbers in parenthesis () indicate negative number.
TP turboprop
RJ regional jet
NB narrow-body
WB wide-body

Cargo Airlines

FedEx and UPS dominate the cargo activity at Logan Airport accounting for three-quarters of all-cargo aircraft operations in 2011. The fleets of all-cargo carriers like FedEx and UPS primarily consist of passenger aircraft that have been retired from service and converted to cargo use. Cargo aircraft currently in use that will be retired over the forecast period include older, fuel inefficient models such as the Boeing 727 (narrow-body jet), DC-9 (narrow-body jet), and DC-10 (wide-body jet). These models will be replaced with models such as the MD-11 (wide-body), Boeing 767 (wide-body), Airbus 300-600 (wide-body) and Boeing 757 (narrow-body). Overall, cargo airlines are expected to move into larger capacity aircraft allowing them to accommodate growth by carrying more cargo per aircraft operation.

These cargo industry trends are reflected in the cargo airline fleet forecast for Logan Airport. While overall cargo demand is forecast to increase at a rate of 2.6 percent per year, all-cargo aircraft operations are forecast to increase at a slower rate of 1.0 percent per year. Table E-12 summarizes the base 2011 and forecast 2030 fleet mix for cargo airlines at Logan Airport.

Table E-12 Cargo Airline Operations by Aircraft Category, Actual 2011 and Forecast 2030

Aircraft Category	Actual 2011 Operations	Percent of Total	Forecast 2030 Operations	Percent of Total	Percent Change (2011-2030)
Narrow-body Jet	1,334	21.3%	2,032	26.6%	52.3%
Wide-body Jet	3,719	59.3%	5,300	69.4%	42.5%
Non-Jet	1,217	19.4%	304	4.0%	(75.0%)
Total	**6,270**	**100.0%**	**7,636**	**100.0%**	**21.8%**

Source: Massport and ICF SH&E.
Notes: Numbers in parenthesis () indicate negative number.

General Aviation

The future fleet mix for general aviation is based the current aircraft types in use at Logan Airport. The general aviation types that accounted for 90 percent of general aviation operations in 2011 were assumed to account for all of the forecast 2030 GA operations.

Table E-13 summarizes the 2030 forecast of Logan Airport operations by user type and aircraft type.

Table E-13 Forecast Logan Airport Operations by Aircraft Type, 2030

Category/ Aircraft Type	2030 Operations	Category/ Aircraft Type	2030 Operations
Scheduled + Charter Passenger Airlines		**Cargo Airlines**	
Airbus A319	35,153	Airbus A300-600	2,466
Airbus A319 Neo	3,999	Boeing 757-200	2,032
Airbus A320	33,523	Boeing 767-300/ER	300
Airbus A320 Neo	33,790	Cessna 208	304
Airbus A321	1,655	McDonnell Douglas MD-11	2,534
Airbus A321 Neo	3,525	**Subtotal**	**7,636**
Airbus A330-200	670		
Airbus A330-300	2,153	**General Aviation**	
Airbus A340-200	268	Beechcraft Beechjet 400	1,735
Airbus A340-300	268	Beechcraft Baron 58	384
Airbus A340-600	268	Beechcraft Bonanza 36	164
Airbus A350-800	1,475	Beechcraft King Air 90	158
Airbus A350-900	1,475	Beechcraft Super King Air 200	389
Boeing 737 MAX 7	11,956	Beechcraft Super King Air 300	194
Boeing 737 MAX 8	36,926	Beechcraft Super King Air 350	258
Boeing 737 MAX 9	7,243	Bombardier Canadair Challenger 600	908
Boeing 737-400	151	Bombardier Canadair Regional Jet 200	382
Boeing 737-700	21,261	Bombardier Challenger 300	858
Boeing 737-700 (Winglets)	5,838	Bombardier Global 5000	136
Boeing 737-800	26,502	Bombardier Global Express	302
Boeing 737-800 (Winglets)	5,333	Cessna Skylane 182	183
Boeing 737-900	5,233	Cessna Caravan 208	609
Boeing 747-400	670	Cessna Chancellor 414	298
Boeing 747-800	536	Cessna Citation Bravo	521
Boeing 757-200	1,003	Cessna Citation CJ3	411
Boeing 757-200 (Winglets)	419	Cessna Citation Excel	2,721
Boeing 767-300	2,480	Cessna Citation III	178
Boeing 767-400	432	Cessna Citation Sovereign	1,204
Boeing 777-300	2,183	Cessna Citation V	941
Boeing 787-8	7,290	Cessna Citation X	1,626
Boeing 787-9	4,021	Cirrus SR-22	342
Bombardier Canadair Regional Jet 200	12,937	Embraer EMB RJ135	177
Bombardier Canadair Regional Jet 700	10,202	Falcon 2000	984
Bombardier Canadair Regional Jet 900	10,288	Falcon 50, Mystère 50	388
Bombardier C Series 300	6,238	Falcon 900, Mystère 900	517
Cessna 402	35,989	Gulfstream IV	1,602
de Havilland DHC-8 Dash 8-100	1,572	Gulfstream V	821
de Havilland DHC-8 Dash 8-300	1,572	Hawker Beechcraft 4000	150
de Havilland DHC-8 Dash 8-400	17,495	IAI Gulfstream G150	213
Embraer 170	6,814	IAI Gulfstream G200	777
Embraer 175	20,682	Learjet 35	423
Embraer 190	48,586	Learjet 40	246
Embraer EMB RJ135	2,493	Learjet 45	530
Embraer EMB RJ145	2,064	Learjet 60	563
McDonnell Douglas MD-80	204	Piaggio P-180 Avanti	689
Saab SF 340A/340B	5,353	Pilatus PC-12 Eagle	1,509
Subtotal	**440,189**	Piper Saratoga	142
		Piper Seneca	134
		Raytheon Hawker 800	2,142
		Subtotal	**26,908**
		Grand Total	**474,734**

Source: ICF SH&E

Operations by Stage Length and Time-of-Day

A forecast of aircraft operations by stage length (the distance traveled by the aircraft) and time-of-day was also developed to support the analysis of noise conditions in 2030. Airline schedules for February (off-peak) and August (peak) of 2012 were analyzed and reviewed to develop assumptions for future scheduled passenger airline operations by aircraft type and stage length. Adjustments were made to account for greater use of large wide-bodies on long-haul domestic routes and the introduction of new long-haul international services by 2030.

Specific assumptions for North American and long-haul international operations are summarized in Tables E-14 and E-15. More than half of forecast North American scheduled passenger operations have stage lengths less than 500 nautical miles. One-quarter of the operations are assumed to have stage lengths of 501 to 1,000 nautical miles and 23 percent are assumed to be over 1,000 nautical miles. Long-haul international operations are dominated by flights to/from Europe; consequently nearly three-quarters of the long-haul international operations have stage lengths of 2,501 to 3,500 nautical miles.

Table E-14 Stage Length Assumptions, North American Scheduled Passenger Airline Operations (2030)

Stage Length (nm)	Pistons	TP <= 50	TP > 50	RJ <= 50	RJ 51-90	NB 100-150	NB> 150	Total	Percent of Total
0 to 500	35,989	8,497	17,495	16,620	31,191	91,973	12,896	214,661	52%
501 to 1000	0	0	0	875	15,355	63,981	21,494	101,705	25%
1001 to 1500	0	0	0	0	1,440	23,993	21,494	46,926	11%
1501 to 2500	0	0	0	0	0	19,994	30,091	50,085	12%
Total	**35,989**	**8,497**	**17,495**	**17,495**	**47,986**	**199,940**	**85,974**	**413,377**	**100%**

Source: ICF SH&E
Notes: North America includes Mexico and the Caribbean.
nm nautical miles
TP Turboprop
RJ Regional jet
NB Narrow-body jet

Table E-15 Stage Length Assumptions, Long-Haul International Scheduled Passenger Airline Operations (2030)

Stage Length (nm)	Narrow-Body > 150	Wide-Body <= 240	Wide-Body > 240	Total	Percent of Total
1501 to 2500	419	1,523	0	1,942	8%
2501 to 3500	850	4,570	13,405	18,825	74%
3501 to 4500	0	1,726	0	1,726	7%
4501 to 5500	0	406	0	406	2%
5501 to 6500	0	1,219	559	1,777	7%
Over 6500	0	711	0	711	3%
Total	**1,269**	**10,155**	**13,963**	**25,388**	**100%**

Source: ICF SH&E
Notes:
nm nautical miles

The distribution of forecast operations by stage length for cargo airlines and passenger charter airlines was based on the distribution of actual activity for 2011 as reported in the U.S. Department of Transportation (U.S. DOT), T-100 database. Specific assumptions for all-cargo and charter airline operations by stage length are summarized in Tables E-16 and E-17.

Table E-16 Stage Length Assumptions, Cargo Airline Operations (2030)

Stage Length (nm)	Narrow-body Jet	Wide-body Jet	Non-Jet	Total	Percent of Total
0 to 500	532	1,550	304	2,385	31%
501 to 1000	1,501	3,493	0	4,994	65%
1001 to 1500	0	257	0	257	3%
Total	**2,032**	**5,300**	**304**	**7,636**	**100%**

Source: ICF SH&E
Notes:
nm nautical miles

Table E-17 Stage Length Assumptions, Charter Airline Operations (2030)

Stage Length (nm)	Narrow-Body 100 - 150	Narrow-Body > 150	Wide-Body <= 240	Wide-Body > 240	Total	Percent of Total
0 to 500	332	183	20	0	536	38%
501 to 1000	147	96	2	2	247	17%
1001 to 1500	120	177	2	0	300	21%
1501 to 2500	159	128	14	6	308	22%
2501 to 3500	0	10	8	4	22	2%
4501 to 5500	0	0	0	8	8	1%
5501 to 6500	0	0	0	4	4	0%
Total	**758**	**595**	**47**	**24**	**1,424**	**100%**

Source: ICF SH&E
Notes:
nm nautical miles

Forecasts of activity during the daytime and nighttime periods, where nighttime hours are defined as 10:00 PM to 7:00 AM were also prepared to support the analysis of future noise conditions. Time-of-day assumptions for scheduled passenger airline operations by stage length are based on airline schedules for July 2012. For cargo, charter and GA operations, time-of-day assumptions are based on the actual 2011 time-of-day distribution from the Logan Airport radar data. A summary of the time-of-day assumptions is presented in Table E-18.

Table E-18 Time-of-Day Assumptions by User Category and Stage Length (2030)

User Category	Stage Length	Arrivals Day	Arrivals Night	Departures Day	Departures Night
Sched Psgr - No America	0 to 500	95.3%	4.7%	92.9%	7.1%
Sched Psgr - No America	501 to 1000	84.9%	15.1%	87.5%	12.5%
Sched Psgr - No America	1001 to 1500	72.3%	27.7%	80.9%	19.1%
Sched Psgr - No America	1501 to 2500	60.1%	39.9%	94.5%	5.5%
Sched Psgr – Long-Haul Int'l	1501 to 2500	100.0%	0.0%	71.4%	28.6%
Sched Psgr – Long-Haul Int'l	2501 to 3500	100.0%	0.0%	78.6%	21.4%
Sched Psgr – Long-Haul Int'l	3501 to 4500	100.0%	0.0%	100.0%	0.0%
Sched Psgr – Long-Haul Int'l	4501 to 5500	100.0%	0.0%	100.0%	0.0%
Sched Psgr – Long-Haul Int'l	5501 to 6500	100.0%	0.0%	100.0%	0.0%
Sched Psgr – Long-Haul Int'l	over 6500	100.0%	0.0%	100.0%	0.0%
Cargo	0 to 500	45.5%	54.5%	45.8%	54.2%
Cargo	501 to 1000	51.4%	48.6%	34.1%	65.9%
Cargo	1001 to 1500	23.6%	76.4%	42.2%	57.8%
Charter	0 to 500	77.4%	22.6%	73.9%	26.1%
Charter	501 to 1000	77.4%	22.6%	73.9%	26.1%
Charter	1001 to 1500	77.4%	22.6%	73.9%	26.1%
Charter	1501 to 2500	77.4%	22.6%	73.9%	26.1%
Charter	2501 to 3500	77.4%	22.6%	73.9%	26.1%
Charter	4501 to 5500	77.4%	22.6%	73.9%	26.1%
Charter	5501 to 6500	77.4%	22.6%	73.9%	26.1%
General Aviation	0 to 500	91.0%	9.0%	91.5%	8.5%

Source: ICF SH&E

Peak Month, Busy Day Hourly Passenger Forecast

A peak passenger forecast was developed to support the analysis of future ground transportation conditions at Logan Airport. The peak passenger forecast reflects a busy weekday of the peak month for Logan Airport passengers. In 2011, the peak month for passenger traffic was July, which accounted for 9.8 percent of annual enplaned and deplaned passengers. In prior years, the peak month for passenger traffic has consistently been either July or August. Since the ground transportation analyses involve passengers traveling to and from the airport by ground modes, the peak passenger forecast is based on 2030 origin-destination, or "local", passengers and excludes passengers that transfer from one flight to another. Based on the base year analysis of Logan Airport passengers, approximately 94 percent of domestic and 86 percent of international passengers are local passengers. The busy day for total passengers is estimated to be 104.1 percent of the average day based on peak month scheduled airline seats. Busy day domestic passengers are 104.5 percent of the average day and busy day international passengers are 101.9 percent of the average day.

The actual and forecast peak month, busy day local passengers are summarized in Table E-19.

Table E-19 Peak-Month Busy Day Local Passengers, 2011 Base Year, and 2030 Forecast				
	2011 Domestic	2011 International	2030 Domestic	2030 International
Annual Enplaned + Deplaned Passengers [1]	24,831,068	3,962,454	32,137,828	7,585,965
Percent Peak Month	9.6%	11.3%	9.6%	11.3%
Peak Month Enplaned + Deplaned Passengers	2,384,320	446,279	3,085,927	854,384
Percent Local	94.1%	86.0%	94.1%	86.0%
Peak Month Local Passengers	2,243,989	383,956	2,904,303	735,070
Peak Month, Average Day Local Passengers	72,387	12,386	93,687	23,712
Busy Day as a Percent of Average Day	104.5%	101.9%	104.5%	101.9%
Peak Month, Busy Day Local Passengers	**75,680**	**12,615**	**97,950**	**24,152**

Source: Massport and ICF SH&E.
Notes: Excludes general aviation passengers, which do not use the airline terminals at Logan Airport.

Forecast busy day passengers were distributed by terminal to assess the effects of forecast passengers on the Airport roadways. The future distribution of passengers by terminal assumes that in 2030 passengers in the domestic airline terminals (A, B and C) will be distributed in proportion to their narrow-body equivalent gate capacity. Terminal A is estimated to have 25 narrow-body equivalent gates based on 22 actual jet gates and seven RJ gates, which are assumed to the equivalent of three narrow-body jet gates. In Terminal B, five former regional jet gates are being reconfigured as narrow-body gates as part of the Terminal B renovation project. When the project in completed there will be 36 narrow-body gates in Terminal B. As shown in Table E-20, Terminal B has the most narrow-body gate capacity at 41 percent of the total narrow-body gate capacity for Terminals A-C. However, in 2011 Terminal B was underutilized; it accommodated only 33 percent of the peak month passengers. In comparison, Terminal C was over utilized at 43 percent of passengers. The forecast assumes that over the long-term passengers in the domestic airline terminals will be balanced in proportion to terminal gate capacity, as shown in Table E-20.

Table E-20 Actual and Assumed Future Distribution of Passengers by Terminal				
Terminal	Narrow-body Equivalent Gates	Percent of Total	2011 Peak Month Passengers	2030 Peak Month Passengers
A	25	28%	24%	28%
B	36	41%	33%	41%
C	27	31%	43%	31%
Total	**88**	**100%**	**100%**	**100%**

Source: ICF SH&E

Actual and forecast local passengers by terminal for the peak month, busy day are summarized in Table E-21. In the 2011 base year, Terminal E accommodated both domestic and international passengers; Southwest Airlines, which only serves domestic markets from Logan Airport, operated from three gates in Terminal E in 2011. The forecast assumes that by 2030 Terminal E will exclusively accommodate international passengers. A small portion of international passengers will continue to be accommodated at Terminals A-C. These include international departures on U.S. flag airlines and arrivals primarily on U.S. airlines from origins with customs and immigration pre-clearance rights[1].

1 Pre clearance markets are Canada, Bermuda, the Bahamas, Aruba and Ireland. At Logan Airport, flights from Canada, Bermuda, the Bahamas and Aruba were accommodated in the domestic airline terminals in 2011, but Aer Lingus flights arriving from Ireland were accommodated in Terminal E.

Table E-21 Peak-Month Busy Day Local Passengers by Terminal, 2011 Actual and 2030 Forecast

Terminal	2011 Domestic	2011 International	2030 Domestic	2030 International
A	16,445	994	27,827	1,794
B	22,694	1,699	40,070	2,583
C	31,384	606	30,053	1,938
E	5,157	9,317	-	17,836
Total Airport	**75,680**	**12,615**	**97,950**	**24,152**

Source: ICF SH&E.

Hourly and peak hour local arriving and departing passengers by terminal are estimated for the base year based on actual passengers by terminal and scheduled airline seat capacity by terminal for July 2011. The hourly distribution of passengers by terminal for 2011 is shown in Table E-22.

Table E-22 Distribution of Terminal Passengers by Hour for a Busy Day of the Peak Month, 2011

	Terminal A		Terminal B		Terminal C		Terminal E		Total Airport		
Hour	Arrive	Depart	Arrive	Depart	Arrive	Depart	Arrive	Depart	Arrive	Depart	Total
00:00-00:59	1.5%	0.0%	3.0%	0.0%	2.1%	0.0%	2.5%	0.0%	2.3%	0.0%	1.2%
01:00-01:59	0.0%	0.0%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.1%
02:00-02:59	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
03:00-03:59	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
04:00-04:59	0.0%	0.0%	0.0%	0.8%	1.6%	0.0%	0.0%	0.0%	0.5%	0.2%	0.4%
05:00-05:59	1.2%	2.6%	0.9%	2.4%	1.6%	0.0%	0.0%	0.0%	1.0%	1.3%	1.2%
06:00-06:59	1.4%	11.0%	2.5%	12.6%	3.3%	12.2%	0.0%	7.1%	2.1%	11.3%	6.7%
07:00-07:59	2.5%	6.8%	3.7%	6.1%	5.4%	8.5%	2.5%	3.1%	3.8%	6.6%	5.2%
08:00-08:59	3.6%	5.1%	4.8%	5.7%	4.6%	8.6%	4.6%	4.6%	4.5%	6.4%	5.4%
09:00-09:59	5.0%	5.4%	3.5%	8.8%	6.3%	5.7%	1.3%	3.9%	4.3%	6.3%	5.3%
10:00-10:59	4.3%	5.6%	5.9%	3.0%	4.8%	7.4%	2.5%	1.6%	4.6%	4.9%	4.7%
11:00-11:59	2.9%	2.5%	6.4%	5.4%	4.3%	6.4%	1.3%	3.1%	4.1%	4.7%	4.4%
12:00-12:59	7.9%	4.9%	4.5%	6.9%	4.2%	3.4%	6.4%	3.1%	5.4%	4.7%	5.1%
13:00-13:59	9.0%	5.4%	5.3%	4.1%	2.4%	3.3%	8.9%	2.4%	5.8%	3.9%	4.8%
14:00-14:59	4.1%	8.3%	5.7%	3.3%	6.5%	4.5%	8.5%	2.2%	6.1%	4.7%	5.4%
15:00-15:59	8.8%	4.5%	6.3%	7.3%	4.2%	5.1%	11.6%	6.3%	7.1%	5.8%	6.4%
16:00-16:59	5.7%	6.2%	7.9%	7.5%	6.3%	4.6%	9.0%	1.6%	7.1%	5.3%	6.2%
17:00-17:59	10.3%	8.3%	7.8%	5.3%	6.2%	7.0%	7.6%	10.9%	7.7%	7.3%	7.5%
18:00-18:59	5.1%	15.2%	5.4%	9.1%	9.6%	5.2%	7.0%	10.6%	7.0%	9.4%	8.2%
19:00-19:59	8.2%	4.4%	5.8%	7.7%	6.3%	8.3%	10.4%	12.7%	7.3%	7.9%	7.6%
20:00-20:59	5.2%	0.9%	7.7%	2.1%	5.6%	5.1%	9.0%	7.4%	6.7%	3.6%	5.2%
21:00-21:59	5.7%	1.4%	5.3%	0.8%	2.4%	3.3%	3.1%	12.9%	4.1%	3.5%	3.8%
22:00-22:59	4.7%	1.3%	3.4%	1.0%	6.8%	0.0%	2.5%	6.6%	4.6%	1.6%	3.1%
23:00-23:59	2.9%	0.0%	3.2%	0.0%	5.4%	1.5%	1.3%	0.0%	3.5%	0.5%	2.0%
Peak Pct	**10.3%**	**15.2%**	**7.9%**	**12.6%**	**9.6%**	**12.2%**	**11.6%**	**12.9%**	**7.7%**	**11.3%**	**8.2%**
Peak Hour	**17:00-17:59**	**18:00-18:59**	**16:00-16:59**	**06:00-06:59**	**18:00-18:59**	**06:00-06:59**	**15:00-15:59**	**21:00-21:59**	**17:00-17:59**	**06:00-06:59**	**18:00-18:59**

Source: Massport and ICF SH&E.

For the forecast year, hourly and peak hour passengers are projected based on the forecast of passengers by terminal and assumptions regarding the future hourly distribution of passengers. For Terminals A-C, the hourly distribution is assumed to be the same as the hourly distribution of scheduled airline seat capacity for July 2012. The hourly assumptions for Terminal E are based on schedule airline seat capacity for July 2012, with adjustments to reflect the relocation of domestic services to Terminals A-C, the addition of new international services to Asia and the Middle East, and smoothing of the international peaking pattern overtime as the market matures. Table E-23 summarizes the hourly passenger distribution assumptions by terminal for 2030.

Table E-23 Assumed Distribution of Terminal Passengers by Hour for a Busy Day of the Peak Month, 2030

	Terminals A, B and C		Terminal E	
Hour	**Arriving**	**Departing**	**Arriving**	**Departing**
00:00-00:59	3.0%	0.0%	0.0%	0.0%
01:00-01:59	0.3%	0.0%	0.0%	0.0%
02:00-02:59	0.0%	0.0%	0.0%	0.0%
03:00-03:59	0.0%	0.0%	0.0%	0.0%
04:00-04:59	0.3%	0.3%	0.0%	0.0%
05:00-05:59	1.2%	2.3%	0.0%	0.0%
06:00-06:59	2.4%	11.0%	0.0%	1.0%
07:00-07:59	4.9%	7.9%	1.7%	0.0%
08:00-08:59	3.6%	5.2%	4.0%	3.9%
09:00-09:59	5.0%	8.1%	0.0%	2.1%
10:00-10:59	5.1%	6.5%	0.8%	0.0%
11:00-11:59	4.0%	3.8%	4.1%	4.8%
12:00-12:59	4.7%	4.8%	10.4%	0.0%
13:00-13:59	6.7%	5.0%	6.3%	4.3%
14:00-14:59	4.4%	4.3%	12.9%	2.8%
15:00-15:59	5.3%	5.6%	10.8%	2.1%
16:00-16:59	6.7%	6.3%	11.1%	7.7%
17:00-17:59	8.8%	6.9%	6.4%	8.1%
18:00-18:59	6.2%	10.1%	7.4%	10.4%
19:00-19:59	5.2%	6.0%	9.6%	15.5%
20:00-20:59	6.5%	3.4%	10.5%	11.9%
21:00-21:59	4.3%	1.3%	3.9%	10.8%
22:00-22:59	6.5%	0.6%	0.0%	14.6%
23:00-23:59	4.8%	0.6%	0.0%	0.0%
Peak Percentage	**8.8%**	**11.0%**	**12.9%**	**15.5%**
Peak Hour	**17:00-17:59**	**06:00-06:59**	**14:00-14:59**	**19:00-19:59**

Source: ICF SH&E and Massport.

Arriving and departing passengers by terminal and by hour for the base year are summarized in Table E-24. In 2011, Terminal C accommodated more than 31,000 local passengers making it the busiest terminal at the Airport. Terminal E was the least busy terminal with approximately 15,000 local passengers in 2011.

Table E-24 Peak Month Busy Day Passenger by Terminal and by Hour, 2011

	Terminal A		Terminal B		Terminal C		Terminal E		Total		
Hour	Arrive	Depart	Arrive	Depart	Arrive	Depart	Arrive	Depart	Arrive	Depart	Total
00:00-00:59	125	0	373	0	332	0	215	0	1,045	0	1,045
01:00-01:59	0	0	116	0	0	0	0	0	116	0	116
02:00-02:59	0	0	0	0	0	0	0	0	0	0	0
03:00-03:59	0	0	0	0	0	0	0	0	0	0	0
04:00-04:59	0	0	0	96	247	0	0	0	247	96	343
05:00-05:59	106	237	106	308	247	-	-	-	459	545	1,004
06:00-06:59	116	1,021	315	1,611	521	1,932	-	450	953	**5,014**	5,967
07:00-07:59	215	628	464	784	850	1,337	215	199	1,744	2,949	4,693
08:00-08:59	307	477	595	730	721	1,354	392	294	2,015	2,855	4,870
09:00-09:59	428	500	430	1,130	983	907	107	250	1,948	2,788	4,736
10:00-10:59	364	520	736	389	753	1,165	215	100	2,068	2,174	4,242
11:00-11:59	246	234	792	692	673	1,005	107	199	1,818	2,130	3,949
12:00-12:59	674	458	555	879	657	541	545	199	2,431	2,078	4,510
13:00-13:59	764	503	657	528	375	515	759	151	2,555	1,696	4,251
14:00-14:59	348	773	709	426	1,013	703	729	138	2,800	2,041	4,841
16:00-16:59	484	570	985	953	987	724	773	100	3,229	2,348	5,577
17:00-17:59	871	767	964	680	972	1,099	648	695	**3,455**	3,241	6,696
18:00-18:59	430	1,411	671	1,163	1,500	826	603	676	3,203	4,076	**7,279**
19:00-19:59	695	412	714	979	983	1,306	893	810	3,284	3,506	6,790
20:00-20:59	439	84	953	272	883	800	774	470	3,049	1,627	4,676
21:00-21:59	487	129	661	96	381	526	264	822	1,794	1,574	3,367
22:00-22:59	397	125	425	129	1,070	-	215	420	2,107	674	2,782
23:00-23:59	243	-	402	-	843	244	107	-	1,595	244	1,839
Total	8,486	9,269	12,402	12,786	15,644	15,797	8,556	6,374	45,088	44,226	89,314

Source: Massport
Note: Bold indicates airport-wide peak hour passengers

Table E-25 shows 2030 forecast passengers by terminal and by hour for a busy day of the peak month. Terminal B is projected to accommodate nearly 43,000 local passengers, making it the most utilized terminal in the forecast year. In comparison, 32,000 local passengers are forecast to travel through Terminal C. Terminal E remains the least utilized terminal overall with a forecast of approximately 17,000 passengers.

Table E-25 Peak Month Busy Day Passenger by Terminal and by Hour, 2030

	Terminal A		Terminal B		Terminal C		Terminal E		Total		
Hour	Arrive	Depart	Arrive	Depart	Arrive	Depart	Arrive	Depart	Arrive	Depart	Total
00:00-00:59	436	0	627	0	470	0	0	0	1,533	0	1,533
01:00-01:59	47	0	67	0	50	0	0	0	164	0	164
02:00-02:59	0	0	0	0	0	0	0	0	0	0	0
03:00-03:59	0	0	0	0	0	0	0	0	0	0	0
04:00-04:59	44	39	63	57	47	43	0	0	154	139	293
05:00-05:59	179	345	258	497	193	372	0	0	630	1,214	1,844
06:00-06:59	353	1,670	509	2,404	382	1,803	0	70	1,243	5,948	7,191
07:00-07:59	709	1,192	1,021	1,716	766	1,287	193	0	2,689	4,195	6,883
08:00-08:59	520	795	749	1,145	561	859	445	268	2,275	3,067	5,342
09:00-09:59	718	1,229	1,034	1,770	776	1,327	0	146	2,528	4,473	7,000
10:00-10:59	741	989	1,068	1,424	801	1,068	90	0	2,700	3,480	6,179
11:00-11:59	574	580	827	835	620	626	455	328	2,476	2,370	4,846
12:00-12:59	681	735	981	1,059	736	794	1,140	0	3,539	2,587	6,127
13:00-13:59	969	754	1,396	1,086	1,047	814	694	295	4,106	2,949	7,055
14:00-14:59	636	645	916	929	687	696	1,422	191	3,661	2,461	6,122
15:00-15:59	760	851	1,094	1,226	820	919	1,184	140	3,858	3,136	6,994
16:00-16:59	971	952	1,399	1,370	1,049	1,028	1,224	523	4,643	3,873	8,516
17:00-17:59	1,278	1,046	1,840	1,506	1,380	1,129	709	550	**5,208**	4,231	9,439
18:00-18:59	891	1,537	1,282	2,213	962	1,660	812	710	3,946	**6,119**	**10,066**
19:00-19:59	752	915	1,082	1,317	812	988	1,061	1,058	3,706	4,279	7,985
20:00-20:59	939	520	1,353	749	1,015	562	1,151	811	4,458	2,641	7,099
21:00-21:59	620	192	893	277	669	208	433	740	2,615	1,418	4,032
22:00-22:59	944	97	1,359	140	1,020	105	0	994	3,323	1,336	4,659
23:00-23:59	688	88	991	127	743	95	0	0	2,421	311	2,733
Total	14,450	15,171	20,808	21,846	15,606	16,385	11,011	6,825	61,875	60,227	122,101

Source: Massport and ICF SH&E.
Note: Bold indicates airport-wide peak hour passengers

Conclusion

Passenger demand for services at Logan Airport is forecast to grow at an average annual rate of 1.7 percent per year from 2011 to 2030, slightly slower than local economic growth (2.1 percent per year) reflecting the continuing maturation of the Logan Airport air travel market. Aircraft operations are expected to increase almost as fast as passenger demand, growing at an average annual rate of 1.3 percent. Changes in the airline fleet mix will result in the introduction of new aircraft models such as the next generation Boeing 737 MAX aircraft and the Boeing 787 Dreamliners. A shift in the aircraft fleet mix, with reductions in small regional jets and turboprops (less than 50 seats), increases in larger regional jets and turboprops (> 50 seats), larger seating capacities for the next generation narrow-bodies, faster growth in long-haul international services, and a small increase in average load factor is expected to increase the average passenger throughput from approximately 78 passengers per operation in 2011 to 84 passengers per operation in 2030.

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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 2011
- Table F-2 Percentage Change in Aircraft Operations by Classification for New England's Airports, 2000 to 2011
- 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 2011

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
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 Aviation1	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 Aviation1	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 Aviation1	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 Aviation1	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 Aviation1	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 Aviation1	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 2011

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
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 Aviation1	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 Aviation1	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 Aviation1	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 Aviation1	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 Aviation1	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 Aviation1	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

Source: Massport, Federal Aviation Administration (FAA) Tower Counts, and individual airport records.

Notes:

1 Includes itinerant and local general aviation 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 2011

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
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 2010

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
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%

Source: Massport, Federal Aviation Administration (FAA) Tower Counts, and individual airport records.

Notes:

1 Includes itinerant and local general aviation operations at the regional airports. There are no local (touch-and-go training) operations at Logan Airport.

2 Commercial operations at Hanscom Field include scheduled commercial operations only; other air taxi operations counted as GA.

3 Operations at Logan Airport include international operations.

Table F-3 Scheduled Passenger Operations by Market and Carrier for Bradley International Airport

				Departures													Departing Seats												
Carrier	Code	Market	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Jet Carriers																															
Alaska	AS	Chicago O'Hare	ORD	30												0	-	4,050												0	-
America West	HP	Columbus	CMH	149												0	-	18,441												0	-
America West	HP	Las Vegas	LAS	210	204	65										0	-	27,469	30,255	9,683										0	-
America West	HP	Phoenix	PHX	275	304	275	361	366	365	365	61					0	-	37,772	44,992	40,700	53,365	51,960	54,570	54,750	7,564					0	-
American	AA	Chicago O'Hare	ORD	2,139	2,147	2,112	1,756	2,001	1,570	959						0	-	304,855	291,219	279,895	232,333	265,113	203,929	123,729						0	-
American	AA	Dallas/Fort Worth	DFW	1,343	1,283	1,421	1,147	1,403	1,052	1,082	1,091	1,068	1,043	1,052	1,078	26	2.5%	185,922	165,562	183,272	148,000	180,987	136,897	144,171	154,505	158,001	154,343	160,983	172,457	11,474	7.1%
American	AA	Los Angeles	LAX	214	304											0	-	31,244	44,384											0	-
American	AA	Miami	MIA	366	365	427	426	487	365	365	365	366	365	413	516	103	24.9%	51,427	53,290	62,342	62,196	71,102	49,990	52,732	51,720	54,168	54,020	63,559	82,560	19,001	29.9%
American	AA	New York J F Kennedy	JFK		214											0	-		31,244											0	-
American	AA	San Juan	SJU	366	471	604	529	366	365	365	365	366	365	365	365	0	0.0%	69,348	79,653	103,144	90,017	92,171	84,425	81,776	70,856	65,880	56,900	55,856	58,400	2,544	4.6%
American	AA	St. Louis	STL		124	1,267	869									0	-		17,608	163,480	112,046									0	-
Boston-Maine Airways	E9	Fort Lauderdale/Hollywood	FLL						13							0	-						1,993							0	-
Continental	CO	Cleveland	CLE	582	387	380	74	127	131	92	131	105	75			0	-	68,974	45,629	47,331	11,417	15,985	16,262	9,875	16,262	12,807	9,203			0	-
Continental	CO	Houston Intercontinental	IAH	366	295		214	222	313	227	232	119				0	-	45,790	37,089		24,483	25,341	34,072	26,618	26,393	13,650				0	-
Continental	CO	New York Newark	EWR	331	186						4					0	-	38,916	21,712						446					0	-
Delta	DL	Atlanta	ATL	2,192	2,194	2,331	2,164	2,558	3,098	2,406	2,158	2,152	2,103	2,099	2,094	(4)	(0.2%)	392,835	400,879	452,378	395,332	450,671	479,098	347,090	326,949	328,814	300,052	300,185	310,149	9,965	3.3%
Delta	DL	Boston	BOS	4												0	-	634												0	-
Delta	DL	Cancun	CUN									31	30	35	35	0	0.0%									5,136	4,543	5,470	5,397	(73)	(1.3%)
Delta	DL	Cincinnati	CVG	1,464	1,460	1,447	1,447	1,438	1,373	768	562	663	250			0	-	244,837	250,529	246,514	264,450	257,177	196,741	102,635	82,000	97,102	37,709			0	-
Delta	DL	Detroit	DTW											1,003	658	(346)	(34.4%)											129,228	91,657	(37,572)	(29.1%)
Delta	DL	Fort Lauderdale/Hollywood	FLL	732	945	1,095	885	702	673	717	669	479	281	237	210	(27)	(11.4%)	87,108	112,455	130,305	122,463	139,613	133,927	127,218	97,327	70,389	39,902	33,674	29,280	(4,394)	(13.0%)
Delta	DL	Fort Myers	RSW							31	142	121	121	99	90	(9)	(9.0%)							4,402	20,184	17,182	17,369	13,104	12,780	(324)	(2.5%)
Delta	DL	Las Vegas	LAS							109				9		(9)	(100.0%)							16,329				1,394		(1,394)	(100.0%)
Delta	DL	Los Angeles	LAX						100	291	287	135		83		(83)	(100.0%)						19,928	48,428	43,093	20,601		13,257		(13,257)	(100.0%)
Delta	DL	Minneapolis	MSP											758	576	(182)	(24.0%)											99,431	79,418	(20,013)	(20.1%)
Delta	DL	New York J F Kennedy	JFK	183												0	-	39,894												0	-
Delta	DL	Orlando	MCO	1,838	1,702	1,460	1,172	1,023	1,095	890	824	692	558	704	608	(96)	(13.7%)	218,705	202,538	173,740	165,251	203,634	217,905	160,415	118,320	106,599	79,256	99,129	88,041	(11,088)	(11.2%)
Delta	DL	Salt Lake City	SLC						27	208						0	-						3,986	31,243						0	-
Delta	DL	Tampa	TPA		582	822	886	662	678	682	660	470	180	252	120	(132)	(52.4%)		69,258	97,818	123,897	131,795	134,894	117,960	93,781	66,811	25,828	33,625	15,420	(18,205)	(54.1%)
Delta	DL	West Palm Beach	PBI	732	945	1,003	556	537	516	365	356	370	160	283	120	(163)	(57.5%)	87,108	112,455	119,357	75,907	106,806	102,684	62,395	51,099	53,971	22,659	37,536	16,500	(21,036)	(56.0%)
Frontier Airlines	F9	Denver	DEN								306	209				0	-								40,392	27,645				0	-
jetBlue	B6	Fort Lauderdale/Hollywood	FLL											101	599	499	495.7%											15,086	90,231	75,146	498.1%
jetBlue	B6	Orlando	MCO											101	730	629	625.9%											15,086	109,860	94,774	628.2%
jetBlue	B6	San Juan	SJU													0	-													0	-
jetBlue	B6	West Palm Beach	PBI													0	-													0	-
Laker Airways (Bahamas)	7Z	Freeport	FPO	39	78	43	43	26								0	-	5,850	11,700	6,471	6,471	3,900								0	-
Midway Airlines	JI	Raleigh/Durham	RDU	683	391											0	-	69,213	45,802											0	-
Midwest/Republic	YX	Milwaukee	MKE	619	504	420										0	-	44,455	36,082	29,366										0	-
Northwest	NW	Amsterdam	AMS								184	274				0	-								29,440	43,840				0	-
Northwest	NW	Detroit	DTW	1,699	1,638	1,487	1,597	1,504	1,451	1,399	1,374	1,189	960			0	-	215,750	199,154	190,874	193,856	204,604	192,679	181,501	178,364	152,492	113,746			0	-
Northwest	NW	Fort Myers	RSW													0	-													0	-
Northwest	NW	Minneapolis	MSP	1,177	1,148	1,099	1,116	1,098	1,042	1,060	1,060	1,002	654			0	-	135,570	137,404	134,201	144,001	149,646	140,194	147,350	142,982	130,019	84,739			0	-
Northwest	NW	Orlando	MCO										115			0	-										14,278			0	-
Northwest	NW	Tampa	TPA										261			0	-										32,382			0	-
Northwest	NW	West Palm Beach	PBI										205			0	-										25,473			0	-
Southwest	WN	Baltimore	BWI	2,841	2,755	2,689	3,072	3,059	3,094	3,116	3,137	2,883	2,713	2,700	2,708	8	0.3%	389,158	377,285	367,798	420,903	419,083	423,878	426,399	429,393	394,440	371,357	367,534	367,414	(120)	(0.0%)
Southwest	WN	Chicago Midway	MDW	723	700	708	687	710	953	1,034	1,061	1,033	940	923	979	57	6.1%	99,090	95,861	97,016	93,838	97,309	130,541	141,717	145,318	140,567	128,780	126,412	133,267	6,855	5.4%
Southwest	WN	Denver	DEN											306	365	59	19.3%											41,922	50,005	8,083	19.3%
Southwest	WN	Fort Lauderdale/Hollywood	FLL				35							70	365	295	423.6%				4,756							9,551	50,005	40,454	423.6%
Southwest	WN	Fort Myers	RSW												0	-													0	-
Southwest	WN	Las Vegas	LAS	52	52	22	122	375	365	365	365	366	365	361	365	4	1.2%	7,163	7,144	2,955	16,714	51,336	50,005	50,005	50,005	50,142	50,005	49,398	50,005	607	1.2%
Southwest	WN	Nashville	BNA	672	730	674	586	366	365	365	365	366	365	361	304	(57)	(15.7%)	92,064	100,010	92,299	80,341	50,142	50,005	50,005	50,005	49,810	50,005	49,398	41,648	(7,750)	(15.7%)
Southwest	WN	Orlando	MCO	375	448	726	730	833	1,108	1,108	1,091	1,081	1,047	1,016	1,003	(13)	(1.3%)	51,336	61,317	99,403	100,010	114,082	151,816	151,816	148,887	148,058	143,459	139,212	137,411	(1,801)	(1.3%)
Southwest	WN	Philadelphia	PHL					296	1,590	1,078	169					0	-					40,591	217,850	147,666	23,094					0	-
Southwest	WN	Tampa	TPA		78	365	365	383	695	730	730	736	426	570	656	86	15.0%		10,706	50,005	50,005	52,530	95,156	100,010	99,366	100,871	58,362	78,129	89,852	11,723	15.0%
Southwest	WN	West Palm Beach	PBI												61	61	-												8,357	8,357	-
Sunworld International	SM	Philadelphia	PHL			153										0	-			22,886										0	-
Trans World Airlines	TW	Portland (ME)	PWM	305												0	-	43,310												0	-
Trans World Airlines	TW	St. Louis	STL	1,460	1,336											0	-	206,109	185,855											0	-
United	UA	Chicago O'Hare	ORD	2,034	1,751	2,122	2,185	2,065	1,812	1,816	1,800	1,643	1,364	1,296	1,077	(219)	(16.9%)	299,522	262,838	302,260	310,554	317,682	259,437	254,198	259,509	237,995	200,920	198,709	159,738	(38,971)	(19.6%)
United	UA	Denver	DEN	366	304	13										0	-	46,901	39,381	1,630										0	-
United	UA	San Francisco	SFO	366	243											0	-	45,384	33,018											0	-
United	UA	Washington Dulles	IAD	1,455	1,155	365	365	492	726	944	1,112	1,076	1,008	1,192	812	(380)	(31.9%)	173,869	143,374	46,815	44,087	63,854	81,631	111,596	133,741	131,169	131,883	155,750	108,500	(47,250)	(30.3%)
US Airways	US	Baltimore	BWI	488	1,305											0	-	41,760	149,554											0	-
US Airways	US	Charlotte	CLT	1,464	1,521	1,681	1,349	1,574	2,188	1,660	1,525	1,412	1,104	1,588	1,664	76	4.8%	214,719	235,997	260,958	191,931	229,826	350,776	227,845	219,915	192,821	146,512	228,119	238,508	10,389	4.6%
US Airways	US	Fort Lauderdale/Hollywood	FLL	366	239			9	123							0	-	39,232	26,818			1,272	15,161							0	-
US Airways	US	Orlando	MCO	1,098	663			48	30	30						0	-	117,696	74,184			5,986	3,842	3,737						0	-
US Airways	US	Philadelphia	PHL	2,148	2,107	1,825	1,781	1,913	2,102	930	665	518	583	361	317	(43)	(12.0%)	310,118	318,428	277,118	253,658	267,741	301,242	139,939	84,575	61,974	58,153	49,914	44,595	(5,319)	(10.7%)
US Airways	US	Phoenix	PHX								241	335				0	-								28,869	40,200				0	-
US Airways	US	Pittsburgh	PIT	1,800	1,825	1,729	1,399	1,198	27							0	-	278,575	270,919	255,327	205,951	157,633	3,189							0	-
US Airways	US	Washington Dulles	IAD	732												0	-	86,376												0	-
US Airways	US	Washington National	DCA	1,329	1,142	1,091	1,077	1,081	1,064	947	1,092	1,203	755	361	365	4	1.2%	171,891	146,558	139,812	138,468	141,901	141,068	130,161	143,281	141,492	84,917	51,434	52,210	776	1.5%
US Airways	US	West Palm Beach	PBI	366	225											0	-	39,232	25,268											0	-
USA 3000 Airlines	U5	Cancun	CUN						26	30	21					0	-						4,336	5,088	3,600					0	-
USA 3000 Airlines	U5	Punta Cana	PUJ						13	22	17					0	-						2,128	3,624	2,880					0	-
Subtotal				38,171	36,450	31,921	28,996	28,921	30,507	26,558	24,223	22,463	18,396	18,695	18,841	146	0.8%	5,179,671	5,005,409	4,487,153	4,136,700	4,361,471	4,486,236	3,784,422	3,374,113	3,114,646	2,496,754	2,622,086	2,693,666	71,580	2.7%

Table F-3 Scheduled Passenger Operations by Market and Carrier for Bradley International Airport

Carrier	Code	Market	Code	Departures													Departing Seats												
				2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Regional/Commuter Carriers																															
Air Canada Express	AC	Montreal Dorval	YUL	1,385	1,360	1,343	1,437	1,037	1,038	1,021	1,043	1,024	1,008	1,021	986	(35)	(3.4%)	19,392	25,894	25,474	27,025	21,557	19,475	19,402	19,814	19,453	19,157	19,399	18,739	(660)	(3.4%)
Air Canada Express	AC	Toronto	YYZ	1,589	1,574	1,446	1,444	1,338	1,342	1,282	1,277	1,241	1,286	1,287	1,308	21	1.6%	61,991	58,254	53,518	46,094	35,666	38,242	42,200	41,623	40,366	38,410	36,960	38,342	1,381	3.7%
America West Express	HP	Columbus	CMH	450	1,104	1,356	500								0	-		22,493	55,179	67,786	24,993									0	-
American Connection	AA	St. Louis	STL				113	880	947	896	958	827	210		0	-					4,192	32,571	44,356	44,821	43,414	36,407	9,240			0	-
American Eagle	AA	Chicago O'Hare	ORD					9		701	1,825	1,297	1,034	1,501	1,630	129	8.6%					416		34,094	80,300	57,606	50,374	79,594	95,985	16,391	20.6%
American Eagle	AA	New York J F Kennedy	JFK	1,460	1,185	1,005	240								0	-		48,166	39,105	33,165	8,880									0	-
American Eagle	AA	Raleigh/Durham	RDU		197	1,128	1,038	1,233	1,364	1,370	1,185	1,155	1,043	257		(257)	(100.0%)		7,273	41,752	38,422	46,535	54,521	52,371	44,685	44,275	45,154	10,774		(10,774)	(100.0%)
American Eagle	AA	St. Louis	STL										92		0	-											4,600			0	-
Continental Connection	CO	Albany	ALB			148	626	860	51						0	-				2,815	11,889	16,337	961							0	-
Continental Connection	CO	Binghamton	BGM		156										0	-			2,964											0	-
Continental Connection	CO	Boston	BOS		434										0	-			8,238											0	-
Continental Connection	CO	Buffalo	BUF	89	582										0	-		1,683	11,050											0	-
Continental Connection	CO	Burlington	BTV	4	154										0	-		84	2,934											0	-
Continental Connection	CO	New York J F Kennedy	JFK		235										0	-			4,470											0	-
Continental Connection	CO	New York Newark	EWR									672	375	608	901	294	48.3%									46,520	13,859	22,485	33,353	10,867	48.3%
Continental Connection	CO	Philadelphia	PHL		566										0	-			10,749											0	-
Continental Connection	CO	Rochester	ROC	93	569										0	-		1,767	10,806											0	-
Continental Connection	CO	Syracuse	SYR	97	445										0	-		1,851	8,447											0	-
Continental Express	CO	Cleveland	CLE	803	1,064	971	1,121	1,124	1,102	1,159	1,151	1,145	1,164	1,208	1,200	(8)	(0.7%)	39,357	52,441	48,374	55,469	56,179	54,951	57,971	57,507	57,045	58,179	60,400	59,979	(421)	(0.7%)
Continental Express	CO	New York Newark	EWR	1,747	1,685	1,591	1,382	1,368	1,351	1,364	1,386	696	841	465	258	(208)	(44.6%)	82,365	80,263	78,540	69,030	68,285	67,455	68,221	66,703	34,171	42,029	23,264	12,879	(10,386)	(44.6%)
Delta Connection	DL	Atlanta	ATL							83		4			48	48	-							5,820		310			3,396	3,396	-
Delta Connection	DL	Cincinnati	CVG							623	798	714	1,088	1,218	1,251	33	2.7%							40,956	49,854	40,876	60,954	61,642	66,559	4,916	8.0%
Delta Connection	DL	Columbus	CMH					93	994	621	595	191			0	-						4,650	49,196	27,671	29,707	9,543				0	-
Delta Connection	DL	Detroit	DTW											1,004	1,323	319	31.8%											54,265	82,915	28,649	52.8%
Delta Connection	DL	Fort Lauderdale/Hollywood	FLL									53			0	-										3,680				0	-
Delta Connection	DL	Fort Myers	RSW						612	359		4			0	-							42,840	25,100		290				0	-
Delta Connection	DL	Minneapolis	MSP											481	814	333	69.2%											36,567	61,731	25,164	68.8%
Delta Connection	DL	Myrtle Beach	MYR	61											0	-		3,057												0	-
Delta Connection	DL	New York J F Kennedy	JFK							546	1,177	1,050	795	365	304	(61)	(16.7%)							20,207	48,637	52,493	39,736	18,250	15,200	(3,050)	(16.7%)
Delta Connection	DL	Orlando	MCO							88					0	-								6,130						0	-
Delta Connection	DL	Raleigh/Durham	RDU											100	569	469	467.9%											6,136	28,436	22,299	363.4%
Delta Connection	DL	Tampa	TPA									79			0	-										5,520				0	-
Delta Connection	DL	Washington National	DCA											166	929	764	461.3%											11,324	51,524	40,200	355.0%
Delta Connection	DL	West Palm Beach	PBI									8			0	-										580				0	-
Frontier Express	F9	Milwaukee	MKE											140	417	276	196.9%											6,313	18,746	12,433	196.9%
Independence Air	DH	Washington Dulles	IAD					1,154	1,966	93						0	-					57,714	98,307	4,650						0	-
Midway Airlines	JI	Raleigh/Durham	RDU	1,348	1,065											0	-	67,393	53,243											0	-
Midwest Connect	YX	Milwaukee	MKE	4	144	271	896	941	965	943	831	532				0	-	142	4,594	8,999	28,686	30,117	30,871	30,171	35,492	26,600				0	-
Northwest Airlink	NW	Detroit	DTW							95	330	523	804			0	-							4,771	16,493	30,948	53,556			0	-
Northwest Airlink	NW	Indianapolis	IND					113	638	625	608	610	77			0	-					5,664	31,907	31,257	30,400	30,500	3,857			0	-
Northwest Airlink	NW	Memphis	MEM									53				0	-									2,657				0	-
Northwest Airlink	NW	Minneapolis	MSP						31			57	459			0	-						1,550			4,299	34,895			0	-
Shuttle America	S5	Albany	ALB	66												0	-	3,286												0	-
Shuttle America	S5	Bedford	BED	233	34											0	-	11,671	1,714											0	-
Shuttle America	S5	Buffalo	BUF	337												0	-	16,857												0	-
Shuttle America	S5	Islip	ISP	27												0	-	1,329												0	-
Shuttle America	S5	Wilmington	ILG	159												0	-	7,936												0	-
Swissair	SR	New York J F Kennedy	JFK	31												0	-	1,023												0	-
Trans World Airlines	TW	New York J F Kennedy	JFK	1,098												0	-	31,842												0	-
United Express	UA	Chicago O'Hare	ORD		336	547	184	475	691	691	689	501	382	548	685	137	25.0%		16,800	27,350	9,200	24,456	48,370	48,261	47,315	34,216	26,387	36,797	43,701	6,903	18.8%
United Express	UA	Cleveland	CLE												0	-														0	-
United Express	UA	New York Newark	EWR												0	-														0	-
United Express	UA	Washington Dulles	IAD		335	1,095	1,095	1,676	1,519	1,014	794	692	708	494	889	394	79.8%		16,750	54,750	54,660	84,513	84,484	63,290	49,069	47,354	46,746	30,270	54,707	24,437	80.7%
US Airways Express	US	Baltimore	BWI	1,185												0	-	43,850												0	-
US Airways Express	US	Buffalo	BUF	1,032	986	909	865	889	839	830	812	94				0	-	38,200	36,493	33,638	32,000	32,121	28,607	28,215	27,623	3,206				0	-
US Airways Express	US	Charlotte	CLT					13	4	104	278	658	1,035	537	452	(86)	(15.9%)					650	221	6,700	23,658	55,459	86,653	45,043	37,510	(7,533)	(16.7%)
US Airways Express	US	New York La Guardia	LGA											139	1,057	917	657.9%											5,159	39,098	33,940	657.9%
US Airways Express	US	New York Newark	EWR		350											0	-		10,146											0	-
US Airways Express	US	Philadelphia	PHL		273	188	9	206	439	1,943	2,250	2,227	2,015	2,404	2,430	26	1.1%		10,101	6,951	322	9,500	27,685	119,743	156,739	167,459	148,400	183,838	163,675	(20,163)	(11.0%)
US Airways Express	US	Pittsburgh	PIT					183	1,646	1,634	1,581	976	939	939	939	0	0.0%					9,247	84,598	88,694	80,184	48,800	46,929	46,929	46,929	0	0.0%
US Airways Express	US	Rochester	ROC	937	1,225	641	552	575	574	569	613	530	574	478		(478)	(100.0%)	34,658	45,325	23,733	20,429	21,280	19,555	19,351	20,832	18,005	19,501	16,242		(16,242)	(100.0%)
US Airways Express	US	Syracuse	SYR	732	878	481	574	584	478							0	-	27,084	32,470	14,421	10,898	11,093	9,077							0	-
US Airways Express	US	Washington National	DCA			236	313	392	551	899	863	683	904	1,334	1,411	77	5.8%			7,071	13,054	19,813	34,454	59,076	51,252	42,356	60,107	89,629	89,940	311	0.3%
Subtotal				14,968	16,935	13,356	12,388	15,144	19,143	19,553	21,046	18,299	16,833	16,694	19,799	3,105	18.6%	567,477	605,702	528,336	455,243	588,364	871,682	949,146	1,021,302	960,993	908,722	901,282	1,063,342	162,060	18.0%
Total				53,139	53,384	45,277	41,384	44,064	49,651	46,111	45,269	40,761	35,229	35,389	38,640	3,251	9.2%	5,747,148	5,611,111	5,015,489	4,591,943	4,949,835	5,357,918	4,733,569	4,395,415	4,075,639	3,405,476	3,523,368	3,757,008	233,640	6.6%

Source: OAG Schedules.
Note: All Northwest operations included in Delta from 2010 onwards

Table F-4 Scheduled Passenger Operations by Market and Carrier for T.F. Green Airport

				Departures													Departing Seats											
Carrier	Code	Market	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Jet Carriers																															
American	AA	Chicago O'Hare	ORD	1,464	1,460	1,452	1,421	1,609	1,113	257						0	-	203,104	188,340	187,253	183,309	207,543	143,522	33,171						0	-
American	AA	Dallas/Fort Worth	DFW				61	366	365	90						0	-				7,869	47,214	47,085	11,610						0	-
Continental	CO	Cleveland	CLE	569	167	208	13	131	13	4						0	-	69,771	20,446	24,382	1,629	15,622	1,630	446						0	-
Continental	CO	Houston Intercontinental	IAH	366	243											0	-	45,946	28,062											0	-
Continental	CO	New York Newark	EWR	738	1,170	869	450	331	282	282	248	38				0	-	96,448	148,092	105,448	53,213	38,535	34,808	29,298	27,309	4,348				0	-
Delta	DL	Atlanta	ATL	1,464	1,460	1,678	1,825	1,830	1,976	827	256	25	43	510	1,043	533	104.4%	207,888	232,070	283,761	294,173	289,611	290,915	108,427	36,556	3,570	6,147	72,461	150,526	78,065	107.7%
Delta	DL	Cincinnati	CVG	732	730	730	730	732	695	237						0	-	103,944	105,055	129,715	129,625	103,944	89,235	23,714						0	-
Delta	DL	Detroit	DTW											414	58	(356)	(86.1%)											50,065	7,139	(42,927)	(85.7%)
Delta	DL	Fort Lauderdale/Hollywood	FLL		306											0	-		36,414											0	-
Delta	DL	Minneapolis	MSP											74		(74)	(100.0%)											9,211		(9,211)	(100.0%)
Delta	DL	Orlando	MCO	732	730	730	424									0	-	87,108	86,870	86,870	50,456									0	-
Laker Airways (Bahamas)	7Z	Freeport	FPO					9								0	-					1,329								0	-
Northwest	NW	Detroit	DTW	1,682	1,631	1,534	1,513	1,512	1,550	1,395	1,278	1,120	1,006			0	-	200,509	201,221	185,628	187,255	203,837	202,255	191,678	163,119	144,120	104,662			0	-
Northwest	NW	Minneapolis	MSP			668	726	641	539	303	282					0	-			82,832	95,305	85,995	68,977	41,988	34,986					0	-
Sata Internacional	S4	Ponta Delgada	PDL					17		18	13	13				0	-					3,486		3,514	2,629	2,629				0	-
Southwest	WN	Baltimore	BWI	3,913	3,877	3,789	4,043	4,222	4,180	4,249	4,259	3,995	3,427	3,260	3,043	(217)	(6.7%)	535,911	531,110	519,132	553,911	578,063	572,699	582,133	581,240	547,223	468,695	442,637	415,554	(27,083)	(6.1%)
Southwest	WN	Chicago Midway	MDW	1,072	1,022	1,013	1,056	1,089	1,349	1,373	1,400	1,390	1,231	1,135	1,095	(40)	(3.5%)	146,844	139,975	138,399	144,672	149,232	184,813	188,160	191,469	190,410	167,712	153,121	149,877	(3,244)	(2.1%)
Southwest	WN	Fort Lauderdale/Hollywood	FLL	9	30			26			222	427	656	594	590	(4)	(0.7%)	1,194	4,149			3,562			30,473	58,499	89,852	81,378	80,791	(587)	(0.7%)
Southwest	WN	Houston	HOU	152												0	-	20,824												0	-
Southwest	WN	Islip	ISP	608	1,369	1,351										0	-	83,237	187,494	185,126										0	-
Southwest	WN	Kansas City	MCI	366	365	361	365	366	365	31						0	-	50,142	50,005	49,398	50,005	50,142	50,005	4,247						0	-
Southwest	WN	Las Vegas	LAS					9	31	365	365	366	365	365	365	0	0.0%					1,194	4,247	50,005	50,005	50,142	50,005	50,005	50,005	0	0.0%
Southwest	WN	Nashville	BNA	706	700	726	708	706	721	396	365	366	365	296	123	(173)	(58.4%)	96,702	95,861	99,403	97,055	96,722	98,816	54,252	50,005	50,142	49,154	39,578	16,067	(23,512)	(59.4%)
Southwest	WN	Orlando	MCO	955	1,095	1,183	1,460	1,586	1,821	1,838	2,030	2,161	1,842	1,799	1,659	(139)	(7.8%)	130,855	150,015	162,012	200,020	217,302	249,418	251,806	278,130	296,077	252,021	245,156	225,244	(19,912)	(8.1%)
Southwest	WN	Philadelphia	PHL					1,199	1,773	1,918	1,986	1,721	1,669	1,402	1,298	(104)	(7.4%)					164,224	238,366	262,328	272,023	230,076	228,594	192,054	177,001	(15,053)	(7.8%)
Southwest	WN	Phoenix	PHX	366	703	730	730	732	726	730	638	366	365	361	365	4	1.2%	50,142	96,370	100,010	100,010	100,284	99,403	100,010	87,406	50,142	50,005	49,398	50,005	607	1.2%
Southwest	WN	Tampa	TPA	745	730	818	1,095	1,085	1,086	1,091	1,095	993	826	813	808	(4)	(0.5%)	102,065	100,010	112,007	150,015	148,625	148,821	149,408	150,015	136,100	112,247	111,231	109,572	(1,659)	(1.5%)
Spirit Airlines	NK	Detroit	DTW					61	120							0	-					9,150	18,000							0	-
Spirit Airlines	NK	Fort Lauderdale/Hollywood	FLL					131	568	400	151					0	-					19,586	84,117	57,411	21,095					0	-
Spirit Airlines	NK	Fort Myers	RSW					70	365	181	184					0	-					10,436	54,750	29,706	32,533					0	-
United	UA	Chicago O'Hare	ORD	1,477	1,491	1,670	1,666	1,555	1,460	1,491	1,491	1,003	730	644	626	(18)	(2.9%)	239,076	239,727	245,812	242,105	234,843	200,677	189,260	179,413	124,349	98,155	82,802	78,487	(4,315)	(5.2%)
US Airways	US	Baltimore	BWI	2,462	2,101											0	-	263,921	239,659											0	-
US Airways	US	Charlotte	CLT	977	1,309	1,438	1,513	1,582	1,858	1,435	1,256	1,425	1,655	1,643	1,599	(44)	(2.7%)	128,984	181,656	216,134	218,364	223,314	274,039	224,384	181,130	187,163	208,090	233,886	226,854	(7,032)	(3.0%)
US Airways	US	Fort Lauderdale/Hollywood	FLL					31	17							0	-					3,941	2,186							0	-
US Airways	US	Orlando	MCO	52	48			48	43	13	13	9				0	-	5,605	5,440			6,126	5,831	1,831	1,831	1,080				0	-
US Airways	US	Philadelphia	PHL	1,830	1,794	1,766	1,738	2,416	2,182	1,131	1,429	862	928	1,299	1,012	(287)	(22.1%)	253,015	257,340	265,192	254,348	345,461	312,890	149,514	170,237	90,225	97,365	130,008	101,987	(28,021)	(21.6%)
US Airways	US	Pittsburgh	PIT	1,339	1,460	1,460	1,165	1,290	31							0	-	185,109	184,748	219,611	161,979	174,598	4,446							0	-
US Airways	US	Washington National	DCA	1,333	1,147	1,407	1,390	1,107	1,270	1,334	761	684	463	365	313	(52)	(14.3%)	167,278	145,960	175,855	178,061	149,503	170,009	176,649	96,999	81,540	58,046	49,501	44,006	(5,495)	(11.1%)
Subtotal				26,108	27,136	25,580	24,093	26,488	26,499	21,387	19,720	16,965	15,571	14,974	13,998	(976)	(6.5%)	3,475,622	3,656,088	3,573,982	3,353,377	3,683,422	3,651,961	2,914,952	2,638,603	2,247,835	2,040,751	1,992,492	1,883,114	(109,378)	(5.5%)
Regional/Commuter Carriers																															
Air Canada Express	AC	Toronto	YYZ	989	991	835	906	798	734	699	700	658	639	625	591	(34)	(5.5%)	37,482	36,656	29,701	17,478	14,364	13,783	13,286	13,292	12,494	12,136	11,880	11,232	(649)	(5.5%)
American Eagle	AA2	Chicago O'Hare	ORD							842	1,095	784				0	-							37,107	48,386	34,490				0	-
American Eagle	AA2	New York J F Kennedy	JFK	1,291	1,404	731	330									0	-	42,589	46,341	24,979	12,210									0	-
American Eagle	AA2	New York La Guardia	LGA	2,756	1,788	961										0	-	90,957	63,908	35,568										0	-
American Eagle	AA2	Raleigh/Durham	RDU					643	343							0	-					25,643	13,081							0	-
Cape Air	9K	Hyannis	HYA							26						0	-							231						0	-
Cape Air	9K	Martha's Vineyard	MVY	1,762	1,871	1,948	1,502	1,960	1,015	1,045	1,014	967	795	747	672	(75)	(10.0%)	15,861	16,839	17,535	13,515	17,640	9,132	9,408	9,129	8,707	7,154	6,722	6,048	(674)	(10.0%)
Cape Air	9K	Nantucket	ACK	2,453	2,653	2,592	1,975	2,765	1,199	1,285	1,183	879	733	681	668	(13)	(1.9%)	22,073	23,874	23,332	17,775	24,885	10,787	11,569	10,650	7,912	6,593	6,128	6,012	(116)	(1.9%)
Continental Connection	CO	Albany	ALB		944	1,116	863	702	51							0	-		17,941	21,212	16,397	13,335	961							0	-
Continental Connection	CO	Boston	BOS		51											0	-		961											0	-
Continental Connection	CO	New York Newark	EWR									625	1,043	427	171	(257)	(60.1%)									46,261	77,150	31,630	6,316	(25,313)	(80.0%)
Continental Connection	CO	Plattsburgh	PLB		22											0	-		415											0	-
Continental Express	CO	Cleveland	CLE	699	1,190	1,186	1,200	1,119	1,238	1,286	1,326	1,290	1,264	1,217	1,079	(138)	(11.3%)	34,936	59,234	59,266	59,930	55,900	61,900	64,307	66,250	64,500	63,214	60,836	53,943	(6,893)	(11.3%)
Continental Express	CO	New York Newark	EWR	1,482	465	650	1,019	1,395	1,455	1,438	1,481	1,080	417	1,028	1,268	240	23.3%	86,552	23,216	32,493	50,770	67,702	71,185	70,697	72,165	53,297	20,871	51,407	63,407	12,000	23.3%
Delta Connection	DL	Atlanta	ATL						31	705	1,291	1,373	1,136	724	9	(715)	(98.8%)						1,550	37,276	70,664	84,816	78,920	52,959	662	(52,297)	(98.7%)
Delta Connection	DL	Cincinnati	CVG		275	365	334	335	373	749	978	993	816	43		(43)	(100.0%)		13,750	18,250	16,700	16,750	19,109	43,523	53,217	51,691	41,597	2,150		(2,150)	(100.0%)
Delta Connection	DL	Detroit	DTW											1,324	1,995	671	50.6%											78,701	111,901	33,199	42.2%
Delta Connection	DL	Minneapolis	MSP											347	392	44	12.7%											26,192	29,553	3,361	12.8%
Delta Connection	DL	New York J F Kennedy	JFK							542	1,238	671	90			0	-							20,043	50,095	33,550	4,500			0	-
Delta Connection	DL	New York La Guardia	LGA	610	155											0	-	19,520	4,960											0	-
Delta Connection	DL	Raleigh/Durham	RDU												131	131	-												6,557	6,557	-
Delta Connection	DL	Washington National	DCA												685	685	-												34,243	34,243	-
Independence Air	DH	Washington Dulles	IAD					875	1,509	93						0	-					43,764	75,429	4,650						0	-
Midway Airlines	JI	Raleigh/Durham	RDU		510											0	-		25,507											0	-
Northwest Airlink	NW	Detroit	DTW									113	373			0	-									8,610	25,817			0	-
Northwest Airlink	NW	Minneapolis	MSP		302	93	40	79	31			271	262			0	-		15,079	4,650	1,986	3,943	1,550			20,563	19,912			0	-
Swissair	SR	New York J F Kennedy	JFK	31												0	-	1,023												0	-
United Express	UA	Chicago O'Hare	ORD					214	262	334	217	213	370	455	375	(80)	(17.5%)					10,700	18,330	23,380	14,847	14,077	24,401	29,820	24,079	(5,741)	(19.3%)
United Express	UA	Washington Dulles	IAD	1,468	1,507	1,460	1,460	1,876	1,716	1,656	1,589	1,464	1,460	1,569	1,421	(148)	(9.4%)	52,832	74,367	73,000	73,000	93,779	85,821	85,133	90,282	88,930	90,648	99,719	89,593	(10,126)	(10.2%)
US Airways Express	US	Albany	ALB	679												0	-	12,898												0	-
US Airways Express	US	Boston	BOS	48												0	-	909												0	-
US Airways Express	US	Charlotte	CLT					13	18	338	491	348	92	126	147	22	17.1%					657	879	26,581	38,945	28,677	5,998	10,047	12,035	1,988	19.8%
US Airways Express	US	Hyannis	HYA			183	17									0	-			3,480	326									0	-
US Airways Express	US	Nantucket	ACK				9									0	-				292									0	-
US Airways Express	US	New York La Guardia	LGA	2,298	2,233	1,930	1,876	1,808	1,669	1,816	1,855	1,589	1,705	1,222	957	(266)	(21.7%)	84,116	81,795	57,349	48,101	50,163	55,077	59,675	57,420	53,702	63,090	45,225	33,141	(12,084)	(26.7%)
US Airways Express	US	New York Newark	EWR	1,569	1,507	80										0	-	31,176	43,707	2,312										0	-
US Airways Express	US	Philadelphia	PHL	366	365	365	9	22	716	1,685	1,356	1,800	1,788	1,526	1,713	187	12.3%	13,542	13,505	13,505	322	1,324	45,199	105,463	88,590	135,360	123,761	107,790	122,386	14,596	13.5%
US Airways Express	US	Pittsburgh	PIT					183	1,360	1,395	978	303				0	-					9,157	72,808	76,891	51,251	15,136				0	-
US Airways Express	US	Plattsburgh	PLB	26												0	-	497												0	-
US Airways Express	US	Washington National	DCA					143	482	625	1,254	1,373	1,256	1,373	1,304	(70)	(5.1%)					7,171	30,996	31,326	78,780	84,215	79,539	92,151	95,527	3,376	3.7%
Subtotal				18,527	18,233	14,496	11,538	14,930	14,200	16,560	18,046	16,795	14,239	13,436	13,577	142	1.1%	546,963	562,057	416,630	328,803	456,879	587,576	720,547	813,962	846,987	745,302	713,356	706,634	(6,721)	(0.9%)
Total				44,635	45,369	40,076	35,631	41,419	40,699	37,946	37,766	33,760	29,809	28,409	27,575	(834)	(2.9%)	4,022,585	4,218,145	3,990,612	3,682,181	4,140,301	4,239,537	3,635,498	3,452,565	3,094,822	2,786,053	2,705,848	2,589,748	(116,100)	(4.3%)

Source: OAG Schedules.
Note: All Northwest operations included in Delta from 2010 onwards

Table F-5 Scheduled Passenger Operations by Market and Carrier for Manchester-Boston Regional Airport

				Departures													Departing Seats											
Carrier	Code	Market	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Jet Carriers																															
Boston-Maine Airways	PN	Myrtle Beach	MYR				26	83								0	-				3,943	12,429								0	-
Boston-Maine Airways	PN	Portsmouth	PSM				26	183								0	-				3,921	27,471								0	-
Boston-Maine Airways	PN	Sanford	SFB				13	87								0	-				1,971	13,114								0	-
Continental	CO	Cleveland	CLE	130	91						9					0	-	16,151	10,857								1,038			0	-
Continental	CO	New York Newark	EWR	462	874	694	326	314	286	260	4					0	-	62,358	105,765	80,049	37,310	36,123	30,953	27,025	446					0	-
Delta	DL	Atlanta	ATL	244	730	944	881	732	668			13		275	565	290	105.6%	34,648	103,660	134,048	125,102	103,944	94,856			1,826		39,050	81,600	42,550	109.0%
Delta	DL	Cincinnati	CVG		214	579	730	710	664							0	-		30,388	82,218	103,660	100,840	86,583							0	-
Delta	DL	Detroit	DTW											796		(796)	(100.0%)											89,289		(89,289)	(100.0%)
Northwest	NW	Detroit	DTW	1,609	1,613	1,534	1,429	1,460	1,399	1,301	1,199	832	778			0	-	194,058	214,073	205,234	193,043	202,623	180,879	181,073	149,221	101,760	93,450			0	-
Northwest	NW	Minneapolis	MSP				214	362	365	241	153					0	-				26,536	44,835	46,933	30,575	18,972					0	-
Southwest	WN	Baltimore	BWI	2,828	2,812	3,128	3,625	3,874	3,850	3,859	3,898	3,638	3,312	2,891	2,761	(130)	(4.5%)	387,397	385,205	428,516	496,645	530,588	527,405	525,342	530,545	496,372	450,616	393,093	376,945	(16,148)	(4.1%)
Southwest	WN	Chicago Midway	MDW	706	708	704	669	693	1,355	1,399	1,631	1,651	1,253	1,144	1,244	100	8.8%	96,702	97,055	96,448	91,712	94,744	185,481	191,722	222,957	226,101	169,754	155,466	169,440	13,975	9.0%
Southwest	WN	Denver	DEN												92	92	-												12,604	12,604	-
Southwest	WN	Fort Lauderdale/Hollywood	FLL		9		22	9				254	120	9	9	0	0.0%		1,194		2,955	1,194				34,692	16,440	1,194	1,194	0	0.0%
Southwest	WN	Kansas City	MCI	366	365	365	365	305								0	-	50,142	50,005	50,005	50,005	41,785								0	-
Southwest	WN	Las Vegas	LAS				122	375	365	365	365	366	365	365	365	0	0.0%				16,714	51,336	50,005	50,005	50,005	50,142	50,005	50,005	50,005	0	0.0%
Southwest	WN	Nashville	BNA	397	721	730	730	715	730	62						0	-	54,389	98,816	99,682	99,686	97,896	99,879	8,494						0	-
Southwest	WN	Orlando	MCO	410	697	818	1,095	1,129	1,468	1,456	1,774	1,602	1,201	1,125	977	(148)	(13.2%)	56,111	95,469	112,007	150,015	154,673	201,175	199,413	243,032	219,402	164,332	154,145	133,829	(20,315)	(13.2%)
Southwest	WN	Philadelphia	PHL					788	1,786	1,756	2,005	2,026	1,894	1,411	1,325	(86)	(6.1%)					107,995	244,356	240,533	274,328	269,953	259,275	192,456	180,871	(11,585)	(6.0%)
Southwest	WN	Phoenix	PHX								122	366	365	322	273	(49)	(15.2%)								16,714	50,142	50,005	44,114	37,401	(6,713)	(15.2%)
Southwest	WN	Tampa	TPA		306	453	730	845	1,099	1,095	1,030	741	673	782	629	(153)	(19.6%)		41,922	62,002	100,010	115,693	150,165	150,015	141,071	101,283	92,240	107,173	86,212	(20,961)	(19.6%)
United	UA	Chicago O'Hare	ORD	1,403	1,431	1,694	1,460	1,464	1,339	1,096	1,067	824	608			0	-	221,523	231,477	248,062	219,888	209,179	179,151	138,080	129,086	106,943	85,929			0	-
United	UA	Portland (ME)	PWM	57	90											0	-	7,241	13,230											0	-
US Airways	US	Baltimore	BWI	1,782	1,444											0	-	191,078	163,901											0	-
US Airways	US	Charlotte	CLT		62	730	901	1,276	1,308	660	623	689	378	365	51	(314)	(85.9%)		8,122	98,076	118,445	167,699	178,836	91,141	85,232	86,775	53,676	52,560	7,406	(45,154)	(85.9%)
US Airways	US	Orlando	MCO	52	48											0	-	5,605	5,440											0	-
US Airways	US	Philadelphia	PHL	1,821	1,821	1,812	1,602	1,806	2,021	683	634	366	395	365	313	(52)	(14.3%)	222,331	226,973	245,108	212,916	244,129	274,215	95,260	73,396	48,403	56,219	33,132	30,973	(2,159)	(6.5%)
US Airways	US	Pittsburgh	PIT	1,085	1,095	1,086	820	553								0	-	139,837	142,409	150,124	103,168	77,259								0	-
US Airways	US	Washington National	DCA	675	599			113	575	539	304	296				0	-	82,085	77,187			14,323	77,461	77,575	43,717	40,724				0	-
Subtotal				14,026	15,731	15,270	15,787	17,876	19,279	14,771	14,810	13,664	11,352	9,850	8,604	(1,246)	(12.6%)	1,821,657	2,103,146	2,091,581	2,157,645	2,449,873	2,608,335	2,006,253	1,978,722	1,834,518	1,542,979	1,311,677	1,168,481	(143,196)	(10.9%)
Regional/Commuter Carriers																															
Air Canada Express	AC	Montreal Dorval	YUL		423											0	-		7,606											0	-
Air Canada Express	AC	Toronto	YYZ	339	1,299	1,295	1,391	1,024	930	908	917	910	908	707	403	(305)	(43.1%)	5,616	23,385	23,305	25,863	18,758	17,439	17,260	17,415	17,295	17,252	13,441	7,652	(5,790)	(43.1%)
American Eagle	AA	New York La Guardia	LGA	1,833	810											0	-	60,480	26,735											0	-
Boston-Maine Airways	E9	Bangor	BGR				192	4								0	-				3,453	80								0	-
Boston-Maine Airways	E9	Martha's Vineyard	MVY				105									0	-				1,885									0	-
Boston-Maine Airways	E9	Nantucket	ACK				214									0	-				3,844									0	-
Boston-Maine Airways	E9	New London/Groton	GON				118	22								0	-				2,124	399								0	-
Boston-Maine Airways	E9	Portsmouth	PSM				148	4								0	-				2,667	80								0	-
Boston-Maine Airways	E9	Saint John	YSJ				139									0	-				2,510									0	-
Continental Connection	CO	Albany	ALB	80	1,131	1,116	1,130	1,007	313							0	-	1,515	21,486	21,212	21,470	19,130	5,944							0	-
Continental Connection	CO	New York J F Kennedy	JFK		349											0	-		6,623											0	-
Continental Connection	CO	New York Newark	EWR									62	337	141	175	34	23.9%									4,588	24,906	9,483	6,486	(2,997)	(31.6%)
Continental Connection	CO	Plattsburgh	PLB		39											0	-		746											0	-
Continental Connection	CO	Rochester	ROC	44	129											0	-	841	2,443											0	-
Continental Connection	CO	Syracuse	SYR	22	64											0	-	421	1,221											0	-
Continental Connection	CO	Westchester County	HPN		328											0	-		6,224											0	-
Continental Express	CO	Cleveland	CLE	593	914	1,343	1,173	1,198	1,186	1,213	1,236	1,212	1,178	1,178	935	(244)	(20.7%)	29,614	45,371	66,906	58,053	59,729	58,991	60,240	60,374	60,487	58,893	58,921	46,736	(12,186)	(20.7%)
Continental Express	CO	New York Newark	EWR	1,028	603	762	1,125	1,150	1,165	1,196	1,451	1,380	1,072	1,267	1,215	(51)	(4.1%)	64,944	29,821	38,107	55,935	57,169	58,140	59,779	72,054	68,613	53,579	63,336	60,764	(2,571)	(4.1%)
Delta Connection	DL	Atlanta	ATL	488			214	366	485	1,621	1,176	692	365	90		(90)	(100.0%)	24,400			10,700	18,300	26,620	107,251	82,310	48,440	25,550	6,300		(6,300)	(100.0%)
Delta Connection	DL	Bangor	BGR	244												0	-	12,200												0	-
Delta Connection	DL	Cincinnati	CVG	1,673	1,246	881	726	750	735	986	982	775				0	-	83,657	62,300	44,050	40,657	39,299	38,426	54,667	55,601	39,633				0	-
Delta Connection	DL	Detroit	DTW											499	1,858	1,359	272.2%											32,795	95,802	63,007	192.1%
Delta Connection	DL	New York J F Kennedy	JFK							453	1,059					0	-							16,766	41,783					0	-
Delta Connection	DL	New York La Guardia	LGA	727	124		825	1,067	486							0	-	36,357	6,200		41,250	53,350	24,300							0	-
Independence Air	DH	Washington Dulles	IAD					1,439	1,568	93						0	-					71,971	78,379	4,650						0	-
Northwest Airlink	NW	Detroit	DTW					13		89	49	397	359			0	-					664		4,450	3,011	30,242	25,524			0	-
Northwest Airlink	NW	Minneapolis	MSP				214	324	233	89	153	271	92			0	-				10,700	16,179	11,664	4,450	9,358	20,563	6,992			0	-
United Express	UA	Chicago O'Hare	ORD				83	213	31	333	363	322	388	1,040	983	(57)	(5.5%)				4,157	10,650	2,170	23,310	24,922	21,200	25,402	67,675	62,096	(5,579)	(8.2%)
United Express	UA	Washington Dulles	IAD		124	1,460	1,460	1,678	1,760	1,316	1,429	1,098	1,161	1,104	658	(446)	(40.4%)		6,200	73,000	73,000	83,900	90,419	65,881	75,866	61,533	62,534	55,951	33,514	(22,437)	(40.1%)
US Airways Express	US	Boston	BOS									73				0	-									1,384				0	-
US Airways Express	US	Charlotte	CLT						307	396	416	196	227	153	318	165	107.9%						21,863	29,701	33,671	16,039	19,547	13,146	27,181	14,036	106.8%
US Airways Express	US	New York La Guardia	LGA	2,583	2,095	2,109	2,335	2,632	2,499	2,454	2,454	2,157	1,464	1,381	1,269	(112)	(8.1%)	96,936	77,531	77,425	81,678	90,511	86,492	84,057	83,265	73,334	49,761	49,420	43,737	(5,683)	(11.5%)
US Airways Express	US	Philadelphia	PHL				275	370	562	2,120	1,720	1,878	1,929	2,116	2,068	(48)	(2.3%)				12,957	19,654	30,239	115,950	107,421	127,396	118,750	140,277	135,156	(5,120)	(3.7%)
US Airways Express	US	Pittsburgh	PIT				214	567	1,022							0	-				10,700	28,935	51,107							0	-
US Airways Express	US	Washington National	DCA			844	1,017	976	508	547	782	845	1,008	1,039	1,043	4	0.4%			29,377	38,697	48,684	25,379	35,327	55,456	58,271	76,259	81,095	81,683	588	0.7%
Subtotal				9,655	9,677	9,809	13,098	14,804	13,788	13,815	14,186	12,269	10,486	10,716	10,925	209	1.9%	416,980	323,892	373,382	502,301	637,439	627,572	683,739	722,508	649,020	564,949	591,840	600,808	8,967	1.5%
Total				23,681	25,408	25,079	28,885	32,680	33,067	28,586	28,996	25,933	21,839	20,566	19,529	(1,037)	(5.0%)	2,238,636	2,427,038	2,464,963	2,659,946	3,087,313	3,235,907	2,689,992	2,701,229	2,483,538	2,107,928	1,903,517	1,769,288	(134,229)	(7.1%)

Source: OAG Schedules.
Note: All Northwest operations included in Delta from 2010 onwards

Table F-6 Scheduled Passenger Operations by Market and Carrier for Portland International Jetport

				Departures													Departing Seats												
Carrier	Code	Market	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Jet Carriers																															
AirTran	FL	Atlanta	ATL										153	92	167	75	81.4%										18,189	10,764	19,522	8,758	81.4%
AirTran	FL	Baltimore	BWI								589.714	1,012	948	944	927	(17)	(1.8%)								68,997	118,437	111,024	112,951	109,024	(3,928)	(3.5%)
AirTran	FL	Orlando	MCO								91.5714	156	91	52	52	0	0.8%								10,714	18,367	11,117	6,503	6,355	(148)	(2.3%)
Continental	CO	Cleveland	CLE										9			0	-										1,373			0	-
Continental	CO	New York Newark	EWR		62		66									0	-		7,068		7,675									0	-
Delta	DL	Atlanta	ATL	732	730	730	730	732	486			118	114	424	793	370	87.2%	103,944	103,660	103,660	103,660	103,944	61,229			16,715	16,208	60,167	114,597	54,429	90.5%
Delta	DL	Cincinnati	CVG	1,089	853	730	730	732	486	92						0	-	154,658	121,126	103,660	103,660	103,944	69,012	9,200						0	-
Independence Air	DH	Washington Dulles	IAD						307							0	-						40,524							0	-
jetBlue	B6	New York J F Kennedy	JFK							856	1504.29	1,571	1,527	1,201	1,323	122	10.1%							119,872	178,914	179,850	178,129	128,936	135,379	6,443	5.0%
jetBlue	B6	Orlando	MCO									296	286	212	181	(31)	(14.6%)									29,614	28,629	21,214	21,344	130	0.6%
Northwest	NW	Detroit	DTW	523	744	458	368	368	427	612	307					0	-	52,105	70,929	45,800	36,800	36,800	42,700	61,157	30,700					0	-
Trans World Airlines	TW	Hartford	BDL	305												0	-	43,310												0	-
United	UA	Chicago O'Hare	ORD	728	608											0	-	88,996	77,723											0	-
United	UA	Manchester	MHT	366	243											0	-	53,802	35,721											0	-
US Airways	US	Charlotte	CLT										122	395	352	(43)	(11.0%)										10,736	48,688	47,130	(1,558)	(3.2%)
US Airways	US	Philadelphia	PHL	1,312	1,460	1,124	1,399	294	154						217	217	-	163,051	181,329	149,318	179,229	37,687	19,404						21,525	21,525	-
US Airways	US	Pittsburgh	PIT	1,081	1,095	1,031	184									0	-	137,472	141,080	133,590	23,552									0	-
US Airways	US	Washington National	DCA					62	52							0	-					7,936	6,668							0	-
Subtotal				6,135	5,795	4,073	3,477	2,188	1,912	1,560	2,493	3,153	3,251	3,320	4,013	693	20.9%	797,338	738,636	536,028	454,576	290,311	239,537	190,229	289,325	362,984	375,404	389,224	474,876	85,651	22.0%
Regional/Commuter Carriers																															
Air Canada Express	AC	Montreal Dorval	YUL	344	348											0	-	4,734	6,269											0	-
Air Canada Express	AC	Toronto	YYZ											481	783	302	62.7%											9,142	14,872	5,730	62.7%
America West	HP	New York Newark	EWR	52												0	-	2,457												0	-
American Eagle	AA	Boston	BOS	3,804	2,273	1,570	334	105								0	-	125,518	75,204	55,457	12,580	3,932								0	-
American Eagle	AA	Chicago O'Hare	ORD		381	726	761	702								0	-		17,289	33,557	33,792	40,456								0	-
American Eagle	AA	New York La Guardia	LGA	2,033	1,617	960	819	690								0	-	67,084	65,442	35,525	30,746	25,672								0	-
Continental Connection	CO	Albany	ALB		507	1,116	1,199	1,268	291							0	-		9,636	21,212	22,786	24,097	5,537							0	-
Continental Connection	CO	Boston	BOS	204	1,493				241							0	-	3,871	28,372				4,576							0	-
Continental Connection	CO	New York Newark	EWR									718	1,412	1,426	1,343	(83)	(5.8%)									53,164	104,509	105,503	99,361	(6,142)	(5.8%)
Continental Connection	CO	Presque Isle	PQI		30											0	-		570											0	-
Continental Express	CO	Cleveland	CLE	425	569	197	135	135	223	210	236	324	276	188	188	0	0.0%	20,378	25,606	9,176	6,700	6,757	11,021	10,493	11,197	16,193	13,786	9,400	9,400	0	0.0%
Continental Express	CO	New York Newark	EWR	1,429	1,355	1,443	1,355	1,425	1,394	1,420	1,438	746	13	4	83	79	1975.0%	70,393	63,715	70,587	67,610	70,061	69,605	71,007	71,921	36,831	657	200	4,150	3,950	1975.0%
Delta Connection	DL	Atlanta	ATL						700	1,369	1,055	784	742	350		(350)	(100.0%)						48,440	95,820	73,880	54,724	51,970	25,532		(25,532)	(100.0%)
Delta Connection	DL	Boston	BOS		642	1,672	1,582	1,464	1,153							0	-		20,544	56,798	70,334	69,924	57,650							0	-
Delta Connection	DL	Cincinnati	CVG		61	120		184	600	942	1,013	706				0	-		3,050	6,000		9,200	31,166	47,966	47,813	35,463				0	-
Delta Connection	DL	Detroit	DTW											1,217	1,314	96	7.9%											62,320	65,686	3,366	5.4%
Delta Connection	DL	New York J F Kennedy	JFK							436	1,391	1,273	1,286	270		(270)	(100.0%)							16,143	64,967	65,560	64,286	13,500		(13,500)	(100.0%)
Delta Connection	DL	New York La Guardia	LGA	475	766	1,095	1,095	1,098	1,095	1,000	585			786	1,034	249	31.6%	15,191	24,512	38,334	54,750	54,900	54,750	50,014	29,243			41,440	57,437	15,996	38.6%
Independence Air	DH	Washington Dulles	IAD					1,197	1,384	93						0	-					59,864	69,186	4,650						0	-
Lufthansa German Airlines	LH	Washington Dulles	IAD	31												0	-	1,550												0	-
Northwest Airlink	NW	Detroit	DTW	484	78	334	772	1,027	915	329	585	845	997			0	-	33,366	5,392	19,550	43,832	57,748	53,132	17,039	30,613	61,181	61,251			0	-
Northwest Airlink	NW	Minneapolis	MSP			22	141	441	404	91	122	122	30			0	-			1,093	7,064	22,057	20,186	4,550	6,100	6,100	1,500			0	-
Starlink Aviation	Q4	Yarmouth	YQI										393	521	521	0	0.0%										7,071	9,386	9,386	0	0.0%
Swissair	SR	Boston	BOS	31												0	-	1,023												0	-
United Express	UA	Chicago O'Hare	ORD		244	1,095	1,340	1,464	1,095	1,252	1,265	1,255	1,257	1,249	1,176	(72)	(5.8%)		12,200	54,750	67,000	73,200	67,590	87,660	85,347	82,719	82,662	82,273	72,457	(9,816)	(11.9%)
United Express	UA	Washington Dulles	IAD	996	975	1,309	1,117	1,342	1,456	1,408	1,112	1,072	1,099	1,078	1,066	(13)	(1.2%)	49,779	48,750	65,450	55,850	67,100	83,730	92,899	70,940	68,020	67,831	64,767	62,493	(2,274)	(3.5%)
US Airways Express	US	Bangor	BGR	231	252	13										0	-	8,558	9,238	424										0	-
US Airways Express	US	Boston	BOS	2,229	1,748	698	204									0	-	42,359	40,311	14,362	4,615									0	-
US Airways Express	US	Charlotte	CLT					193	365	431	365	541	384	88	18	(70)	(79.8%)					9,643	23,710	30,942	31,390	46,129	32,987	5,323	1,364	(3,959)	(74.4%)
US Airways Express	US	New York La Guardia	LGA	1,218	1,231	1,404	1,356	1,364	1,665	1,843	1,767	1,940	1,874	1,647	1,526	(121)	(7.3%)	43,901	44,651	42,640	44,009	45,007	77,909	89,773	84,304	94,419	93,079	78,477	68,755	(9,722)	(12.4%)
US Airways Express	US	Philadelphia	PHL				61	1,222	1,913	2,148	2,042	2,000	1,891	1,947	1,987	39	2.0%				3,050	68,684	100,307	113,072	121,427	124,630	134,837	133,521	129,133	(4,389)	(3.3%)
US Airways Express	US	Pittsburgh	PIT				484	799	219							0	-				24,200	43,103	10,971							0	-
US Airways Express	US	Plattsburgh	PLB	48												0	-	909												0	-
US Airways Express	US	Presque Isle	PQI				131	130								0	-				2,497	2,470								0	-
US Airways Express	US	Washington National	DCA	1,089	890	865	1,022	984	1,149	1,173	1,377	1,574	1,113	1,043	1,043	0	0.0%	33,976	35,453	25,954	44,564	49,207	75,568	77,587	85,732	95,623	78,421	83,302	87,190	3,888	4.7%
US Airways Express	US	Westchester County	HPN	65												0	-	1,235												0	-
Subtotal				15,187	15,460	14,639	13,909	17,235	16,261	14,145	14,355	13,898	12,766	12,296	12,081	(215)	(1.7%)	526,282	536,204	550,870	595,979	803,084	865,033	809,613	814,876	840,756	794,848	724,086	681,682	(42,404)	(5.9%)
Total				21,322	21,255	18,712	17,386	19,423	18,174	15,705	16,848	17,051	16,017	15,615	16,094	478	3.1%	1,323,619	1,274,840	1,086,898	1,050,555	1,093,395	1,104,570	999,842	1,104,200	1,203,740	1,170,251	1,113,310	1,156,558	43,248	3.9%

Source: OAG Schedules.
Note: All Northwest operations included in Delta from 2010 onwards

Table F-7 Scheduled Passenger Operations by Market and Carrier for Burlington International Airport

				Departures													Departing Seats											
Carrier	Code	Market	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Jet Carriers																															
AirTran	FL	Baltimore	BWI									512	609			0	-									59,887	71,253			0	-
Continental	CO	New York Newark	EWR					4								0	-					531								0	-
jetBlue	B6	New York J F Kennedy	JFK	244	730	730	782	1,094	1,126	1,460	1,495	1,477	1,500	1,434	1,405	(29)	(2.0%)	39,528	118,260	118,260	126,730	170,597	173,920	221,784	224,759	217,650	219,750	180,286	163,839	(16,447)	(9.1%)
jetBlue	B6	Orlando	MCO									361	317	330	339	9	2.6%									41,121	37,700	33,014	33,871	857	2.6%
Northwest	NW	Detroit	DTW					214	174							0	-					21,400	17,429							0	-
United	UA	Chicago O'Hare	ORD	815	862	730	454	401	365	426	652	632	90			0	-	105,509	113,504	96,537	59,145	51,286	42,379	54,754	79,331	77,707	11,031			0	-
United	UA	Portland (ME)	PWM		61											0	-		7,808											0	-
US Airways	US	Philadelphia	PHL	1,098	1,095	1,126	338	366	365	365	181					0	-	150,338	145,596	144,205	43,264	46,848	46,170	44,089	21,720					0	-
US Airways	US	Pittsburgh	PIT	732	730	699										0	-	103,568	102,444	91,825										0	-
US Airways	US	Washington National	DCA						4							0	-						558							0	-
Subtotal				2,889	3,478	3,285	1,574	2,079	2,035	2,251	2,328	2,982	2,516	1,764	1,744	(20)	(1.2%)	398,943	487,612	450,827	229,139	290,663	280,456	320,627	325,810	396,366	339,734	213,300	197,710	(15,590)	(7.3%)
Regional/Commuter Carriers																															
America West	HP	New York Newark	EWR	166												0	-	7,889												0	-
American Eagle	AA	Boston	BOS	3,094	1,855											0	-	102,111	61,215											0	-
American Eagle	AA	Chicago O'Hare	ORD			490	180									0	-			21,901	7,920									0	-
Continental Connection	CO	Albany	ALB		287	970	652	541								0	-		5,456	18,425	12,396	10,284								0	-
Continental Connection	CO	Boston	BOS	244	1,714	44			634	982	208					0	-	4,628	32,571	828			12,054	18,658	3,947					0	-
Continental Connection	CO	Buffalo	BUF	4	26											0	-	84	491											0	-
Continental Connection	CO	Hartford	BDL		129											0	-		2,443											0	-
Continental Connection	CO	New York Newark	EWR									573	973	405	975	570	140.5%									42,423	71,981	30,002	72,161	42,159	140.5%
Continental Connection	CO	Plattsburgh	PLB	213	2,127	617	521	423	367	582	177					0	-	4,039	40,405	11,726	9,904	8,037	6,970	11,061	3,358					0	-
Continental Connection	CO	Plattsburgh International	PBG								31					0	-								589					0	-
Continental Connection	CO	Poughkeepsie	POU	66	521											0	-	1,262	9,894											0	-
Continental Connection	CO	Westchester County	HPN		26			17								0	-		494			331								0	-
Continental Express	CO	Cleveland	CLE	322	352	330	422	493	509	540	614	615	370	366	348	(17)	(4.7%)	16,064	17,086	16,288	20,990	24,145	25,351	26,993	28,485	29,662	18,493	18,286	17,421	(864)	(4.7%)
Continental Express	CO	New York Newark	EWR	1,458	1,643	1,369	1,360	1,407	1,455	1,447	1,451	882	457	1,020	450	(570)	(55.9%)	70,203	78,296	67,410	67,189	70,028	72,707	72,343	71,370	43,593	22,857	51,000	22,514	(28,486)	(55.9%)
Continental Express	CO	Westchester County	HPN				9									0	-				322									0	-
Delta Connection	DL	Atlanta	ATL						62	699	616	506	304			0	-						3,100	34,971	33,597	35,430	21,280			0	-
Delta Connection	DL	Boston	BOS		1,548	1,460	1,582	1,098	1,002		244	120				0	-		49,536	46,720	50,624	45,072	50,100		4,636	2,280				0	-
Delta Connection	DL	Cincinnati	CVG		552	1,095	1,095	1,098	1,060	651	365	152				0	-		17,664	48,270	54,750	54,900	52,979	31,567	18,250	7,600				0	-
Delta Connection	DL	Detroit	DTW											1,227	1,309	82	6.7%											61,417	65,443	4,026	6.6%
Delta Connection	DL	New York J F Kennedy	JFK							582	1,364	1,251	1,182	1,336	1,338	2	0.2%							24,144	62,901	62,536	59,741	67,071	81,259	14,189	21.2%
Delta Connection	DL	New York La Guardia	LGA	355	124											0	-	11,351	3,968											0	-
Independence Air	DH	Washington Dulles	IAD					977	1,903	93						0	-					48,829	95,136	4,650						0	-
Lufthansa German Airlines	LH	Washington Dulles	IAD	31												0	-	1,550												0	-
Northwest Airlink	NW	Detroit	DTW		722	1,087	1,353	1,173	1,159	1,086	866	824	883			0	-		36,093	54,329	72,303	62,125	61,983	63,533	43,279	41,200	44,150			0	-
Northwest Airlink	NW	Minneapolis	MSP					13	61	62	92	92				0	-					657	3,050	3,100	4,600	4,600				0	-
Porter Airlines	PD	Toronto Island Apt	YTZ												9	9	-												620	620	-
Swissair	SR	Boston	BOS	31												0	-	1,023												0	-
United Express	UA	Chicago O'Hare	ORD				698	966	1,003	964	730	618	1,097	1,353	1,565	212	15.7%				34,900	48,314	59,930	67,500	49,266	40,519	70,569	84,431	88,435	4,004	4.7%
United Express	UA	Washington Dulles	IAD	1,477	1,460	1,460	1,399	1,464	1,456	1,456	1,403	1,312	1,196	1,130	1,112	(17)	(1.5%)	73,843	71,110	73,000	69,950	73,200	72,786	72,779	71,925	67,065	63,217	61,988	69,793	7,805	12.6%
US Airways Express	US	Boston	BOS	2,404	1,616	637										0	-	48,139	59,797	23,580										0	-
US Airways Express	US	Charlotte	CLT							4		13				0	-							221		657				0	-
US Airways Express	US	New York La Guardia	LGA	2,074	1,673	1,687	1,812	2,200	2,175	2,382	2,275	2,184	2,154	1,680	1,487	(193)	(11.5%)	76,749	61,896	62,403	67,060	81,400	80,491	88,123	84,175	80,792	79,703	62,144	55,008	(7,136)	(11.5%)
US Airways Express	US	Philadelphia	PHL				1,314	1,224	1,980	1,686	1,749	2,087	1,894	1,903	1,956	53	2.8%				65,107	60,830	97,288	88,078	95,885	122,571	117,257	128,140	131,727	3,587	2.8%
US Airways Express	US	Pittsburgh	PIT		205	304	668	675								0	-		6,163	9,120	33,400	33,771							0	-
US Airways Express	US	Plattsburgh	PLB	2,427												0	-	46,116												0	-
US Airways Express	US	Poughkeepsie	POU	718												0	-	13,639												0	-
US Airways Express	US	Saranac Lake	SLK	44												0	-	841												0	-
US Airways Express	US	Washington National	DCA	988	812	865	1,047	1,024	990	999	1,095	1,224	1,078	1,043	1,043	0	0.0%	31,574	33,714	25,954	44,681	51,200	61,458	58,184	70,278	80,423	65,756	77,625	82,974	5,349	6.9%
US Airways Express	US	Wilkes-Barre Scranton	AVP	22												0	-	415												0	-
Subtotal				16,138	17,390	12,414	14,113	14,794	15,816	14,215	13,280	12,453	11,587	11,461	11,593	132	1.1%	511,521	588,291	479,952	611,497	673,123	755,382	665,906	646,539	661,351	635,004	642,104	687,357	45,253	7.0%
Total				19,028	20,868	15,699	15,686	16,873	17,851	16,466	15,607	15,435	14,103	13,225	13,336	111	0.8%	910,464	1,075,903	930,779	840,636	963,785	1,035,838	986,532	972,349	1,057,717	974,739	855,404	885,067	29,663	3.5%

Source: OAG Schedules.

Note: All Northwest operations included in Delta from 2010 onwards

Table F-8 Scheduled Passenger Operations by Market and Carrier for Bangor International Airport

Carrier	Code	Market	Code	Departures 2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change	Departing Seats 2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Jet Carriers																															
Allegiant Air	G4	Sanford	SFB								17	109	160	181	150	(31)	(17.1%)								2,614	16,350	24,000	27,150	22,500	(4,650)	(17.1%)
Allegiant Air	G4	St. Petersburg/Clearwater	PIE										12	107	93	(14)	(13.1%)										1,800	16,050	13,950	(2,100)	(13.1%)
Pan American Airways	PN	Allentown/Bethlehem	ABE		298											0	-		44,636											0	-
Pan American Airways	PN	Baltimore	BWI		31	303										0	-		4,650	45,514										0	-
Pan American Airways	PN	Pittsburgh	PIT	285	140											0	-	42,729	21,021											0	-
Pan American Airways	PN	Portsmouth	PSM	389	247	303	178									0	-	58,414	37,029	45,514	26,764									0	-
Pan American Airways	PN	Sanford	SFB				17									0	-				2,550									0	-
Subtotal				674	716	607	195	0	0	0	17	109	172	288	243	(45)	(15.6%)	101,143	107,336	91,029	29,314	0	0	0	2,614	16,350	25,800	43,200	36,450	(6,750)	(15.6%)
Regional/Commuter Carriers																															
American Eagle	AA	Boston	BOS	4,670	3,461	2,731	2,242	1,722	1,530	1,491	1,046					0	-	154,115	114,559	98,201	86,533	64,063	56,594	56,193	38,697					0	-
American Eagle	AA	New York La Guardia	LGA	382	396	457	427	428	518	409	339					0	-	12,606	15,754	16,909	15,799	15,836	19,166	15,122	12,538					0	-
Boston-Maine Airways	E9	Halifax	YHZ				340	4								0	-				6,120	80								0	-
Boston-Maine Airways	E9	Manchester	MHT				258	22								0	-				4,636	399								0	-
Boston-Maine Airways	E9	Portsmouth	PSM				295									0	-				5,318									0	-
Boston-Maine Airways	E9	Saint John	YSJ				90									0	-				1,628									0	-
Continental Connection	CO	Albany	ALB			401	652	575	189							0	-			7,616	12,383	10,928	3,583						0	-
Continental Express	CO	New York Newark	EWR						481	563	440	549	407			0	-						22,698	23,928	17,541	25,607	20,343			0	-
Delta Connection	DL	Atlanta	ATL							214	509	274				0	-							14,980	35,650	19,160				0	-
Delta Connection	DL	Boston	BOS		704	1,884	1,464	1,473	1,416	1,038	1,401	1,092	555			0	-		22,528	60,288	47,391	60,375	70,800	51,339	34,332	44,102	27,764			0	-
Delta Connection	DL	Cincinnati	CVG	1,342	1,095	1,095	1,161	1,464	1,394	678	695	125				0	-	67,100	54,750	55,970	72,189	87,840	82,439	35,299	34,764	6,271				0	-
Delta Connection	DL	Detroit	DTW											975	871	(104)	(10.7%)											50,540	54,640	4,100	8.1%
Delta Connection	DL	New York J F Kennedy	JFK									341	942	180		(180)	(100.0%)									17,029	47,100	9,000		(9,000)	(100.0%)
Delta Connection	DL	New York La Guardia	LGA											537	844	307	57.2%											26,958	49,368	22,410	83.1%
Northwest Airlink	NW	Boston	BOS	27												0	-	797												0	-
Northwest Airlink	NW	Detroit	DTW				525	968	1,012	822	822	820	730			0	-				26,264	54,207	55,222	42,848	41,100	40,979	36,500			0	-
Northwest Airlink	NW	Minneapolis	MSP					13	61	13	13	13	13			0	-					657	3,050	657	657	657	887			0	-
Pan American Airways	PN	Portsmouth	PSM			79	27									0	-			1,419	478									0	-
Pan American Airways	PN	Saint John	YSJ			79	27									0	-			1,419	478									0	-
US Airways Express	US	Boston	BOS	1,942	1,371	270										0	-	36,906	42,548	5,130										0	-
US Airways Express	US	New York La Guardia	LGA	35	13	92	171	92	158	135	126	272	713	1,017	1,230	213	20.9%	1,295	486	3,036	8,529	4,600	7,914	6,757	6,321	13,579	27,763	44,051	53,371	9,321	21.2%
US Airways Express	US	Philadelphia	PHL	428	608	511	1,032	1,072	1,179	1,125	1,077	1,085	1,126	1,156	1,405	249	21.5%	15,836	19,283	20,455	32,804	53,593	58,943	56,271	60,830	59,611	58,735	68,510	89,548	21,039	30.7%
US Airways Express	US	Pittsburgh	PIT				153									0	-				7,650									0	-
US Airways Express	US	Portland (ME)	PWM	231	356	147										0	-	8,558	12,689	4,842										0	-
US Airways Express	US	Presque Isle	PQI	299												0	-	6,224												0	-
US Airways Express	US	Washington National	DCA				13					13	22	31	52	22	70.6%				657					657	1,093	1,529	2,607	1,079	70.6%
Subtotal				9,357	8,005	7,745	8,875	7,833	7,937	6,488	6,470	4,583	4,508	3,896	4,402	506	13.0%	303,436	282,597	275,286	328,857	352,577	380,408	303,395	282,430	227,651	220,186	200,587	249,535	48,948	24.4%
Total				10,031	8,720	8,352	9,071	7,833	7,937	6,488	6,487	4,692	4,680	4,184	4,645	461	11.0%	404,579	389,933	366,315	358,171	352,577	380,408	303,395	285,044	244,001	245,986	243,787	285,985	42,198	17.3%

Source: OAG Schedules; U.S. DOT, T100 Database.

Notes: Finnair scheduled technical stop (to Fort Lauderdale) in 2000 and Flyglobespan scheduled technical stops (on route to Sanford) in 2007 and 2008 not included
Allegiant stopped reporting to the OAG in 2009, so Allegiant 2009-2011 statistics from the T100 database.
All Northwest operations included in Delta from 2010 onwards

Table F-9 Scheduled Passenger Operations by Market and Carrier for Tweed-New Haven Airport

Carrier	Code	Market	Code	Departures 2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change	Departing Seats 2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Regional/ Commuter Carriers																															
Delta Connection	DL	Cincinnati	CVG					642	1,025							0	-					32,100	51,236							0	-
Boston-Maine Airways	E9	Baltimore	BWI								279					0	-								5,025					0	-
Boston-Maine Airways	E9	Bedford	BED								113					0	-								2,029					0	-
Boston-Maine Airways	E9	Elmira/Corning	ELM								152					0	-								2,739					0	-
Boston-Maine Airways	E9	Portsmouth	PSM								57					0	-								1,021					0	-
US Airways Express	US	Philadelphia	PHL	1,773	1,773	1,486	1,452	1,372	1,904	2,051	1,703	1,634	1,586	1,608	1,535	(73)	(4.5%)	65,612	65,596	54,977	53,724	50,780	76,208	77,742	63,183	60,726	59,017	59,491	56,806	(2,685)	(4.5%)
US Airways Express	US	Washington National	DCA	937	600											0	-	34,658	22,200											0	-
Total				2,710	2,373	1,486	1,452	2,014	2,929	2,051	2,304	1,634	1,586	1,608	1,535	(73)	(4.5%)	100,270	87,796	54,977	53,724	82,880	127,444	77,742	73,996	60,726	59,017	59,491	56,806	(2,685)	(4.5%)

Source: OAG Schedules.

Table F-10 Scheduled Passenger Operations by Market and Carrier for Worcester Regional Airport

Carrier	Code	Market	Code	Departures 2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change	Departing Seats 2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Jet Carriers																															
Allegiant Air	G4	Sanford	SFB							182						-	-							27,343						-	-
Boston-Maine Airways	PN	Allentown/Bethlehem	ABE			111										-	-			16,693										-	-
Boston-Maine Airways	PN	Portsmouth	PSM		223	111										-	-		33,471	16,693									-	-
Boston-Maine Airways	PN	Sanford	SFB		284											-	-		42,621											-	-
Direct Air	D1/VX/X	Myrtle Beach	MYR										63	73	96	23	31.5%										8,743	9,782	14,120	4,338	44.3%
Direct Air	D1/VX/X	Orlando/Sanford	SFB									17	140	144	148	4	2.8%									2,533	19,809	21,937	24,339	2,402	10.9%
Direct Air	D1/VX/X	Punta Gorda	PGD									17	67	94	105	11	11.7%									2,533	9,569	14,541	17,287	2,746	18.9%
Direct Air	D1/VX/X	West Palm Beach	PBI											13	51	38	292.3%											1,872	7,444	5,572	297.6%
Subtotal				0	507	223	0	0	0	182	0	34	270	324	400	76	23.5%	0	76,093	33,386	0	0	0	27,343	0	5,066	38,121	48,132	63,190	15,058	31.3%
Regional/Commuter Carriers																															
American Eagle	AA	Chicago O'Hare	ORD		368	333										0	-		15,889	15,424									0	-
American Eagle	AA	New York J F Kennedy	JFK	552	666											0	-	18,216	21,978											0	-
Delta Connection	DL	Atlanta	ATL	670	865	304										0	-	33,500	43,271	15,200										0	-
US Airways Express	US	Philadelphia	PHL	1,464	1,382	1,043	257									0	-	54,168	51,118	38,369	9,514									0	-
Subtotal				2,686	3,281	1,680	257	0	0	0	0	0	0	0	0	0	-	105,884	132,257	68,993	9,514	0	0	0	0	0	0	0	0	0	-
Total				2,686	3,788	1,902	257	0	0	182	0	34	270	324	400	76	23.5%	105,884	208,349	102,379	9,514	0	0	27,343	0	5,066	38,121	48,132	63,190	15,058	31.3%

Sources: OAG Schedules; U.S. DOT, T100 Database.

Note: As Direct Air schedule not published in the OAG, all Direct Air statistics from the T100 database. Direct Air flights operated by Xtra Airways, Vision Airlines, Sky King, Casino Express, USA Jet, Miami Air and Falcon Air Express.

Table F-11 Scheduled Passenger Operations by Market and Carrier for Hanscom Field

Carrier	Code	Market	Code	Departures 2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change	Departing Seats 2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Regional/Commuter Carriers																															
Boston-Maine Airways	E9	Elmira/Corning								131	389					0	-							2,366	6,994					-	-
Boston-Maine Airways	E9	Hyannis	HYA				9									0	-				159									-	-
Boston-Maine Airways	E9	Manchester	MHT				157									0	-				2,823									-	-
Boston-Maine Airways	E9	Martha's Vineyard	MVY				4									0	-				72									-	-
Boston-Maine Airways	E9	Nantucket	ACK				148									0	-				2,669									-	-
Boston-Maine Airways	E9	New Haven	HVN								113					0	-								2,029					-	-
Boston-Maine Airways	E9	New London/Groton	GON					61	9							0	-					1,101	159							-	-
Boston-Maine Airways	E9	Portsmouth	PSM				157	336	193	254	221	26				0	-				2,818	6,051	3,482	4,569	3,975	463				-	-
Boston-Maine Airways	E9	Trenton	TTN					987	867	992	1,047	26				0	-					17,763	15,606	17,859	18,841	463				-	-
Pan American Airways	PN	Atlantic City Pomona Field	ACY			9										0	-			154										-	-
Pan American Airways	PN	Martha's Vineyard	MVY			13	4									0	-			234	80									-	-
Pan American Airways	PN	New York Newark	EWR			92										0	-			1,656										-	-
Pan American Airways	PN	Portsmouth	PSM			337	97									0	-			6,061	1,754									-	-
Pan American Airways	PN	Westchester County	HPN			224	106									0	-			4,027	1,913									-	-
Shuttle America	S5	Buffalo	BUF	1,119	980											0	-	55,950	47,625											-	-
Shuttle America	S5	Hartford	BDL	173												0	-	8,636												-	-
Shuttle America	S5	New York La Guardia	LGA	523	854											0	-	26,143	42,707											-	-
Shuttle America	S5	Trenton	TTN	2,062	1,829		196	43								0	-	103,093	88,737		6,482	1,414								-	-
Streamline	xx	Trenton	TTN												155	155	-												4,650	4,650	-
US Airways	US	Martha's Vineyard	MVY			53										0	-			1,740										-	-
US Airways	US	Nantucket	ACK			35										0	-			1,160										-	-
US Airways	US	New York La Guardia	LGA			716										0	-			23,707										-	-
US Airways	US	Philadelphia	PHL		279	1,439										0	-		10,318	48,023										-	-
US Airways	US	Trenton	TTN		340	2,094	1,621	734								0	-		12,575	69,691	53,488	24,213								-	-
US Airways	US	Westchester County	HPN			337										0	-			11,135										-	-
Total				3,876	4,282	5,348	2,500	2,161	1,069	1,377	1,769	51	0	0	155	155	-	193,821	201,962	167,588	72,259	50,541	19,247	24,794	31,839	926	0	0	4,650	4,650	-

Source: OAG Schedules.

Table F-12 Scheduled Passenger Operations by Market and Carrier for Portsmouth International Airport

				Departures													Departing Seats												
Carrier	Code	Market	Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	'10-'11 Change	'10-'11 Pct. Change
Jet Carriers																															
Allegiant Airways	G4	Orlando/Sanford	SFB						35	191	43					-	-						5,229	28,671	6,471				-	-
Boston-Maine Airways	E9	Fort Lauderdale/Hollywood	FLL					9	13							-	-					1,329	1,993							-	-
Boston-Maine Airways	E9	Hartford	BDL						13							-	-						1,993							-	-
Boston-Maine Airways	E9	Newburgh	SWF						48							-	-						7,179							-	-
Boston-Maine Airways	E9	Sanford	SFB					57	57							-	-					8,507	8,593							-	-
Pan American Airways	PN	Allentown/Bethlehem	ABE	93	215											-	-	13,950	32,207											-	-
Pan American Airways	PN	Bangor	BGR	389	247	303	174									-	-	58,414	37,029	45,514	26,164									-	-
Pan American Airways	PN	Gary	GYY	51												-	-	7,714												-	-
Pan American Airways	PN	Manchester	MHT				17	170								-	-				2,614	25,543								-	-
Pan American Airways	PN	New York Newark	EWR			31										-	-			4,650										-	-
Pan American Airways	PN	Pittsburgh	PIT	261												-	-	39,171												-	-
Pan American Airways	PN	Sanford	SFB	296	299	286	271	261								-	-	44,400	44,914	42,943	40,629	39,107								-	-
Pan American Airways	PN	Santo Domingo	SDQ			13										-	-			1,993										-	-
Pan American Airways	PN	St. Petersburg/Clearwater	PIE			65										-	-			9,707										-	-
Pan American Airways	PN	Worcester	ORH		254	111										-	-		38,121	16,693										-	-
Skybus	SX	Columbus	CMH								409	108				-	-								58,896	15,552				-	-
Skybus	SX	Greensboro	GSO									83				-	-									11,952				-	-
Skybus	SX	Punta Gorda	PGD								15	59				-	-								2,160	8,496				-	-
Skybus	SX	Saint Augustine	UST								14	56				-	-								2,016	8,064				-	-
Subtotal				1,091	1,015	810	463	497	167	191	481	306	0	0	0	0	-	163,650	152,271	121,500	69,407	74,486	24,986	28,671	69,543	44,064	0	0	0	0	-
Regional/Commuter Carriers																															
Boston-Maine Airways	E9	Baltimore	BWI				77									-	-				1,391						156			-	-
Boston-Maine Airways	E9	Bangor	BGR				235									-	-				4,222									-	-
Boston-Maine Airways	E9	Bedford	BED				272	420	171	223	221	9				-	-				4,904	7,552	3,083	4,014	3,975	154				-	-
Boston-Maine Airways	E9	Hyannis	HYA				96									-	-				1,731									-	-
Boston-Maine Airways	E9	Manchester	MHT				214	4								-	-				3,847	80								-	-
Boston-Maine Airways	E9	Martha's Vineyard	MVY				39	22								-	-				705	399								-	-
Boston-Maine Airways	E9	Nantucket	ACK				75	82								-	-				1,342	1,476								-	-
Boston-Maine Airways	E9	New Haven	HVN								57					-	-								1,021					-	-
Boston-Maine Airways	E9	New London/Groton	GON				166	217								-	-				2,988	3,901								-	-
Boston-Maine Airways	E9	Saint John	YSJ				466	173								-	-				8,385	3,111								-	-
Boston-Maine Airways	E9	Trenton	TTN						22							-	-						399							-	-
Boston-Maine Airways	E9	Westchester County	HPN				292	43								-	-				5,264	782								-	-
Pan American Airways	PN	Atlantic City Pomona Field	ACY			153										-	-			2,754										-	-
Pan American Airways	PN	Baltimore	BWI			44	22									-	-			784	399									-	-
Pan American Airways	PN	Bangor	BGR			79	27									-	-			1,419	478									-	-
Pan American Airways	PN	Bedford	BED			315	75									-	-			5,662	1,355									-	-
Pan American Airways	PN	Martha's Vineyard	MVY			153	9									-	-			2,754	159									-	-
Pan American Airways	PN	Saint John	YSJ			66	22									-	-			1,183	399									-	-
Subtotal				0	0	809	2,087	961	193	223	278	9	0	0	0	0	-	0	0	14,557	37,569	17,301	3,482	4,014	4,996	154	156	0	0	0	-
Total				1,091	1,015	1,619	2,550	1,458	360	414	759	315	0	0	0	0	-	163,650	152,271	136,057	106,976	91,786	28,467	32,685	74,540	44,218	156	0	0	0	-

Sources: OAG Schedules; U.S. DOT, T100 Database.

Note: Skybus did not report to the OAG, so all 2007 and 2008 Skybus statistics from the T100 database.

G

Ground Access

This appendix provides information in support of *Chapter 5, Ground Access to and from Logan Airport*:

- Table G-1 Logan Express Bus 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
- Table G-5 Logan Airport Employee Parking Supply
- Table G-6 Logan Airport Commercial Parking Supply
- Table G-7 2011 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment, and Vehicle Miles Traveled (VMT) Summary
- VISSIM Traffic Roadway Network
- March 2011 Logan Airport Parking Space Inventory, submitted to Massachusetts Department of Environmental Protection (also known as the *Parking Freeze Report*)
- September 2011 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-1 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%**
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%**

Table G-1 Logan Express Bus Service Ridership (Continued)

Service Year	Ridership			Percent Change		
	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%**
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%**

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-1 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%)[2]
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%**

Source: Massport

1 Changes to employee parking and bus fares were implemented in October 2011.

2 Percent comparison between 2007 and 2005. The I-90 Ted Williams Tunnel closures in 2006 resulted in atypical ridership.

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)	Boston-Logan Water Shuttle (Long Wharf)	Total
1990	181,530	NS	NS	NS	181,530
1991	142,500	NS	NS	NS	142,500
1992	133,297	NS	NS	NS	133,297
1993	159,525	NS	NS	NS	159,525
1994	209,057	NS	NS	NS	209,057
1995	203,829	NS	NS	NS	203,829
1996	159,992	3,364	11,781	NS	175,137
1997	132,542	6,299	71,309	NS	210,150
1998	124,836	9,243	101,174	NS	235,253
1999	122,211	17,252	98,539	NS	238,002
2000	128,097	26,335	83,243	NS	237,675
2001	107,400	29,642	82,704	NS	219,746
2002	75,304	36,736	66,471	NS	178,511
2003	26,480[2]	35,724[3]	61,849	5,722[4]	129,775
2004	NS	54,540	58,788	3,202[5]	116,530
2005	NS	44,975	51,960	NS	96,935
2006	NS	63,639	70,998	NS	134,637
2007	NS	50,737	59,460	NS	110,197
2008	NS	48,630	48,003	NS	96,633
2009	NS	50,734	37,861	NS	88,595
2010	NS	54,382	34,794	NS	89,176
2011	**NS**	**58,879**	**33,403**	**NS**	**92,282**

Source: Massport
Note: Figures from 2003 – 2007 have been revised from previous documents.
1 Operates April-October only.
2 Rowes Wharf Water Shuttle operated from January to June only in 2003.
3 Operated from May to October only in 2003.
4 Long Wharf Boston-Logan Water Shuttle operated from August to December in 2003.
5 Joint operation with City Water Taxi began on August 16, 2003.
NA Data not available.
NS Operation not in service.

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	1,112,024	2,524,079	--
2008[4]	2,212,111	1,435,283	3,647,394	56.7%
2009	2,329,370	1,421,179	3,750,549	5.3%
2010	2,270,241	1,358,952	3,629,193	(2.5%)
2011	**2,277,311**	**NA**	**NA**	**0.3%**

Source: MBTA.
Note: Turnstile counts include both Logan Airport bound (turnstile exits) and non-Logan Airport bound (turnstile entrances) passengers.
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.
NA Data not available

Table G-4 Annual Taxi Dispatches

Year	Total	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%**

Source: Previous EDR/ESPR Documentation.
Note: The available taxi data only reports dispatches from Logan Airport's taxi pool. The data do not include suburban or city taxis that drop passengers at Logan Airport and depart empty, as these companies are not required to provide their ridership statistics to Massport.

Table G-5 Logan Airport Employee Parking Supply

Location	Number of Spaces			
	March 2010	September 2010	March 2011	September 2011
Terminal Area	884	779	**779**	**821**
North Service Area	777	815	**914**	**884**
Southwest Service Area	10	10	**0**	**0**
South Service Area	1,181	884	**894**	**893**
Airside (Fire/Rescue)	5	5	**5**	**5**
Total spaces in service	2,857	2,493	**2,592**	**2,603**
Total spaces out of service	511	880	**781**	**70**
Total employee spaces	3,373	3,373	**3,373**	**2,673**

Source: Logan Airport Parking Space Inventory submitted to Massachusetts Department of Environmental Protection (MassDEP), March and September 2011.
Note: As of April 2011, the Logan Airport Parking Freeze sets a limit of 18,019 commercial spaces and 2,673 employee spaces at the Airport.

Table G-6 Logan Airport Commercial Parking Supply

Location	Number of Spaces			
	March 2010	September 2010	March 2011	September 2011
Terminal Area				
Central Garage and West Garage	10,375	10,375	**10,375**	**10,344**
Terminal B Garage	2,235	1,880	**2,380**	**1,644**
Terminal E Lot 1	269	269	**269**	**269**
Terminal E Lot 2	257	257	**257**	**257**
Terminal E Lot 3 (Gulf Lot)	175	229	**229**	**229**
Logan Airport Hilton	235	235	**235**	**235**
North Service Area				
Economy Lot 2	932	0	**n/a**	**n/a**
Economy Garage	n/a	n/a	**2,880**	**2,789**
Overflow Lot(s)	260	645	**250**	**0**
Signature (General Aviation)	35	35	**35**	**35**
South Service Area				
Harborside Hyatt Conference Center and Hotel	258	251	**270**	**270**
Southwest Service Area				
Former USPS Site (Lot 3)	416	416	**416**	**0**
Total spaces in service	15,447	14,592	**17,596**	**16,072**
Total spaces out of service	1,872	2,727	**23**	**1,947**
Total commercial spaces	17,319	17,319	**17,619**	**18,019**

Source: Logan Airport Parking Space Inventory submitted to MassDEP, March and September 2011.
Note: Logan Airport Parking Freeze sets a limit of 20,692 spaces on airport. As of April 6, 2011, the allocation is 18,019 commercial and 2,673 employee spaces.

Table G-7 2011 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	22	689	902	6320	13775	45	59	412	898
2	496	23	783	1024	7176	15640	74	96	674	1469
3	1347	22	542	709	4967	10825	138	181	1267	2762
4	1166	26	687	899	6298	13727	152	199	1391	3031
5	378	25	1229	1608	11265	24552	88	115	807	1759
6	441	30	601	786	5508	12005	50	66	460	1003
7	896	22	626	818	5735	12499	106	139	974	2122
8	644	17	1026	1343	9407	20503	125	164	1148	2503
9	1214	7	245	321	2246	4895	56	74	516	1125
10	1655	25	743	972	6810	14843	233	305	2135	4652
11	1363	9	378	495	3467	7557	98	128	895	1951
12	2453	32	19	25	176	383	9	12	82	178
13	2043	23	47	62	432	941	18	24	167	364
14	750	19	1472	1926	13496	29415	209	274	1917	4178
15	441	24	825	1079	7564	16485	69	90	632	1376
16	106	23	106	139	973	2120	2	3	20	43
17	163	23	107	140	980	2136	3	4	30	66
20	252	5	11	15	102	223	1	1	5	11
21	127	15	36	47	329	717	1	1	8	17
22	74	5	11	15	102	223	0	0	1	3
23	507	25	211	277	1938	4225	20	27	186	406
24	179	25	188	245	1719	3747	6	8	58	127
25	126	25	26	33	234	510	1	1	6	12
26	121	5	10	13	88	191	0	0	2	4
27	101	22	26	33	234	510	1	1	4	10
29	119	22	10	13	88	191	0	0	2	4
30	74	25	9	11	80	175	0	0	1	2
31	94	7	10	13	88	191	0	0	2	3
32	261	31	24	31	219	478	1	2	11	24
33	79	12	6	8	59	128	0	0	1	2
34	185	12	50	66	461	1004	2	2	16	35
35	683	25	60	78	549	1196	8	10	71	155
36	667	33	34	45	315	686	4	6	40	87
37	433	25	49	64	446	973	4	5	37	80
38	387	33	34	45	315	686	2	3	23	50
39	84	11	113	148	1039	2264	2	2	17	36
40	217	23	113	148	1039	2264	5	6	43	93
42	151	5	10	13	88	191	0	0	3	5
44	132	16	51	67	468	1020	1	2	12	25
45	76	11	10	13	88	191	0	0	1	3
46	208	22	32	42	293	638	1	2	12	25
48	88	22	32	42	293	638	1	1	5	11
50	316	22	32	42	293	638	2	3	18	38
51	45	33	34	45	315	686	0	0	3	6
52	240	33	75	98	688	1499	3	4	31	68
53	446	33	76	99	695	1515	6	8	59	128
54	447	5	73	96	673	1467	6	8	57	124
55	145	5	73	96	673	1467	2	3	19	40
56	247	5	135	176	1236	2694	6	8	58	126
57	366	23	313	409	2867	6250	22	28	199	433
63	361	30	26	34	241	526	2	2	16	36
65	504	30	118	155	1083	2360	11	15	103	225
66	170	30	118	155	1083	2360	4	5	35	76

Table G-7 2011 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
67	217	31	109	143	1002	2184	4	6	41	90
68	231	31	109	143	1002	2184	5	6	44	96
69	299	31	164	215	1507	3284	9	12	85	186
70	146	31	8	10	73	159	0	0	2	4
71	243	31	38	50	351	765	2	2	16	35
72	281	31	38	50	351	765	2	3	19	41
73	398	31	22	29	205	446	2	2	15	34
74	130	31	22	29	205	446	1	1	5	11
75	171	31	41	54	380	829	1	2	12	27
76	63	8	30	40	278	606	0	0	3	7
77	183	26	30	40	278	606	1	1	10	21
79	171	29	34	45	315	686	1	1	10	22
81	146	5	12	16	110	239	0	0	3	7
82	36	8	34	45	315	686	0	0	2	5
83	108	9	31	41	285	622	1	1	6	13
84	164	25	31	41	285	622	1	1	9	19
87	160	5	7	9	66	143	0	0	2	4
88	34	9	7	9	66	143	0	0	0	1
89	128	16	30	40	278	606	1	1	7	15
90	582	8	204	267	1873	4081	22	29	206	450
91	472	13	213	279	1953	4257	19	25	175	380
92	158	27	35	46	322	701	1	1	10	21
93	164	27	35	46	322	701	1	1	10	22
96	154	24	39	51	358	781	1	1	10	23
97	154	5	16	21	146	319	0	1	4	9
98	80	27	39	51	358	781	1	1	5	12
113	565	13	182	238	1668	3635	19	25	179	389
114	609	24	223	291	2041	4448	26	34	235	513
115	451	30	337	441	3087	6728	29	38	264	575
116	399	14	43	56	395	861	3	4	30	65
117	283	14	203	265	1858	4050	11	14	100	217
118	295	13	532	696	4879	10634	30	39	272	594
119	240	7	201	263	1843	4018	9	12	84	183
120	365	22	219	286	2004	4368	15	20	139	302
121	356	14	348	455	3189	6951	23	31	215	469
122	486	20	123	161	1127	2455	11	15	104	226
123	486	22	115	150	1053	2296	11	14	97	211
124	280	25	107	140	980	2136	6	7	52	113
125	280	22	103	135	944	2057	5	7	50	109
126	884	21	353	461	3233	7047	59	77	541	1179
127	1050	19	230	301	2107	4592	46	60	419	913
128	257	25	11	15	102	223	1	1	5	11
129	257	22	16	21	146	319	1	1	7	16
131	784	28	2	3	22	48	0	0	3	7
132	302	24	373	488	3416	7445	21	28	195	426
133	177	23	220	288	2019	4400	7	10	68	147
134	1521	24	365	477	3343	7286	105	137	963	2098
135	1542	23	227	298	2085	4544	66	87	609	1327
136	189	13	30	40	278	606	1	1	10	22
137	173	28	24	31	219	478	1	1	7	16
138	210	23	12	16	110	239	0	1	4	10

Table G-7 2011 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
139	248	26	36	47	329	717	2	2	15	34
140	369	23	270	353	2472	5389	19	25	173	377
141	265	23	230	301	2107	4592	12	15	106	231
142	192	22	340	445	3116	6792	12	16	113	247
143	272	22	272	356	2494	5437	14	18	129	280
144	518	7	196	257	1799	3922	19	25	176	384
145	195	28	110	144	1009	2200	4	5	37	81
146	463	28	108	141	988	2152	9	12	87	189
147	230	28	290	379	2655	5787	13	17	116	252
148	794	28	93	122	856	1865	14	18	129	280
149	661	22	108	141	988	2152	14	18	124	269
150	281	22	129	169	1185	2583	7	9	63	137
151	360	22	75	98	688	1499	5	7	47	102
152	88	32	2	3	22	48	0	0	0	1
153	66	31	53	70	490	1068	1	1	6	13
154	173	32	56	73	512	1116	2	2	17	37
155	258	31	255	334	2341	5102	12	16	115	250
156	645	29	141	185	1295	2822	17	23	158	345
157	218	27	115	150	1053	2296	5	6	43	95
158	185	23	208	272	1909	4161	7	10	67	146
159	354	22	324	424	2970	6473	22	28	199	434
160	470	28	60	78	549	1196	5	7	49	106
161	94	21	201	263	1843	4018	4	5	33	72
162	50	21	21	27	190	415	0	0	2	4
163	66	21	180	236	1653	3603	2	3	21	45
164	367	33	49	65	454	988	3	5	32	69
165	124	30	115	150	1053	2296	3	4	25	54
166	84	30	107	140	980	2136	2	2	16	34
167	956	30	107	140	980	2136	19	25	177	387
168	380	15	54	71	497	1084	4	5	36	78
169	293	21	161	211	1478	3220	9	12	82	179
170	205	33	9	11	80	175	0	0	3	7
174	502	14	144	189	1324	2886	14	18	126	274
175	640	22	397	519	3636	7924	48	63	441	961
176	319	26	853	1116	7820	17043	51	67	472	1028
177	286	29	853	1116	7820	17043	46	60	424	923
178	353	23	708	926	6488	14141	47	62	434	947
179	348	31	891	1165	8164	17792	59	77	538	1172
180	366	20	555	726	5084	11080	38	50	352	768
181	453	19	117	153	1075	2344	10	13	92	201
182	119	19	117	153	1075	2344	3	3	24	53
183	50	19	100	131	914	1993	1	1	9	19
184	54	19	11	15	102	223	0	0	1	2
185	62	19	167	218	1529	3332	2	3	18	39
186	39	19	217	284	1990	4336	2	2	15	32
188	212	33	10	13	88	191	0	1	4	8
190	193	33	8	10	73	159	0	0	3	6
192	540	5	50	66	461	1004	5	7	47	103
193	138	22	399	522	3658	7972	10	14	95	208
194	932	22	405	529	3709	8083	71	93	654	1426
195	79	20	89	117	819	1786	1	2	12	27
196	49	20	176	230	1609	3507	2	2	15	32
197	83	12	176	230	1609	3507	3	4	25	55
198	692	12	196	256	1792	3906	26	34	235	512

Table G-7 2011 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
199	70	27	98	128	900	1961	1	2	12	26
201	160	8	17	22	154	335	1	1	5	10
202	335	22	17	22	154	335	1	1	10	21
204	2022	6	210	275	1924	4193	80	105	737	1606
205	71	27	298	389	2728	5947	4	5	37	80
206	142	27	208	272	1909	4161	6	7	51	112
207	859	32	286	375	2626	5724	47	61	427	931
208	284	32	223	292	2048	4464	12	16	110	240
209	80	20	419	548	3840	8370	6	8	58	127
210	71	20	381	499	3497	7621	5	7	47	103
211	390	20	640	837	5867	12786	47	62	433	944
212	117	20	330	432	3028	6600	7	10	67	147
213	1344	23	825	1079	7564	16485	210	275	1926	4198
214	449	31	1175	1538	10775	23484	100	131	916	1996
215	1110	31	151	197	1383	3013	32	41	291	633
216	905	31	452	591	4140	9024	78	101	710	1548
217	1050	31	315	412	2889	6297	63	82	574	1252
218	581	27	523	685	4799	10459	58	75	528	1150
219	1063	31	372	487	3409	7429	75	98	687	1496
220	415	31	411	538	3767	8211	32	42	296	645
221	698	26	42	55	388	845	6	7	51	112
222	1920	26	4	5	37	80	1	2	13	29
223	1564	29	899	1176	8237	17952	266	348	2440	5317
224	377	28	437	572	4009	8737	31	41	287	624
225	551	28	115	150	1053	2296	12	16	110	240
226	788	32	221	289	2026	4416	33	43	302	659
227	1303	32	226	295	2070	4512	56	73	511	1113
228	580	30	967	1265	8866	19323	106	139	974	2124
229	1653	29	402	526	3687	8035	126	165	1154	2515
230	2058	28	565	739	5179	11288	220	288	2019	4400
231	1300	11	564	738	5172	11272	139	182	1273	2775
232	736	12	1187	1552	10877	23707	165	216	1516	3303
233	488	27	733	958	6715	14636	68	89	621	1353
234	449	16	333	435	3050	6648	28	37	259	565
235	310	10	231	303	2121	4623	14	18	125	271
236	310	7	101	133	929	2025	6	8	55	119
237	105	6	152	198	1390	3029	3	4	28	60
238	697	23	37	48	336	733	5	6	44	97
239	186	22	19	25	176	383	1	1	6	13
240	145	23	143	187	1309	2854	4	5	36	79
241	578	23	162	212	1485	3236	18	23	163	355
242	125	31	37	48	336	733	1	1	8	17
243	564	31	37	48	336	733	4	5	36	78
244	88	31	37	48	336	733	1	1	6	12
246	175	14	162	212	1485	3236	5	7	49	107
247	65	15	3	4	29	64	0	0	0	1
248	39	14	202	264	1851	4034	1	2	14	30
249	128	14	165	216	1514	3300	4	5	37	80
250	484	14	175	229	1602	3492	16	21	147	320
252	308	15	214	280	1960	4273	13	16	115	250
253	54	14	12	16	110	239	0	0	1	2
255	290	23	3	4	29	64	0	0	2	4
256	377	23	4	5	37	80	0	0	3	6

Table G-7 2011 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
257	215	23	3	4	29	64	0	0	1	3
260	362	23	3	4	29	64	0	0	2	4
261	219	25	4	5	37	80	0	0	2	3
262	218	13	6	8	59	128	0	0	2	5
265	2458	27	95	124	870	1897	44	58	405	883
266	752	27	479	626	4389	9566	68	89	625	1362
267	1323	27	531	694	4864	10602	133	174	1218	2656
268	450	14	676	884	6196	13504	58	75	529	1152
269	801	6	657	859	6020	13121	100	130	913	1991
270	1005	8	472	618	4330	9438	90	118	824	1796
271	1048	14	233	305	2136	4655	46	61	424	924
272	665	23	117	153	1075	2344	15	19	135	295
273	294	10	110	144	1009	2200	6	8	56	122
274	1244	28	431	564	3950	8609	102	133	931	2028
275	50	28	421	551	3862	8418	4	5	36	79
276	599	28	124	162	1134	2471	14	18	129	280
277	2473	17	98	128	900	1961	46	60	422	919
278	573	31	264	346	2421	5277	29	38	263	573
279	458	21	272	356	2494	5437	24	31	216	471
280	295	26	164	214	1500	3268	9	12	84	183
281	440	18	164	215	1507	3284	14	18	125	273
282	76	18	145	190	1331	2902	2	3	19	42
283	697	18	320	419	2933	6393	42	55	387	843
284	690	17	654	856	5998	13073	85	112	783	1707
285	91	17	587	768	5384	11734	10	13	93	202
286	464	17	816	1068	7483	16310	72	94	658	1434
287	229	18	786	1028	7205	15704	34	45	313	682
288	500	13	762	997	6986	15226	72	94	661	1440
289	738	11	1341	1755	12297	26800	187	245	1719	3746
290	190	14	1101	1441	10095	22001	40	52	363	791
291	494	27	311	407	2853	6218	29	38	267	582
292	689	26	789	1033	7235	15768	103	135	944	2056
293	325	26	1486	1944	13621	29686	91	120	839	1828
294	396	23	240	314	2202	4799	18	24	165	360
295	1017	29	1248	1633	11441	24935	240	315	2204	4804
296	162	8	229	300	2099	4576	7	9	64	141
297	140	8	158	207	1448	3157	4	5	38	84
298	951	12	180	235	1646	3587	32	42	297	646
299	805	18	152	198	1390	3029	23	30	212	462
300	518	5	115	150	1053	2296	11	15	103	225
301	749	5	160	210	1470	3205	23	30	209	455
302	652	14	241	315	2209	4815	30	39	273	595
303	547	5	61	79	556	1212	6	8	58	125
304	406	5	53	70	490	1068	4	5	38	82
305	442	5	28	37	256	558	2	3	21	47
306	207	16	81	106	746	1626	3	4	29	64
307	70	5	136	177	1244	2710	2	2	16	36
308	319	10	63	82	578	1259	4	5	35	76
309	281	5	128	168	1178	2567	7	9	63	137
310	555	30	428	560	3921	8545	45	59	412	897
311	208	26	2109	2759	19334	42137	83	109	762	1660
312	125	26	796	1042	7300	15911	19	25	173	377

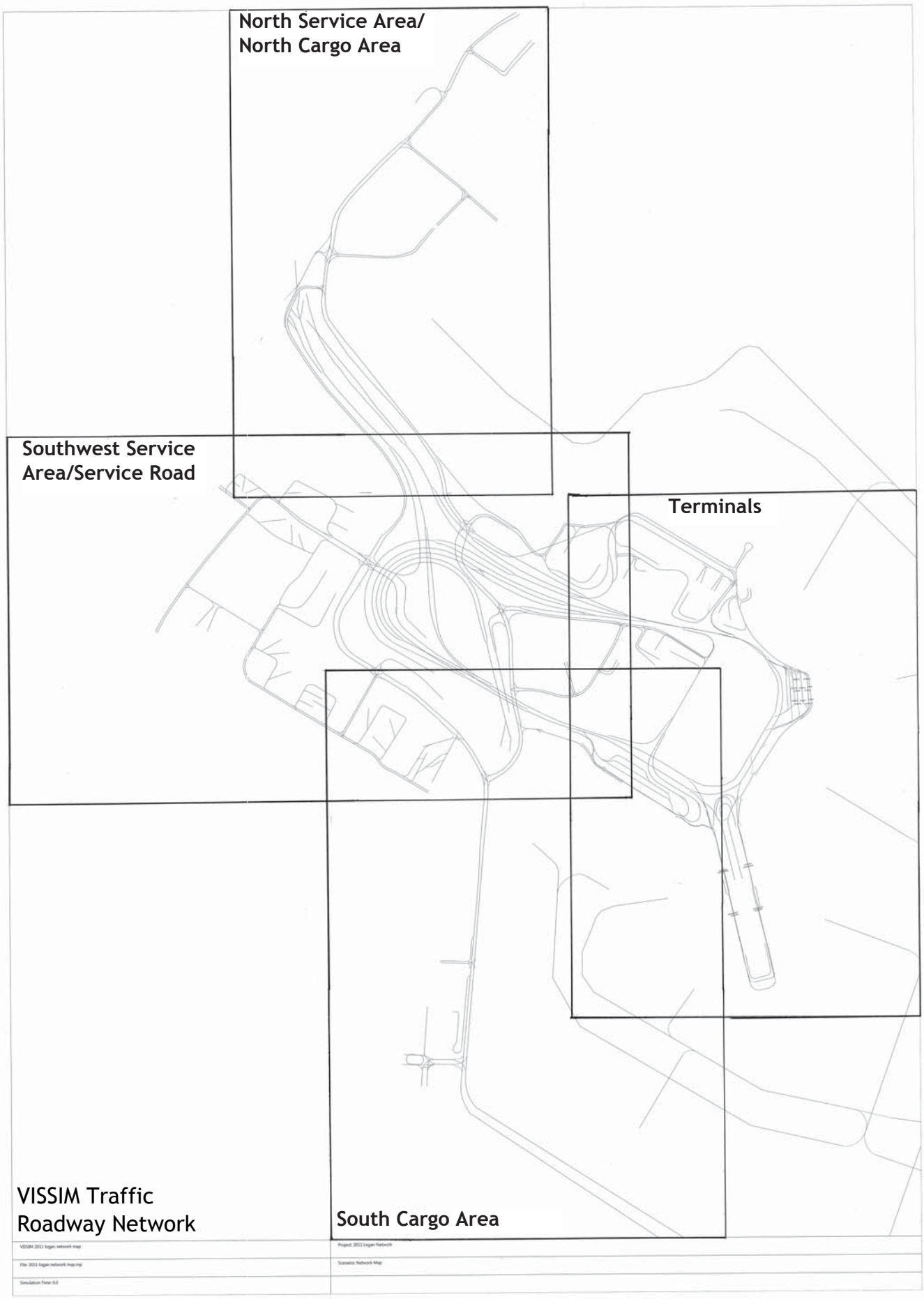
Table G-7 2011 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

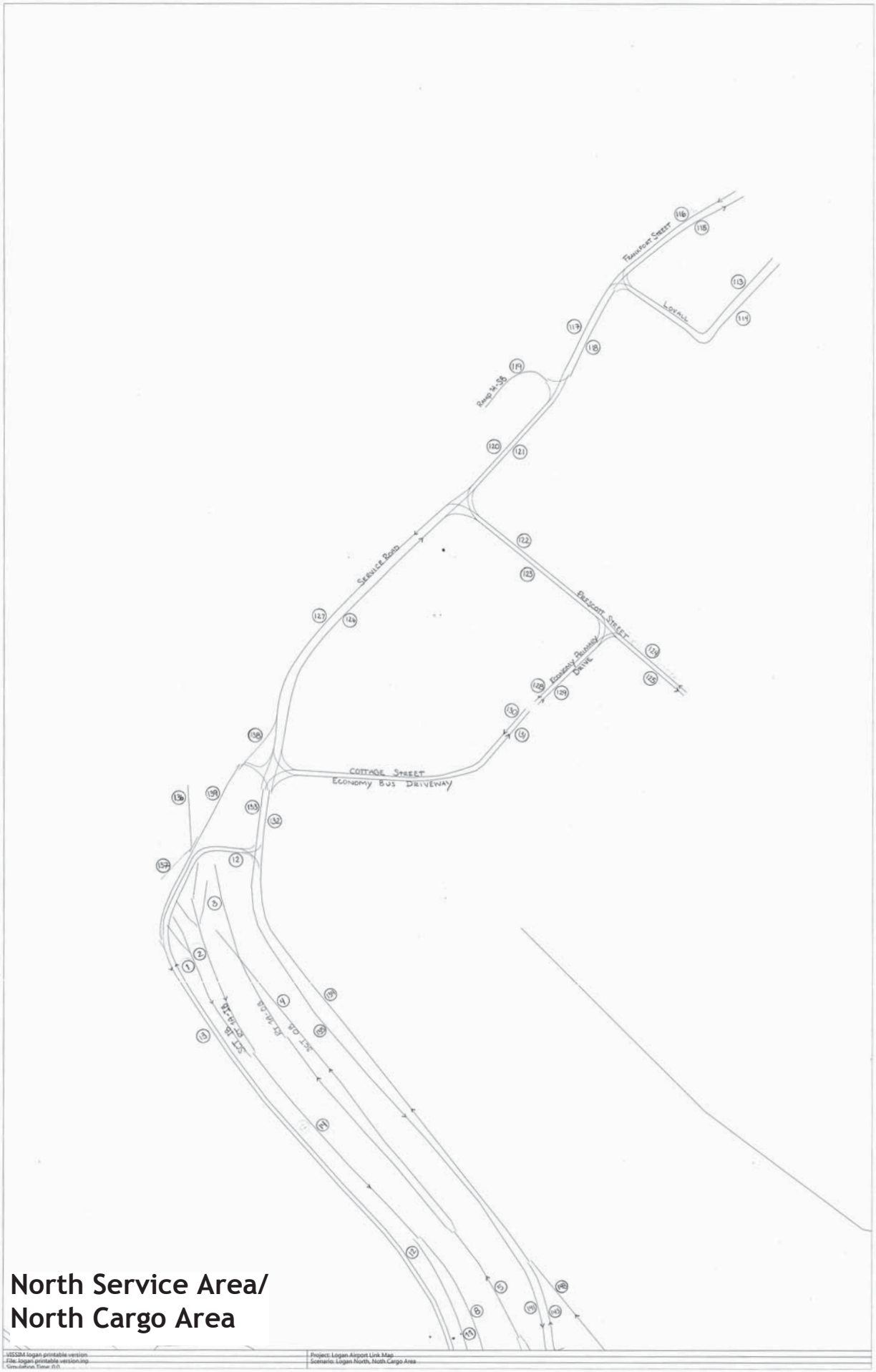
Link Name	Link Distance (ft)	Link Speed (mph)	VOLUME				VMT			
			AM Peak	PM Peak	High 8-Hour	AWDT	AM Peak	PM Peak	High 8-Hour	AWDT
313	332	26	792	1036	7256	15815	50	65	457	995
314	440	26	1290	1688	11828	25780	108	141	986	2149
315	215	14	543	711	4982	10857	22	29	203	442
316	543	13	151	197	1383	3013	16	20	142	310
317	180	8	236	309	2165	4719	8	11	74	161
318	221	5	236	309	2165	4719	10	13	91	197
319	2544	5	375	491	3438	7493	181	237	1656	3610
320	552	9	444	582	4074	8880	46	61	426	928
321	628	13	88	115	805	1754	10	14	96	209
322	181	10	128	167	1170	2551	4	6	40	87
323	58	10	109	142	995	2168	1	2	11	24
324	387	12	18	24	168	367	1	2	12	27
325	406	10	127	166	1163	2535	10	13	89	195
326	89	5	60	78	549	1196	1	1	9	20
327	463	16	136	179	1251	2726	12	16	110	239
328	79	20	182	238	1668	3635	3	4	25	54
329	103	20	182	238	1668	3635	4	5	32	71
330	323	12	41	53	373	813	3	3	23	50
331	179	9	361	472	3306	7206	12	16	112	244
332	993	8	535	701	4908	10698	101	132	923	2012
333	384	13	14	19	132	287	1	1	10	21
334	366	14	460	602	4221	9199	32	42	292	637
335	583	31	855	1118	7834	17075	94	123	865	1885
336	428	32	610	798	5589	12180	49	65	453	988
337	94	18	185	242	1697	3699	3	4	30	66
338	366	5	159	208	1456	3173	11	14	101	220
339	311	7	26	33	234	510	2	2	14	30
340	273	18	22	28	198	430	1	1	10	22
341	66	7	22	28	198	430	0	0	2	5
343	52	27	90	118	827	1802	1	1	8	18
344	82	8	10	14	95	207	0	0	1	3
345	25	5	61	79	556	1212	0	0	3	6
346	121	5	61	79	556	1212	1	2	13	28
347	303	19	71	93	651	1419	4	5	37	81
348	146	21	437	571	4001	8721	12	16	111	241
349	67	21	315	412	2889	6297	4	5	37	80
350	446	5	122	160	1119	2439	10	14	94	206
351	335	5	101	133	929	2025	6	8	59	129
352	430	5	120	157	1097	2391	10	13	89	195
353	360	5	194	254	1778	3874	13	17	121	264
354	50	19	173	227	1587	3460	2	2	15	33
355	88	9	321	420	2941	6409	5	7	49	107
356	113	9	429	561	3928	8561	9	12	84	183
357	965	23	298	389	2728	5947	54	71	499	1087
358	463	13	341	446	3124	6808	30	39	274	597
359	229	25	10	13	88	191	0	1	4	8
360	245	21	13	17	117	255	1	1	5	12
361	248	19	22	28	198	430	1	1	9	20
362	199	18	32	42	293	638	1	2	11	24
363	230	11	30	39	271	590	1	2	12	26
364	256	13	386	505	3540	7716	19	25	172	374

Table G-7 2011 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

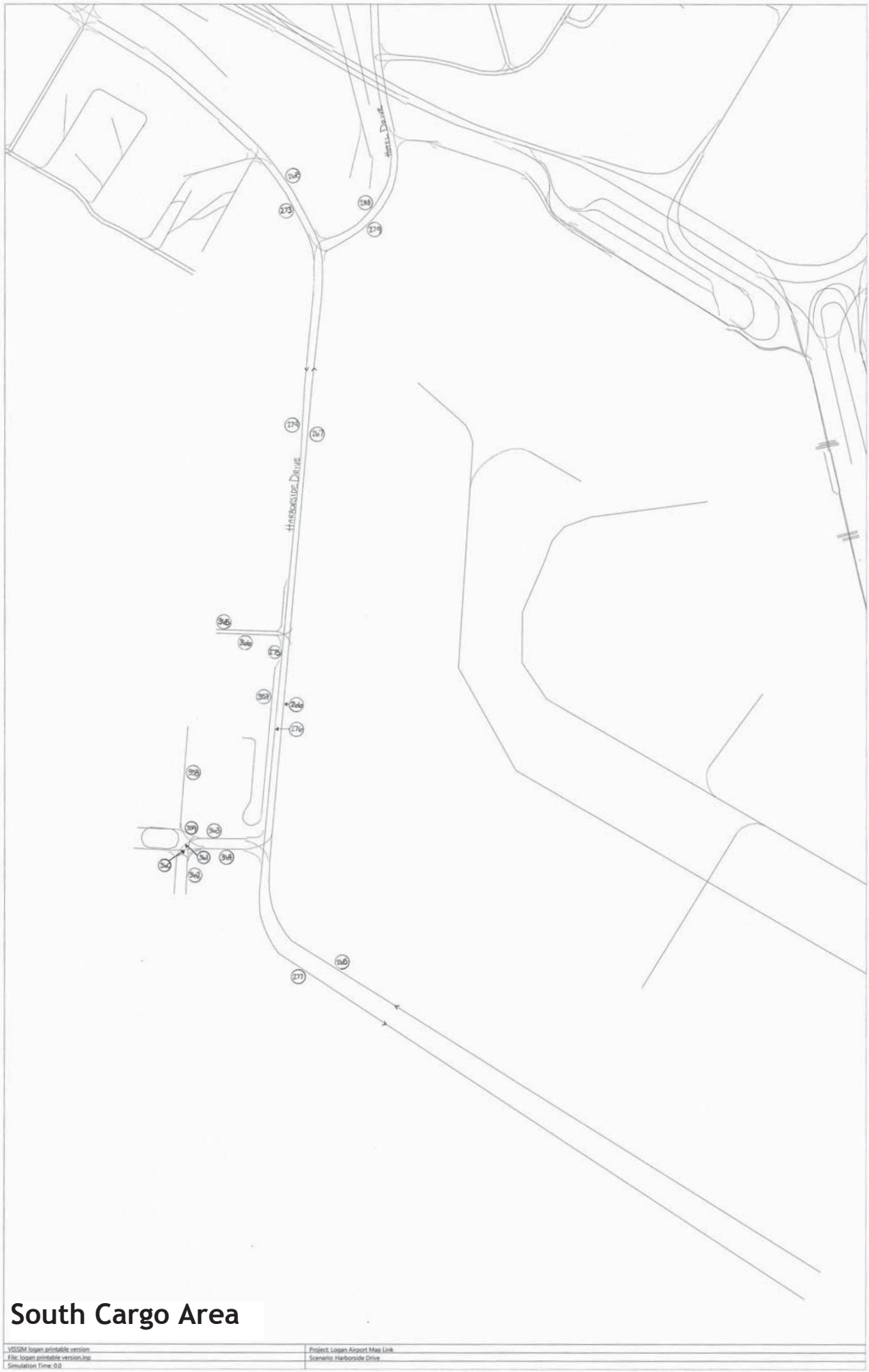
Link Name	Link Distance (ft)	Link Speed (mph)	VOLUME				VMT			
			AM Peak	PM Peak	High 8-Hour	AWDT	AM Peak	PM Peak	High 8-Hour	AWDT
365	201	25	14	18	124	271	1	1	5	10
366	201	10	72	94	658	1435	3	4	25	55
367	337	31	764	1000	7008	15273	49	64	447	975
368	868	10	528	691	4843	10554	87	114	797	1736
369	167	10	493	645	4521	9853	16	20	143	312
370	96	12	244	319	2238	4879	4	6	41	88
371	141	24	393	514	3599	7844	10	14	96	209
				Logan Airport VMT			8390.96	10977.97	76920.2	167646.51

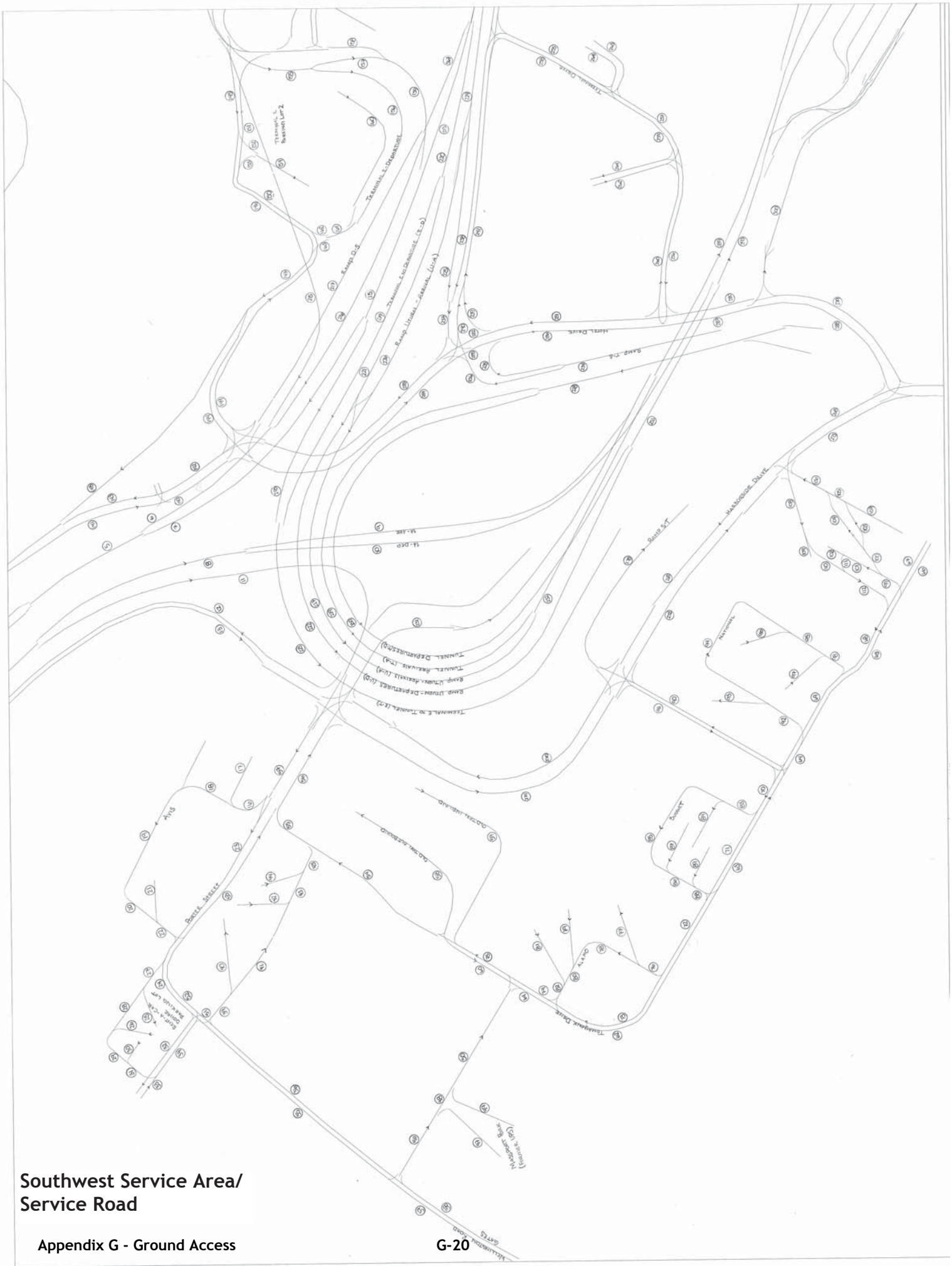
Source: VHB.
Note: AWDT Average annual weekday daily traffic


North Service Area/
North Cargo Area
Southwest Service
Area/Service Road
Terminals
South Cargo Area
VISSIM Traffic
Roadway Network



North Service Area/ North Cargo Area


Harbourside Drive
Harbourside Drive
South Cargo Area
VISSIM logan printable version
File: logan printable version.inp
Simulation Time: 0.0
Project: Logan Airport Map Link
Scenario: Harborside Drive



Southwest Service Area/ Service Road

Terminals
VISSIM logan printable version
File: logan printable version.inp
Simulation Time: 0.0
Project: Logan Airport Link Map
Scenario: Logan Tunnel Ramps, Rental Car Lots

Massachusetts Port Authority
One Harborside Drive, Suite 200S
East Boston, MA 02128-2909
Telephone (617) 568-5000
www.massport.com

March 1st, 2011

Christine Kirby
Department of Environmental Protection
Division of Air Quality Control
One Winter Street
Boston, MA 02108

Re: March 1st, 2011 Logan Airport Parking Space Inventory

Dear Ms. Kwetz:

In compliance with the reporting requirements of 310 CMR 7.30 (3)(d), enclosed are the following March 1st, 2011 Massachusetts Port Authority submissions:

- Commercial Parking Space Inventory
- Employee Parking Space Inventory
- Location Map

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. We continue to provide information on rental car spaces as a courtesy.

The attachments provide the quantity, physical distribution and allocation of commercial and employee parking spaces as defined by 310 CMR 7.30, as amended. These inventory tables are based on information provided by the Aviation Department's Ground Transportation Unit, as supplemented by field checks, and represent the most up to date information on parking at Logan International Airport as of March 1st, 2011.

The Commercial Parking Space Inventory now totals 17,619 parking spaces (17,596 in service and 23 designated). The Employee Parking Space Inventory totals 3,073 employee parking spaces (2,592 in service and 481 designated). Designated spaces reflect parking spaces that are temporarily out of service. The total inventory of spaces at Logan Airport remains unchanged at 20,692.

The Authority has consolidated economy parking spaces in the North Cargo Area by completing construction of two decks over the existing economy parking lot on Prescott Street. The enabling projects necessary to advance the construction of the new rental car facility are ongoing. This has resulted in relocation of employee spaces and will require relocation of commercial spaces; in some cases, spaces may be temporarily removed from or added to service. And effective February 21st, 2011, the Authority converted 300 spaces from the employee to the commercial category.

The attached Logan Airport Parking Space Inventory reflects Massport's successful management of its parking program, within the requirements of 310 CMR 7.30, as amended. If you have any questions, please call me at (617) 568-3570.

Sincerely,

Craig Leiber
Economic Planning & Development Department

cc: L. Dantas
S. Dalzell
I. Wallach
B. Desrosiers
D. Cook

Commercial Parking Space Inventory
Logan International Airport
March 1, 2011 Submission

Commercial Parking Spaces

Map ID#	Location of Commercial Parking Areas	Number of Spaces
Terminal Area and Economy Spaces		
C1a	Central Garage	7,227
C1b	West Garage	3,148
C2	Terminal B Garage	2,380
C3	Lot 3 (former USPS site) (Red Lot)	416
C6	Economy Garage	2,880
C8a	Terminal E Lot 1	269
C8b	Terminal E Lot 2	257
C9	"Gulf Station" Lot	229
	~~"Sky Chefs"/Purple Lot~~ *(closed)*	0
	~~Orange Lot (Wood Is. lot)~~ *(closed)*	0
C12	SWSA Lot *(temporary; to close in April)*	250
	subtotal	*17,056*
Hotel Spaces		
C4	Logan Airport Hilton Hotel (two lots)	235
C7a	Harborside Hyatt Conference Center	270
	subtotal	*505*
General Aviation Spaces		
C5	Signature (General Aviation Terminal)	35
	subtotal	*35*
Total In-Service Commercial Parking Spaces		**17,596**
Total Designated Commercial Parking Spaces		**23**
Total Commercial Parking Spaces		**17,619**
Total Employee Parking Spaces *(see table on next page)*		**3,073**
TOTAL PARKING FREEZE SPACES		**20,692**

Employee Parking Space Inventory
Logan International Airport
March 1, 2011 Submission

Employee Parking Spaces

Map ID#	Location of Employee Parking Areas	Number of Spaces
E1	Central Parking / West Garage	93
E2	Massport Tower	517
E3	Terminal C Pier A (Old Terminal D) (two lots)	45
E4	Massport Facilities 1 (Heating Plant)	94
E5a	North Cargo Building 11, TSA lot	81
E5b	North Cargo Building 11, State Police lot	158
E6	North Gate & EMS Trailer	31
E8	North Cargo Building 8	70
E9	US Airways Administration	90
E10	Massport Facilities 2 (airside)	35
E11	Massport Facilities 3	95
E12a	LSG Sky Chefs, main lot	34
	LSG Sky Chefs, overflow 1 *(closed)*	0
	LSG Sky Chefs, overflow 2 *(closed)*	0
E12b	LSG Sky Chefs, overflow lot	102
E12c	Flight Kitchen Building 1	40
E13a	"Consigli Lot" (Lovell Street)	30
E13b	Lovell Lot	38
E14	Gate Gourmet	85
E15	Bird Island Flats (BIF) / LOC Garage	504
E16	Massport Taxi Pool	10
	Lot B *(closed for construction)*	0
E17	South Cargo Building 63	16
E18	South Cargo Building 62	51
E19	South Cargo Building 58	23
E20	South Cargo Building 57	44
E21	South Cargo Building 56	72
E22	Fire-Rescue HQ & Amelia Earhart Building	89
E25	Hilton Hotel	30
E26	UPS (Cargo Building 13)	44
E94	United Aircraft Maint. (Buildings 93 & 94)	66
N/A	*ARFF Satellite Station* [1]	5

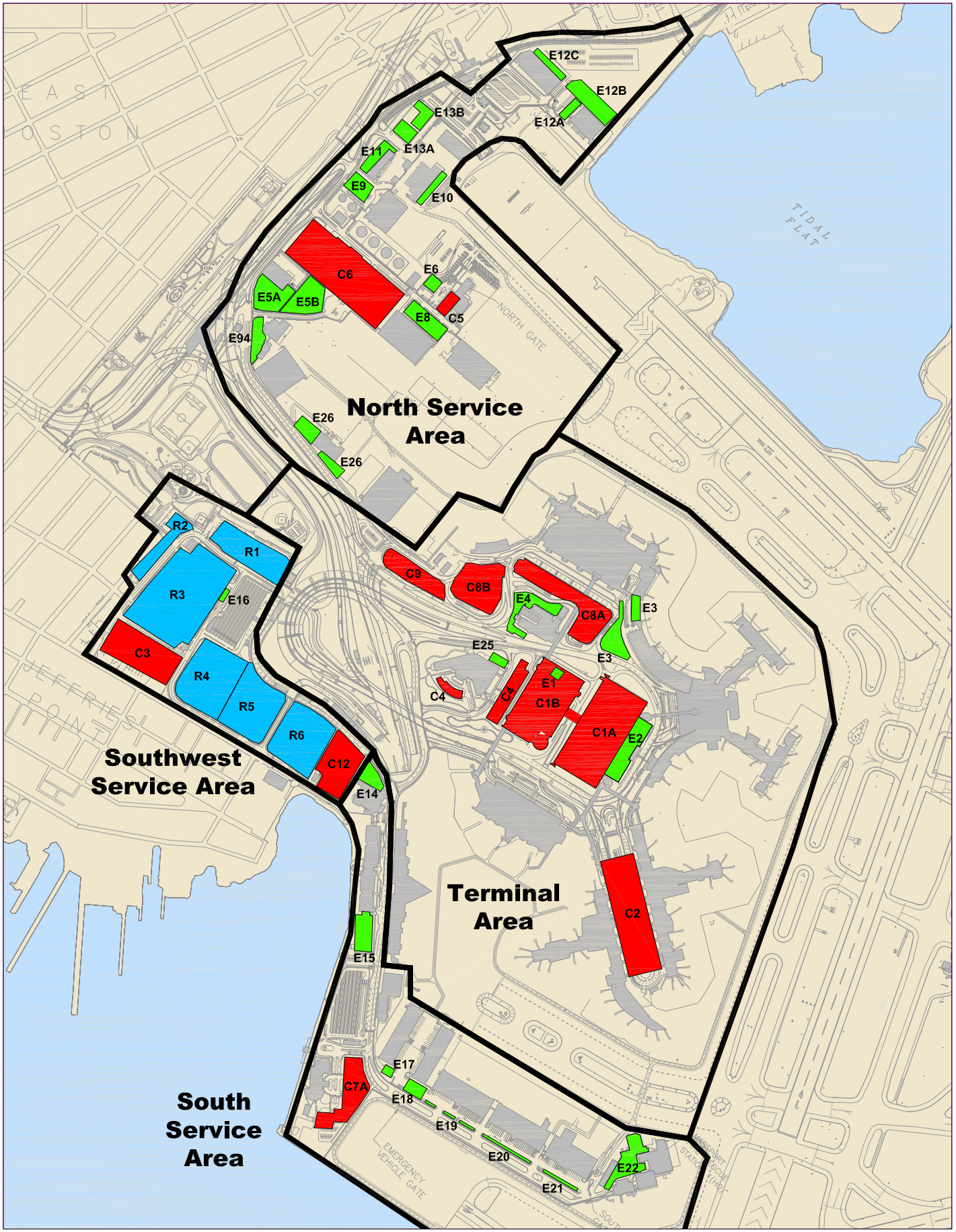
[1] This facility is located on the airfield and is not shown in the map.

Total In-Service Employee Parking Spaces	**2,592**
Total Designated Employee Parking Spaces	**481**
Total Employee Parking Spaces	**3,073**
Total Commercial Parking Spaces *(see table on previous page)*	**17,619**
TOTAL PARKING FREEZE SPACES	**20,692**

Supplemental Information: Rental Car Spaces Inventory
Logan International Airport
March 1, 2011 Submission

Rental Car Company Parking Spaces

Map ID#	Number of Spaces
R1	1,027
R2	130
R3	1,016
R4	1,550
R5	960
R6	337
Total Rental Car Spaces	**5,020**



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Logan Airport
Parking Space Inventory

Logan International Airport
East Boston, MA

Massachusetts Port Authority
March 1, 2011

Legend:

- Logan Parking Service Area Zones
- Commercial Parking Space Locations
- Employee Parking Space Locations
- Rental Car Parking Space Locations

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in feet

Notes:

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Massachusetts Port Authority
One Harborside Drive, Suite 200S
East Boston, MA 02128-2909
Telephone (617) 568-5000
www.massport.com

September 1st, 2011

Christine Kirby
Department of Environmental Protection
Division of Air Quality Control
One Winter Street
Boston, MA 02108

Re: September 1st, 2011 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, 2011 Massachusetts Port Authority submissions:

- Commercial Parking Space Inventory
- Employee Parking Space Inventory
- Location Map

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. We continue to provide information on rental car spaces as a courtesy.

The attachments provide the quantity, physical distribution and allocation of commercial and employee parking spaces as defined by 310 CMR 7.30, as amended. These inventory tables are based on information provided by the Aviation Department's Ground Transportation Unit, as supplemented by field checks, and represent the most up to date information on parking at Logan International Airport as of September 1st, 2011.

The Commercial Parking Space Inventory now totals 18,019 parking spaces (16,072 in service and 1,947 designated). The Employee Parking Space Inventory totals 2,673 employee parking spaces (2,603 in service and 70 designated). Designated spaces reflect parking spaces that are temporarily out of service. The total inventory of spaces at Logan Airport remains unchanged at 20,692.

Terminal B Garage capacity has been reduced by approximately 650 spaces due to garage and roadway construction.

The South West Service Area is now under construction as part of the Consolidated Rental Car project and this will affect the location and number of rental car spaces until the project is completed in 2015. Therefore, the Rental Car Parking Space locations on the attached map may not reflect current site conditions.

The attached Logan Airport Parking Space Inventory reflects Massport's successful management of its parking program, within the requirements of 310 CMR 7.30, as amended. If you have any questions, please call me at (617) 568-3570.

Sincerely,

Craig Leiner

Craig Leiner
Economic Planning & Development Department

cc: L. Dantas
S. Dalzell
I. Wallach
B. Desrosiers
D. Cook

Commercial Parking Space Inventory
Logan International Airport
September 1, 2011 Submission

Commercial Parking Spaces

Map ID#	Location of Commercial Parking Areas	Number of Spaces
Terminal Area and Economy Spaces		
C1a	Central Garage	7,196
C1b	West Garage	3,148
C2	Terminal B Garage	1,644
~~C3~~	~~Lot 3 (former USPS site) (Red Lot)~~ *(closed)*	0
C6	Economy Garage	2,789
C8a	Terminal E Lot 1	269
C8b	Terminal E Lot 2	257
C9	"Gulf Station" Overflow Lot	229
~~C12~~	~~SWSA Lot~~ *(closed)*	0
	subtotal	*15,532*
Hotel Spaces		
C4	Logan Airport Hilton Hotel (two lots)	235
C7a	Harborside Hyatt Conference Center	270
	subtotal	*505*
General Aviation Spaces		
C5	Signature (General Aviation Terminal)	35
	subtotal	*35*
Total In-Service Commercial Parking Spaces		**16,072**
Total Designated Commercial Parking Spaces		**1,947**
Total Commercial Parking Spaces		**18,019**
Total Employee Parking Spaces *(see table on next page)*		**2,673**
TOTAL PARKING FREEZE SPACES		**20,692**

Employee Parking Space Inventory
Logan International Airport
September 1, 2011 Submission

Employee Parking Spaces

Map ID#	Location of Employee Parking Areas	Number of Spaces
E1	Central Parking / West Garage	93
E2	Massport Tower	517
E3	Terminal C Pier A (Old Terminal D) (two lots)	87
E4	Massport Facilities 1 (Heating Plant)	94
E5a	North Cargo Building 11, TSA lot	81
E5b	North Cargo Building 11, State Police lot	158
E6	North Gate & EMS Trailer	31
E8	North Cargo Building 8	111
E9	US Airways Administration	84
E10	Massport Facilities 2 (airside)	35
E11	Massport Facilities 3	95
E12a	LSG Sky Chefs, main lot	34
E12b	LSG Sky Chefs, overflow lot	111
E12c	Flight Kitchen Building 1	22
E13a	Lovell Street Lot	12
E13b	Lovell-Neptune Street Lot	0
E14	Gate Gourmet	85
E15	Bird Island Flats (BIF) / LOC Garage	504
E16	Massport Taxi Pool	9
E17	South Cargo Building 63	16
E18	South Cargo Building 62	51
E19	South Cargo Building 58	23
E20	South Cargo Building 57	44
E21	South Cargo Building 56	72
E22	Fire-Rescue HQ & Amelia Earhart Building	89
E25	Hilton Hotel	30
E26	UPS (Cargo Building 13)	44
E94	United Aircraft Maint. (Buildings 93 & 94)	66
N/A	*ARFF Satellite Station*[1]	5

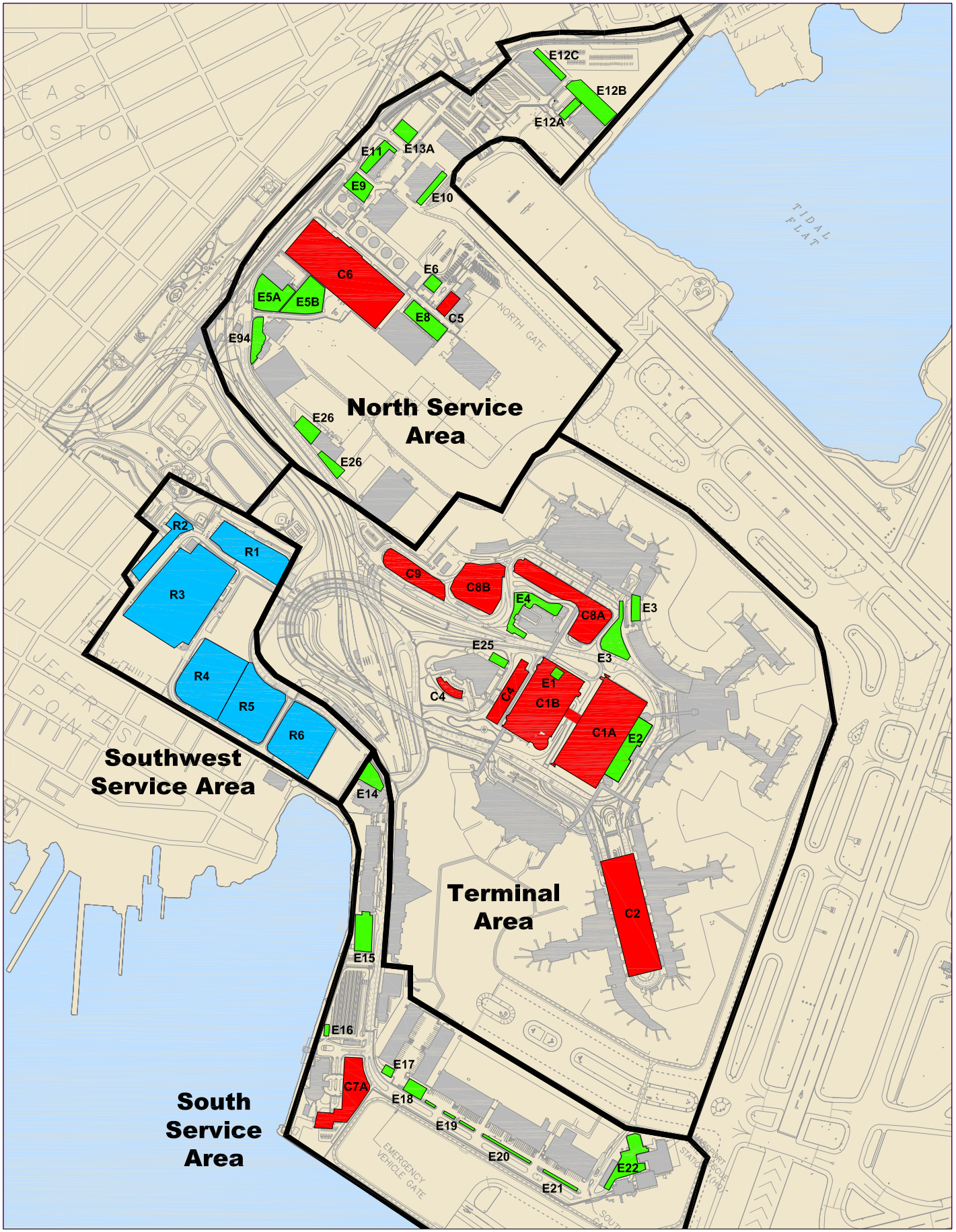
[1] This facility is located on the airfield and is not shown in the map.

Total In-Service Employee Parking Spaces	**2,603**
Total Designated Employee Parking Spaces	**70**
Total Employee Parking Spaces	**2,673**
Total Commercial Parking Spaces *(see table on previous page)*	**18,019**
TOTAL PARKING FREEZE SPACES	**20,692**

Supplemental Information: Rental Car Spaces Inventory
Logan International Airport
September 1, 2011 Submission

Rental Car Company Parking Spaces

Map ID#	Number of Spaces
R1	1,027
R2	130
R3	1,016
R4	1,550
R5	960
R6	337
Total Rental Car Spaces	**5,020**



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Logan Airport
Parking Space Inventory

Logan International Airport
East Boston, MA

Massachusetts Port Authority
September 1, 2011

Legend:

- Logan Parking Service Area Zones
- Commercial Parking Space Locations
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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*:

- Fundamentals of Acoustics and Environmental Noise
  - Figure H-1 Frequency-Response Characteristics of Various Weighting Networks
  - Figure H-2 Common Environmental Sound Levels, in dBA
  - Figure H-3 Variations in the A-Weighted Sound Level Over Time
  - Figure H-4 Sound Exposure Level
  - Figure H-5 Example of a One Minute Equivalent Sound Level
  - Figure H-6 Daily Noise Dose
  - Figure H-7 Examples of Day-Night Average Sound Levels (DNL)
  - Figure H-8 Outdoor Speech Intelligibility
  - Figure H-9 Probability of Awakening at Least Once from Indoor Noise Event
  - Figure H-10 Percentage of People Highly Annoyed
  - Figure H-11 Community Reaction as a Function of Outdoor DNL

- Logan Airport RealContours™ Data Inputs
  - Figure H-12 Schematic Noise Modeling Process (Standard INM vs. RealContours™)
  - Table H-1 2011 Annual Modeled Operations
  - Table H-2 2011 Modeled Runway Use by Aircraft Group
  - Table H-3 Summary of Jet and Non-Jet Aircraft Runway Use
  - Table H-4 Total Count of Flight Tracks Modeled in RealContours™ (2011)

- Residential Sound Insulation Program
  - Table H-5 Residential Sound Insulation Program Status (1986-2011)
  - Table H-6 Schools Treated Under Massport Sound Insulation Program

- Noise Exposed Population
  - Table H-7 Noise-Exposed Population by Community
  - Figure H-13 Number of Callers and Complaints between 2000 and 2011
  - Table H-8 Noise Complaint Line Summary

- History of Operations, Runway Use and Cumulative Noise Index (CNI)
  - Table H-9 Modeled Daily Operations by Commercial and General Aviation Aircraft – 1990 to 2011
  - Table H-10 Percentage of Commercial Jet Operations by Part 36 Stage Category – 1990 to 2011
  - Table H-11 Modeled Nighttime Operations at Logan Airport – 1990 to 2011
  - Table H-12 Summary of Jet Aircraft Runway Use – 1990 to 2011

- Table H-13 Cumulative Noise Index (EPNdB) – 1990 to 2011

- Flight Track Monitoring Report
  - Figure H-14 Logan Airport Gates
  - Table H-14 Runways 4R/4L Nahant Gate Summary for 2011
  - Table H-15 Runways 4R/4L Shoreline Crossings Above 6,000 Feet for 2011
  - Table H-16 Runway 9 Gate Summary – Winthrop Gates 1 and 2 for 2011
  - Table H-17 Runway 9 Shoreline Crossings Above 6,000 Feet for 2011
  - Table H-18 Runway 15R Shoreline Crossings Above 6,000 Feet for 2011
  - Table H-19 Runways 22R/22L Squantum 2 Gate Summary for 2011
  - Table H-20 Runways 15R/22R/22L Gate Summary – North of Hull Peninsula for 2011
  - Table H-21 Runways 22R/22L Shoreline Crossings Above 6,000 Feet for 2011
  - Table H-22 Runway 27 Corridor Percent of Tracks Through Each Gate for 2011
  - Table H-23 Runway 33L Gates – Passages Below 3,000 Feet for 2011

- Runway 22R Departure Analysis Memo

Fundamentals of Acoustics and Environmental Noise

Introduction

This section provides an introduction to the fundamentals of acoustics and to noise terminology, the effects of noise on human activity, and the effects on community annoyance.

Introduction to Acoustics and Noise Terminology

Chapter 6, Noise Abatement of this *2011 Environmental Status and Planning Report (2011 ESPR)* 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. A variety of 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.

- Decibel (dB)
- A-Weighted Decibel (dBA)
- Sound Exposure Level (SEL)
- Equivalent Sound Level (L_{eq})
- 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.

The human ear is 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. But our ears are incapable of detecting small differences in these pressures. Thus, to better 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 0dB, while the loudest sounds humans are able to 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, 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 produce 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)

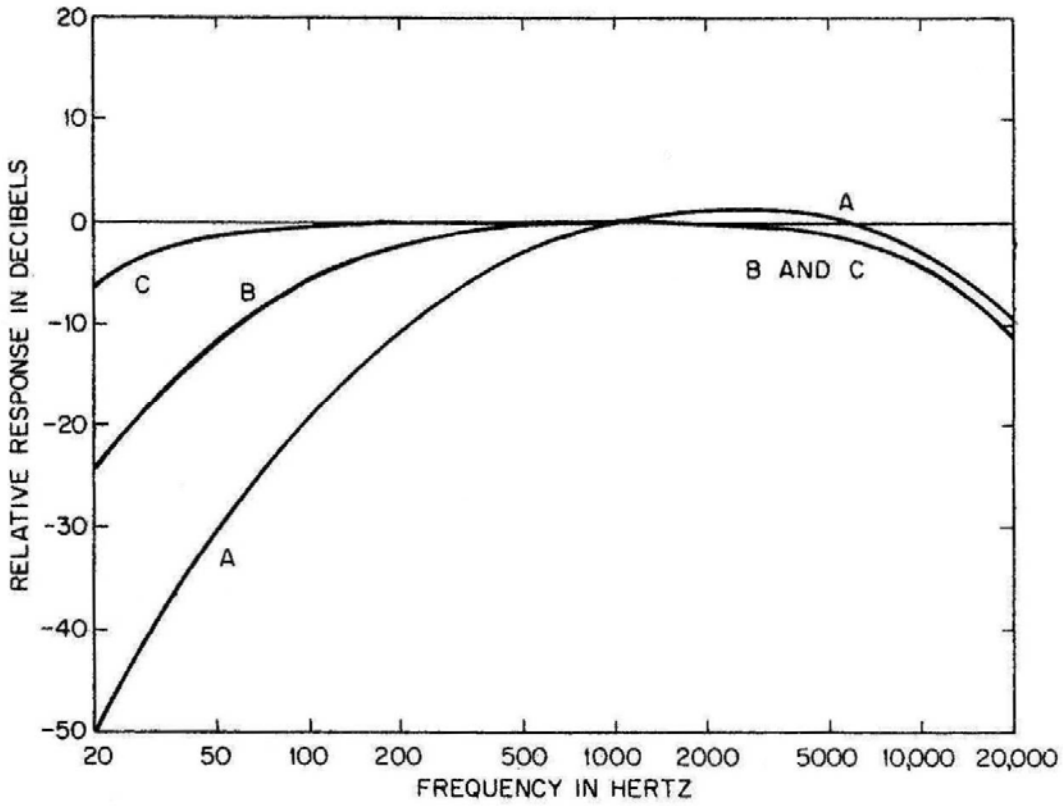
Another important characteristic of sound is its frequency, or "pitch". This is the rate of repetition of the sound pressure oscillations as they reach our ear. Formerly expressed in cycles per second, frequency is now expressed in units known as Hertz (Hz).

Most people are able to 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 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 to be 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.

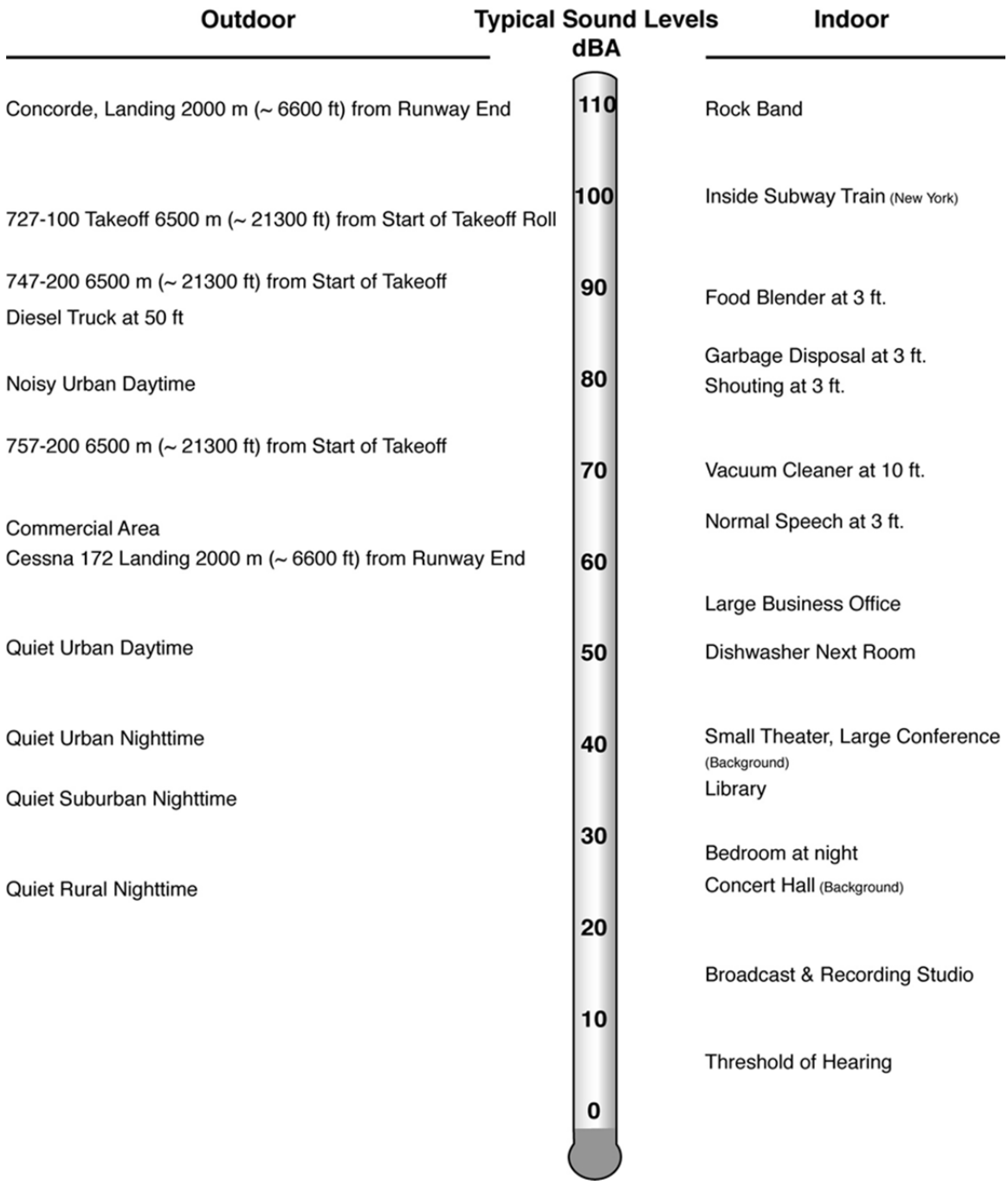
Figure H-1 Frequency-Response Characteristics of Various Weighting Networks



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 United States (U.S.) Environmental Protection Agency (EPA) and by nearly every other federal (including the Federal Aviation Administration (FAA)) and state agency concerned with community noise. The FAA noise regulations are codified at Federal Aviation Regulation (FAR), Part 150, Airport Noise Compatibility Planning. Figure H-2 presents typical A-weighted sound levels of several common environmental sources.

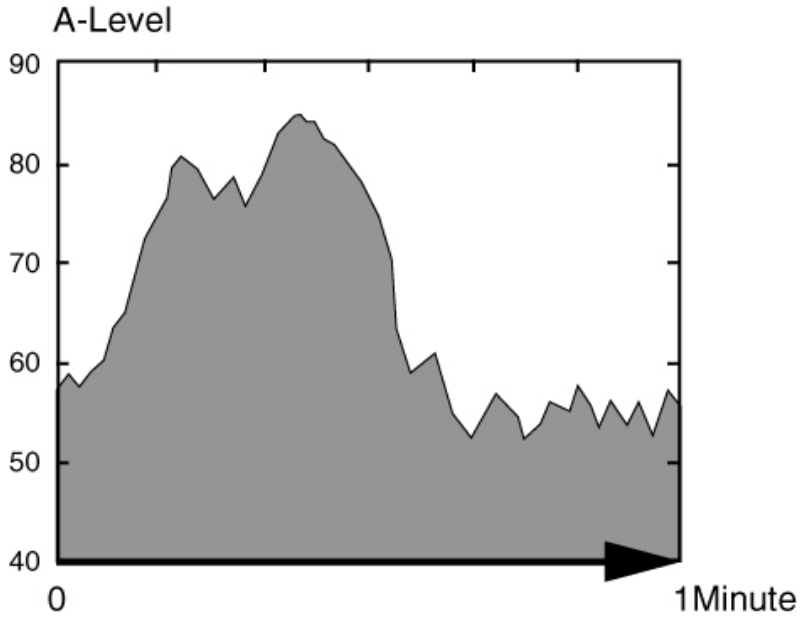
Figure H-2 Common Environmental Sound Levels, in dBA



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.

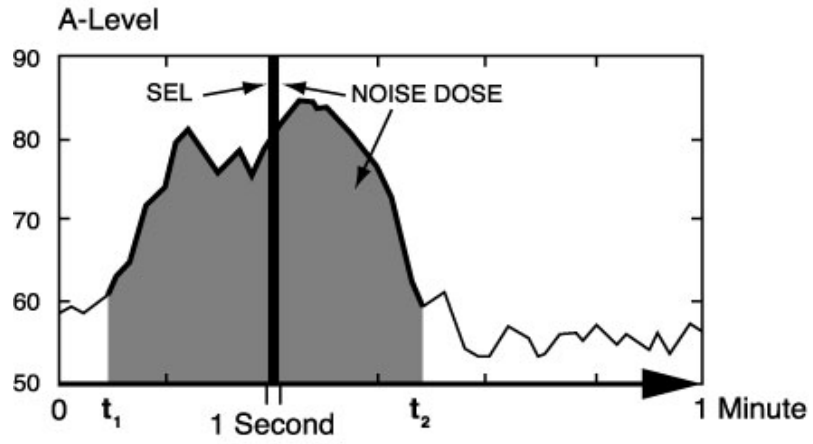
The maximum level describes only one dimension of an event; it provides no information on the cumulative noise exposure. In fact, two events with identical maxima may produce very different total exposures. One may be of very short duration, while the other may continue for an extended period and be 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 FAA Part 150 regulations 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



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 takes duration into account, 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.

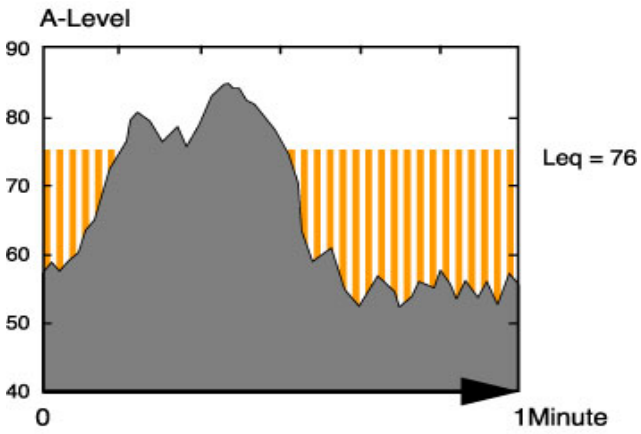
Equivalent Sound Level (L_{eq})

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; for example, 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



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)
Time Above (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 the *2011 ESPR*, 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
Identical to TA, except it is computed for only the 9 hour period between 10 PM and 7 AM.

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 of time.
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.
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.

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

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 of time.

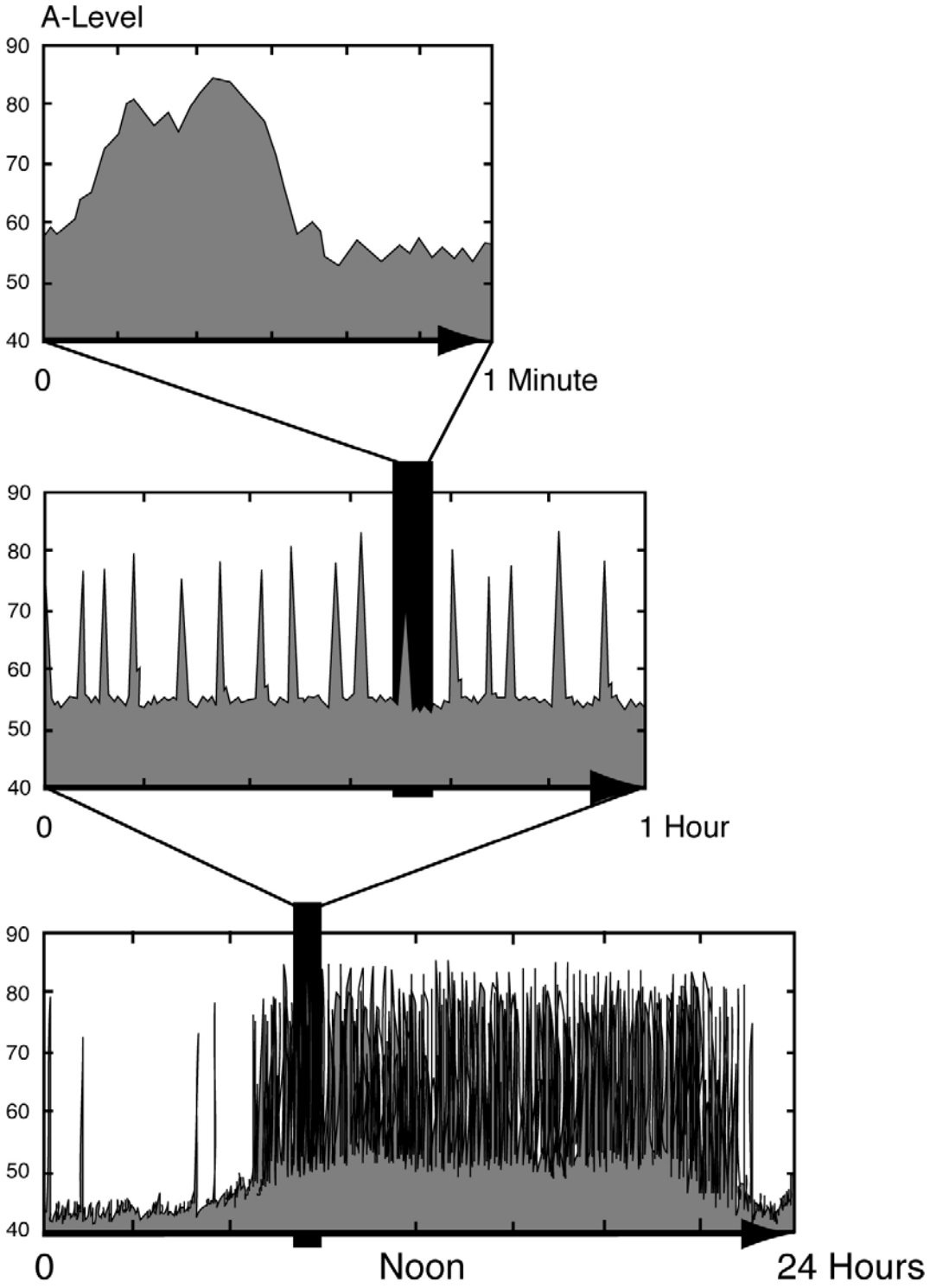
Most federal agencies dealing with noise have formally adopted DNL. The Federal Interagency Committee on Noise (FICON) reaffirmed the appropriateness of DNL in 1992. The FICON summary report stated: "There are no new descriptors or metrics of sufficient scientific standing to substitute for the present 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 PM to 7 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-6 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-6 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.

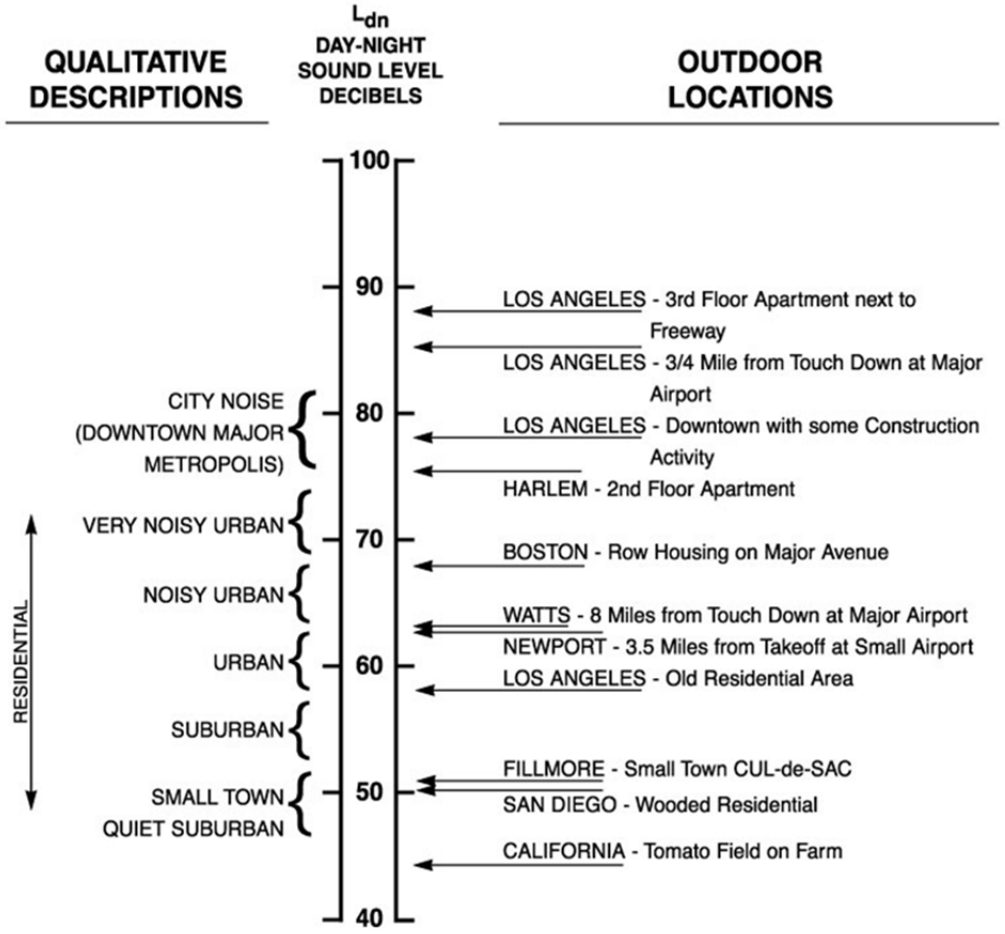
DNL can be measured or estimated. Measurements are practical only for obtaining DNL values for relatively limited numbers of points, and, in the absence of a permanently installed monitoring system, only for relatively short time periods. Most airport noise studies are based on computer-generated DNL 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: United States Environmental Protection Agency, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, March 1974, p. 14.

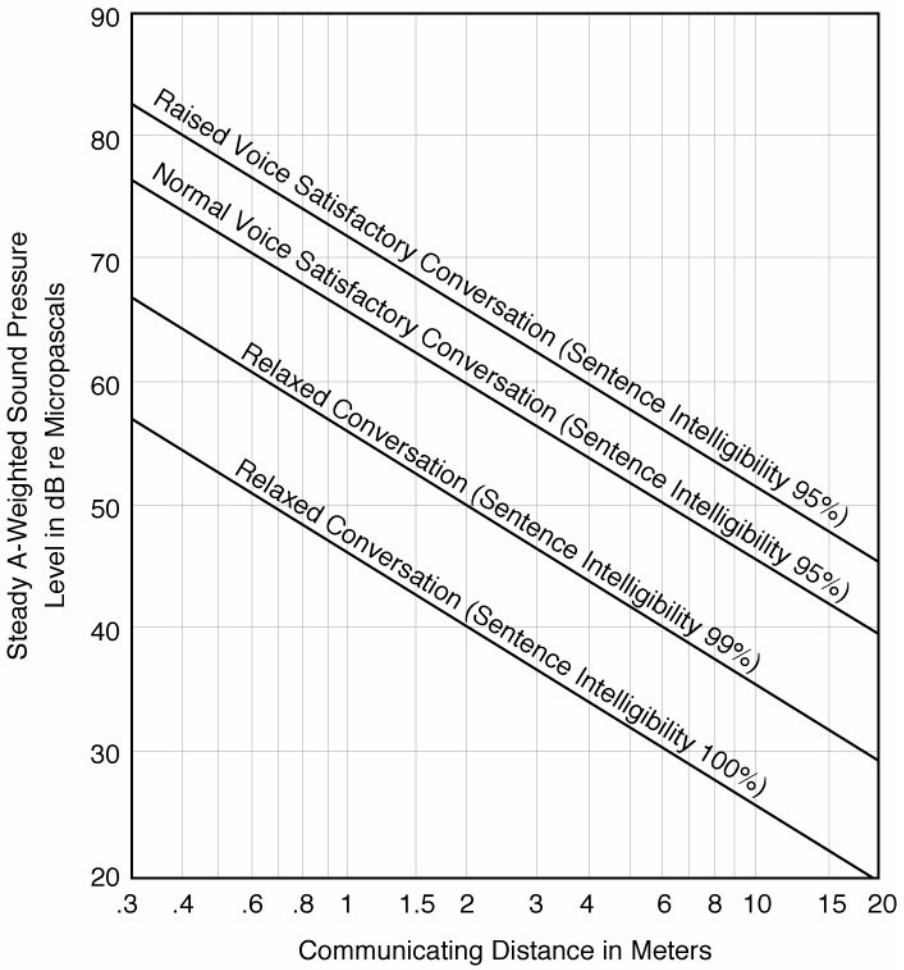
The Effects of Aircraft Noise on People

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: United States Environmental Protection Agency, 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.

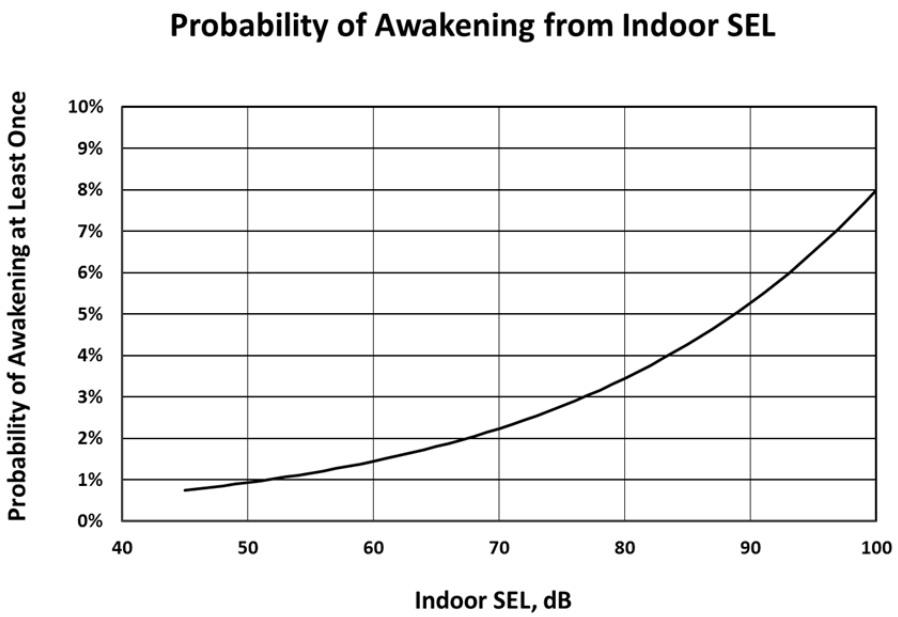
One implication of the relationships in Figure H-8 is that for typical communication at distances of 3 or 4 feet (1 to 1.5 meters), acceptable outdoor conversations can be carried on in a normal voice as long as the background noise outdoors is less than about 65 dBA. If the noise exceeds this level, 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, (3) the tendency to awaken increases with age, and other factors. Figure H-9 shows probability of awakening at least once from an indoor SEL.

Figure H-9 Probability of Awakening at Least Once from Indoor Noise Event



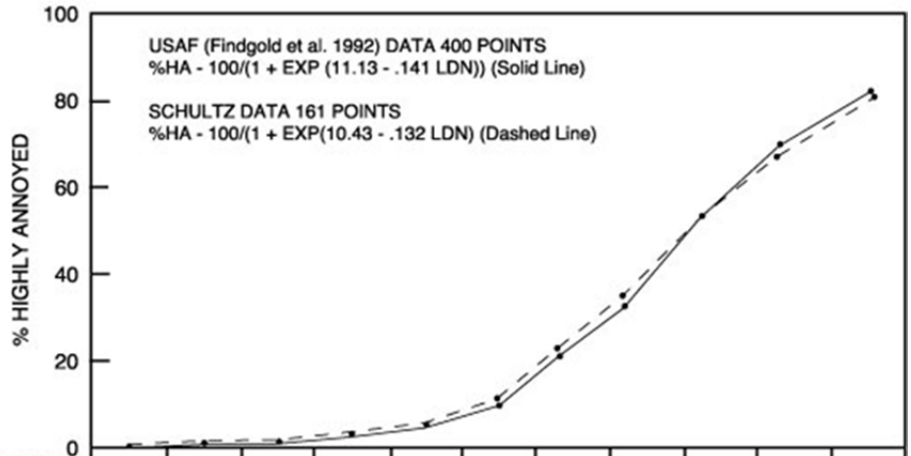
Source: ANSI S12.9-2008/Part 6, Quantities and Procedures for Description and Measurement of Environmental Sound — Part 6: Methods for Estimation of Awakenings Associated with Outdoor Noise Events Heard in Homes; Equation 1

Figure H-9 depicts indoor SEL as the measure of noise exposure; recent work supports the use of this metric in assessing sleep disruption. An indoor SEL of 80 dB results in a maximum of approximately 3.5 percent awakening. Assuming the typical windows-open interior-to-exterior noise level reduction of approximately 12 dB, and a typical L_{max} value for an aircraft flyover is 12 dB lower than the SEL value, an interior SEL of 80 dB roughly translates into an exterior L_{max} of the same value.

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



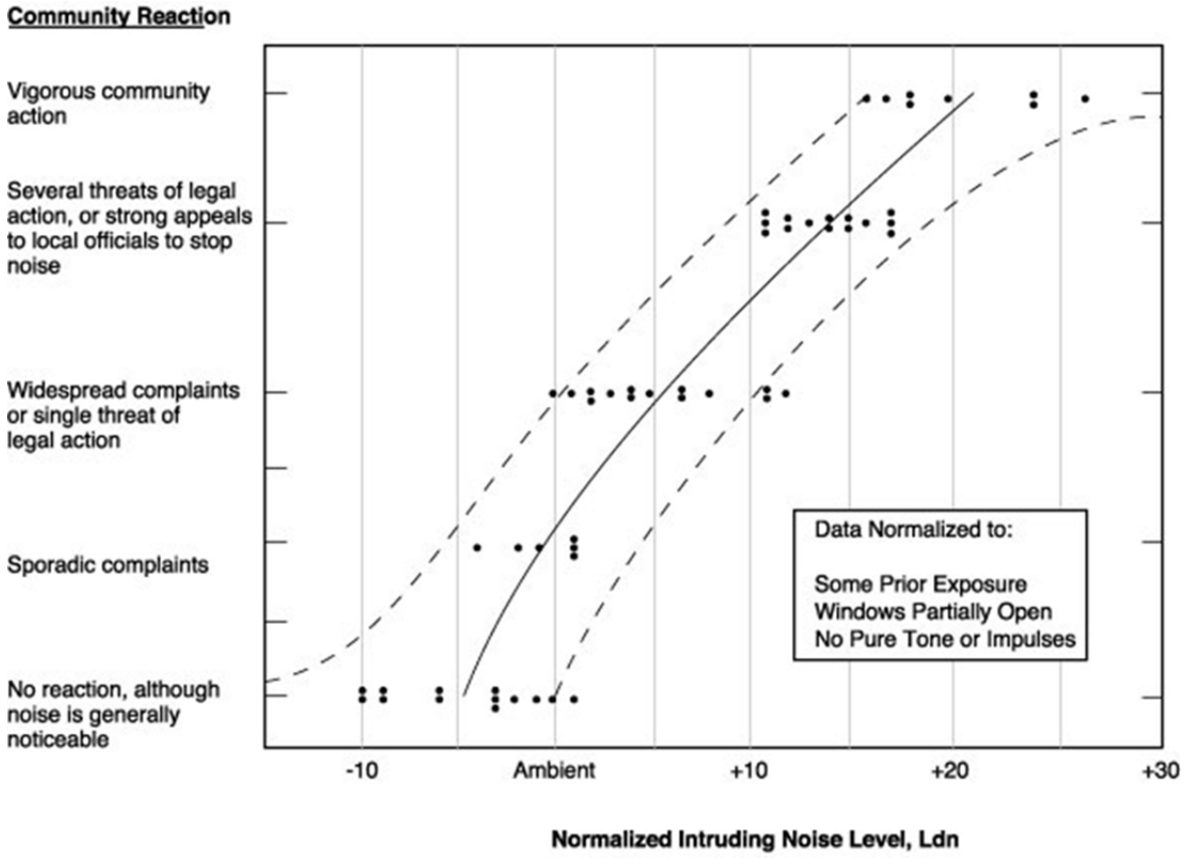
Day - Night Average Sound Level in dB		40	45	50	55	60	65	70	75	80	85	100
Calculated %HA Points	USAF	0.41	0.831	1.66	3.31	6.48	12.29	22.1	36.47	53.74	70.16	82.64
	SCHULTZ	0.576	1.11	2.12	4.03	7.52	13.59	23.32	37.05	53.25	68.78	81

Source: Federal Interagency Committee on Noise. "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 five 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 5 dB below the ambient, while widespread complaints can be expected as intruding noise exceeds background levels by about 5 dB. 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. 20406, December 1971, page 63.

Logan Airport RealContours™ Data Inputs

For this *2011 ESPR*, Massachusetts Port Authority (Massport) has produced a set of noise contours, time above (TA) noise metrics, and population counts for 2011 using the pair of software packages RealProfiles™ and RealContours™. This software incorporates the latest version of the FAA Integrated Noise Model (INM) Version 7.0c as the computational "engine" for calculating noise, but uses individual flight tracks taken directly from the Massport Noise and Operations Management System (NOMS) rather than relying on consolidated data summaries. For 2011, the NOMS retained suitable data for 350,443 flights; all of these were used in the noise model directly.

Introduction

Standard INM methodology involves development of operational inputs and calculation of the day-night average sound level (DNL) for a prototypical average annual day. This approach requires manually collecting, refining, and entering the enormous amount of data related to a full year of activity at an airport. For example, the model inputs may include an aircraft fleet mix with several dozen representative aircraft types, numerous representative flight tracks (on the order of 100 to 300 is common for an airport comparable to Logan Airport), and runway use and flight track use percentages for three or four categories of aircraft types with similar performance characteristics.

This approach 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[2], which automatically collects flight track data and flight identification data for all operations at the Airport and feeds the new NOMS.

For this report, Massport has selected an INM pre-processor, named 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:

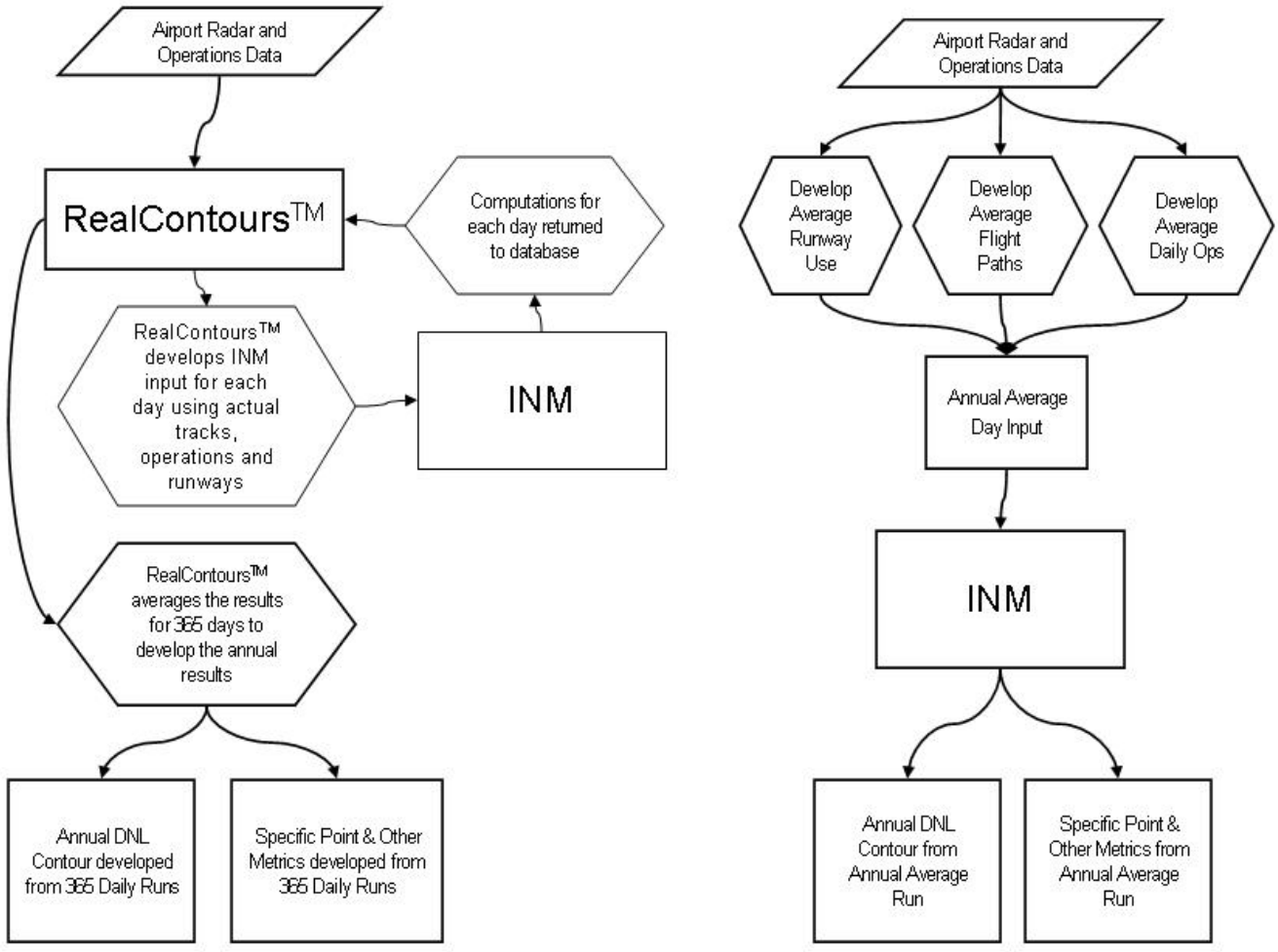
- Directly converts the flight track for every identified aircraft operation to an INM track, rather than assigning all operations to a limited number of prototypical tracks.
- Models each operation on the specific runway that it actually used, rather than applying a generalized distribution to broad ranges of aircraft types.
- Models each operation in the modeling time frame that it occurred which takes in 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.
- Uses each aircraft's actual performance and altitude profile to develop inputs to the model which define the actual arrival or departure profile.

2 For 2010, the Massport system utilizes the Airscene.com product of Era Corporation. During 2010 Era Corporations was acquired by ITT Corporation.

As defined in the INM 7.0 User's Guide, the annual day-night average sound level (YDNL) is used for quantifying airport noise. The YDNL is the 365-day average DNL. To use this definition to model noise in INM, one would have to run 365 cases of the model and average the results. Since this is time consuming and impractical, the current practice is to average the 365 days of data before the run and design one input file.[3] However, RealContours™ accomplishes this task by using the actual radar data to develop INM input files for each day of the year and then averaging 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™)



3 Federal Aviation Administration Integrated Noise Model (INM) Version 7.0 User's Guide, April 2007, p. 12.

2011 Radar Data

Logan Airport's radar data provides 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 has been used for the *2004 ESPR* through the *2008 Environmental Data Report (EDR)*. Beginning with the *2009 EDR*, Massport utilized the radar data from its NOMS system. This radar data is called multilateration radar since it collects data from multiple ground stations (Massport has eight sensors) deployed around the Airport. The positioning data from all of these sensors is correlated to provide better coverage in areas where the traditional FAA radar has limitations and provides a more complete set of points to define each track. Traditional radar provides points every four to five seconds where the multilateration provides data every second. The new system was able to collect 365 complete days of data for 2011 with approximately 95 percent of these tracks usable for the development of the noise exposure contours.

Fleet Mix

The 2011 radar data first were processed to establish a baseline set of operations. After processing 365 days of radar data, 350,343 flight tracks with sufficient data were identified to use as the baseline for the 2011 contour. The operations from these tracks were then scaled upwards by airline and aircraft type to match the reported totals for 2011. Table H-1 provides the scaled annual operations, as modeled, by aircraft type. The INM aircraft types modeled by RealContours™ match the types listed in Table H-1.

Runway Use

RealContours™ obtains its runway use information directly from the radar data based on the actual runways, which were used each day throughout the modeled year. The runway use presented here is broken into six representative aircraft groups listed below (see Table H-2):

- 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
- Turboprops and Piston Aircraft (Non-Jets)

The runway use has been grouped in this format to allow comparison with prior years. However, the definition of regional jet (RJ) used in the EDR was changed to represent aircraft with less than 80 seats which shifted the E190 to the Light Jet B category.[4]

Table H-2 shows the runway use that was used to model the 2011 noise conditions. As described above, turbojet aircraft in the table were grouped into different categories for reporting purposes. Because the 2011 contour developed using RealContours™ reflects the individual use of the runways by each INM aircraft type, it accurately represents 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 than the overall group runway use presented in Table H-2.

4 In the *2010 EDR*, the CRJ9 aircraft was incorrectly identified as having 90 seats. The aircraft in operation at Logan Airport has 78 seats in a two-class configuration.

Table H-1 2011 Annual Modeled Operations

INM Type	Runway Use Group	Arrivals		Departures		Total
		Day	Night	Day	Night	
Commercial Jet Operations						
74720B	HJA	1.0	0.0	1.0	0.0	2.0
747400	HJA	1010.8	16.5	698.7	328.6	2054.7
A340-211	HJA	1051.2	2.0	851.3	201.9	2106.4
A340-642	HJA	566.8	2.1	549.6	19.3	1137.8
DC870	HJA	161.8	117.7	4.1	275.4	558.9
767300	HJB	473.0	112.6	484.4	101.2	1171.2
767400	HJB	355.2	4.1	285.7	73.5	718.4
767CF6	HJB	13.2	3.1	13.2	3.1	32.6
767JT9	HJB	1.2	0.0	0.0	1.2	2.4
777200	HJB	335.2	61.0	389.8	6.4	792.5
777300	HJB	5.0	0.0	5.0	0.0	10.0
A300-622R	HJB	183.4	590.0	327.7	445.6	1546.6
A310-304	HJB	200.7	12.4	28.4	184.7	426.2
A330-301	HJB	1212.3	5.1	1192.0	22.7	2432.1
A330-343	HJB	131.1	0.0	63.9	69.8	264.8
DC1010	HJB	388.5	291.9	207.3	454.9	1342.7
DC1030	HJB	179.0	93.6	96.6	194.2	563.4
MD11GE	HJB	21.1	16.1	27.2	16.7	81.2
MD11PW	HJB	9.1	6.0	4.2	4.2	23.5
717200	LJA	3952.4	574.1	3995.4	531.2	9053.0
727EM2	LJA	235.2	85.7	183.2	137.7	641.7
DC95HW	LJA	310.8	73.8	337.9	46.7	769.2
MD9025	LJA	49.0	0.0	60.9	0.0	109.9
MD9028	LJA	107.2	2.0	95.4	2.0	206.7
7373B2	LJB	566.3	95.5	568.1	93.7	1323.5
737400	LJB	957.8	63.6	967.9	53.5	2042.8
737500	LJB	7113.5	591.5	6795.0	910.0	15410.0
737700	LJB	8769.4	1695.5	9182.8	1282.1	20929.7
737800	LJB	8308.2	1863.9	9165.6	1006.5	20344.2
737N17	LJB	6.6	0.7	6.3	0.0	13.6
737N9	LJB	0.7	0.0	1.9	0.0	2.6
757300	LJB	4.1	1.0	5.1	0.0	10.1
757PW	LJB	6118.5	1369.3	6510.4	994.4	14992.6
757RR	LJB	4872.1	1348.9	5372.5	831.5	12425.1
A319-131	LJB	35299.6	4675.6	35127.0	4848.2	79950.5

Note: Some totals may not match due to rounding.

Table H-1 2011 Annual Modeled Operations (Continued)

INM Type	Runway Use Group	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total
Commercial Jet Operations (Continued)						
A320-211	LJB	3132.3	765.3	3341.9	541.6	7781.1
A320-232	LJB	14808.5	4975.3	17456.3	2341.5	39581.5
A321-232	LJB	314.1	294.0	409.8	198.3	1216.2
MD82	LJB	40.7	2.1	42.7	0.0	85.4
MD83	LJB	1117.4	115.3	1185.2	47.5	2465.5
CRJ9-ER	RJ	5958.0	356.9	5463.1	890.3	12668.3
CRJ9-LR	RJ	1722.8	281.1	1606.8	358.6	3969.3
CIT3	RJ	1.0	0.0	1.0	0.0	2.0
CL600	RJ	99.4	16.7	100.8	16.3	233.3
CL601	RJ	7495.6	361.4	7536.3	319.8	15713.2
CNA560XL	RJ	4.2	0.0	4.2	0.0	8.5
CNA55B	RJ	12.9	1.1	13.0	1.0	28.1
CNA750	RJ	14.1	1.2	14.1	1.2	30.6
CNA680	RJ	16.3	0.0	15.3	1.0	32.6
EMB145	RJ	3632.5	146.5	3158.9	653.5	7591.4
EMB14L	RJ	2209.1	54.4	1987.5	242.6	4493.6
F10062	RJ	22.5	1.5	22.5	1.5	47.9
GIIB	RJ	2.0	0.0	2.0	0.0	4.1
GIV	RJ	27.6	5.7	28.9	4.4	66.6
GV	RJ	22.4	2.0	23.4	1.0	48.9
LEAR25	RJ	0.0	0.8	0.0	0.8	1.7
LEAR35	RJ	41.6	2.6	41.0	3.2	88.5
MU3001	RJ	3.5	0.0	3.5	0.0	7.1
Commercial Jets Subtotal		123613.7	21155.5	126007.8	18761.5	289538.6
Commercial Non-Jet Operations						
BEC58P	NJ	17202.1	669.7	17776.6	95.1	35743.5
C130	NJ	0.5	0.0	0.5	0.0	1.0
CNA208	NJ	170.4	24.4	178.7	16.1	389.5
CNA20T	NJ	0.0	1.0	1.0	0.0	2.0
CNA441	NJ	14.2	1.0	14.1	1.1	30.5
DHC6	NJ	0.1	0.0	0.1	0.0	0.1
DHC8	NJ	809.2	0.0	802.1	7.1	1618.4
DHC830	NJ	2033.1	180.2	1976.3	236.9	4426.4
DO228	NJ	4.5	0.0	4.0	0.5	9.0
GASEPF	NJ	4.2	1.0	2.5	2.7	10.5
GASEPV	NJ	5.0	0.0	5.0	0.0	10.1
PA31	NJ	80.2	186.5	84.7	182.0	533.4
SF340	NJ	4064.7	82.0	4107.9	38.8	8293.3
Commercial Non-Jet Operations Subtotal		24444.2	1149.5	25009.8	584.0	51187.4
Commercial Aircraft Total		148058.0	22305.0	151017.6	19345.4	340726.0
General Aviation (GA) Operations						
74720B	HJA	3.8	0.0	3.8	0.0	7.6
747400	HJA	1.3	0.0	1.3	0.0	2.5
DC870	HJA	3.8	1.3	0.0	5.0	10.1
767300	HJB	6.0	1.3	5.7	1.6	14.6
767CF6	HJB	3.8	0.0	2.5	1.3	7.6

Notes: BEC58P is the INM substitution for the Cessna 402.
The CRJ9-ER in the RJ category is the CRJ700 aircraft.
Some totals may not match due to rounding.

Table H-1 2011 Annual Modeled Operations (Continued)

INM Type	Runway Use Group	Arrivals		Departures		Total
		Day	Night	Day	Night	
General Aviation Operations (Continued)						
767JT9	HJB	1.3	0.0	1.3	0.0	2.5
A330-301	HJB	3.5	1.3	4.8	0.0	9.6
DC1010	HJB	0.0	1.3	0.0	0.0	1.3
DC1030	HJB	0.0	0.0	0.0	1.3	1.3
MD11GE	HJB	1.3	0.0	1.3	0.0	2.5
727EM1	LJA	1.3	2.5	1.3	2.5	7.6
727EM2	LJA	2.5	1.3	3.8	0.0	7.6
7373B2	LJB	3.4	1.7	5.0	0.0	10.1
737500	LJB	1.3	0.0	1.3	0.0	2.5
737N17	LJB	1.3	0.0	2.5	0.0	3.8
737N9	LJB	1.3	0.0	0.0	0.0	1.3
757PW	LJB	5.0	0.0	3.8	1.3	10.1
757RR	LJB	1.3	0.0	1.3	0.0	2.5
A319-131	LJB	6.7	2.1	6.3	2.5	17.6
A320-211	LJB	2.5	0.0	1.3	0.0	3.8
A320-232	LJB	0.0	0.0	1.3	0.0	1.3
MD81	LJB	2.3	0.0	1.3	1.0	4.5
MD82	LJB	1.3	1.3	2.5	0.0	5.0
MD83	LJB	5.0	0.0	5.0	0.0	10.1
CIT3	RJ	73.3	8.4	76.0	5.8	163.5
CL600	RJ	858.5	94.8	880.4	71.2	1904.9
CL601	RJ	883.5	71.1	871.2	85.3	1911.1
CNA500	RJ	37.4	14.2	36.2	10.1	97.9
CNA510	RJ	50.3	2.5	42.8	10.1	105.7
CNA55B	RJ	410.4	61.2	410.4	66.4	948.4
CNA750	RJ	677.1	71.4	691.9	56.6	1497.1
CNA525C	RJ	273.0	17.4	275.9	14.4	580.7
CNA560E	RJ	167.8	13.9	164.4	12.6	358.7
CNA560U	RJ	228.6	22.8	235.1	21.1	507.6
CNA560XL	RJ	1133.2	119.8	1143.5	109.5	2505.9
CNA680	RJ	516.5	38.0	530.6	23.9	1109.0
ECLIPSE500	RJ	17.1	13.1	16.4	13.8	60.4
EMB145	RJ	69.8	11.7	76.5	5.0	163.0
F10062	RJ	427.6	24.2	434.1	17.6	903.5
FAL20	RJ	2.5	0.0	2.7	0.0	5.2
GIV	RJ	648.9	88.8	661.1	76.5	1475.3
GV	RJ	515.2	64.3	520.7	58.9	1159.1
IA1125	RJ	128.4	32.7	148.3	12.7	322.2
MU3001	RJ	744.4	59.5	744.8	59.2	1607.8
LEAR25	RJ	11.3	0.0	11.3	1.3	23.9
LEAR35	RJ	1570.5	170.0	1559.9	178.9	3479.2
SABR80	RJ	1.3	0.0	1.3	0.0	2.5
BEC58P	NJ	806.2	79.0	813.2	72.0	1770.4
C130	NJ	1.3	0.0	1.3	0.0	2.5
CNA172	NJ	47.8	1.3	41.5	7.6	98.2
CNA206	NJ	101.6	0.0	103.2	0.0	204.8

Note: Some totals may not match due to rounding.

Table H-1 2011 Annual Modeled Operations (Continued)

INM Type	Runway Use Group	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total
General Aviation Operations (Continued)						
CNA208	NJ	1002.9	86.7	1033.2	56.4	2179.1
CNA20T	NJ	22.8	1.4	21.4	1.3	46.9
CNA441	NJ	327.1	17.3	307.2	37.2	688.8
DHC6	NJ	0.0	1.3	1.3	0.0	2.5
DHC830	NJ	3.8	0.0	3.8	0.0	7.6
DO228	NJ	195.6	17.6	193.7	19.5	426.3
DO328	NJ	1.3	0.0	1.3	0.0	2.5
EMB120	NJ	1.3	0.0	0.0	1.3	2.5
GASEPF	NJ	13.8	0.0	20.1	0.0	34.0
GASEPV	NJ	408.7	7.9	408.6	8.0	833.2
PA28	NJ	20.1	0.0	12.6	1.3	34.0
PA30	NJ	3.8	0.0	3.8	0.0	7.6
PA31	NJ	50.3	2.5	50.3	2.5	105.7
PA42	NJ	12.6	0.0	12.6	0.0	25.2
SD330	NJ	295.6	21.5	288.2	28.9	634.3
SF340	NJ	1.3	0.0	1.3	0.0	2.5
General Aviation Total		12873.5	1257.0	12959.6	1170.9	28261.0
Grand Total		160931.5	23562.0	163977.2	20516.3	368987.0

Source: HMMH, 2011.
Notes: Annual operations modeled in the 2011 Annual contour.
Some totals may not match due to rounding.
HJA, HJB Heavy Jets A and B
LJA, LJB Light Jets A and B
RJ Regional Jets
NJ Non-jets

Comparing Table H-2 with the similar Table H-2 in the *2010 EDR*, departure use of Runway 33L and 14 decreased during the day and night for all jet groups and increased for Runways 9 and 22R during the day and night for all jet groups. Runway 27 departures also decreased during the day and night for all jet groups except for a raise of 0.05 percent in daytime Heavy Jet Group B. For departures, the largest increase for Heavy Jet Group A was on Runway 4R during the day (26.33 percent in 2011 compared to 15.75 percent in 2010[5]) and the largest decrease was on Runway 15R during the night (32.60 percent in 2011 compared to 52.62 percent in 2010). For Heavy Jet-Group B departures, the largest increase was on Runway 22R during the night (24.17 percent in 2011 compared to 14.23 percent in 2010) and the largest decrease was on Runway 15R during the night (29.08 percent in 2011 compared to 42.37 percent in 2010).

5 The Heavy Jet A Day departure values reported in the *2010 EDR* are incorrect. The correct values are: 04L -0.00%, 04R – 15.75%, 09 – 6.99%, 14 – 0.00%, 15L – 0.00%, 15R – 16.21%, 22L – 10.99%, 22R – 22.75%, 27 – 0.48%, 32 – 0.00%, 33L – 26.83%, 33R – 0.00%

Table H-2 2011 Modeled Runway Use by Aircraft Group

ARRIVALS

	Heavy Jets - Group A		Heavy Jets - Group B		Light Jets - Group A		Light Jets - Group B		Regional Jets		Turboprops (Non-jets)	
Runway	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
04L	0.22%	0.00%	0.35%	0.34%	5.72%	0.70%	5.56%	0.98%	18.46%	3.82%	28.93%	9.22%
04R	48.21%	26.85%	46.77%	26.47%	40.20%	33.61%	39.59%	29.30%	27.63%	29.09%	16.70%	21.91%
09	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
14	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
15L	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%
15R	0.19%	0.00%	0.35%	0.00%	0.38%	0.28%	0.31%	0.13%	0.33%	0.00%	0.24%	0.09%
22L	28.07%	35.38%	16.11%	31.34%	9.35%	33.94%	12.98%	33.80%	14.98%	28.89%	20.01%	36.46%
22R	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.19%	1.35%
27	13.98%	13.70%	27.20%	8.85%	35.18%	11.45%	32.55%	12.85%	26.78%	13.79%	19.76%	11.63%
32	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.25%	0.03%	3.19%	0.29%	4.00%	0.24%
33L	9.33%	24.07%	9.22%	33.00%	9.17%	20.02%	8.76%	22.90%	8.64%	24.12%	6.05%	18.66%
33R	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.11%	0.45%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

DEPARTURES

	Heavy Jets - Group A		Heavy Jets - Group B		Light Jets - Group A		Light Jets - Group B		Regional Jets		Turboprops (Non-jets)	
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%	24.26%	13.29%
04R	26.33%	10.93%	17.92%	5.46%	4.15%	2.52%	6.01%	5.04%	2.32%	4.04%	3.43%	5.55%
09	9.99%	11.14%	22.10%	19.41%	40.41%	24.02%	37.32%	23.49%	47.90%	26.80%	15.46%	9.55%
14	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.06%	0.00%
15L	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.18%	0.13%
15R	10.86%	32.60%	4.80%	29.08%	2.01%	28.01%	2.37%	24.46%	1.29%	31.46%	2.72%	25.19%
22L	12.94%	11.19%	6.47%	3.16%	1.36%	1.30%	1.99%	2.26%	0.52%	0.75%	0.70%	2.09%
22R	26.73%	20.27%	33.37%	24.17%	37.73%	22.41%	36.78%	26.70%	40.35%	28.23%	42.01%	28.09%
27	0.29%	1.76%	4.35%	3.59%	6.45%	12.05%	7.38%	8.27%	7.62%	8.72%	2.79%	2.34%
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	12.85%	12.11%	10.97%	15.13%	7.88%	9.69%	8.15%	9.78%	0.00%	0.00%	8.39%	13.77%
33R	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Source: Massport, HMMH. 2011
Notes: Night for noise modeling is defined as 10 PM to 7 AM.
Nighttime runway restrictions are from 11 PM to 6 AM.
Values may not add to 100 percent due to rounding.

For Light Jets – Group A departures, the largest increase is on Runway 9 during the day (40.41 percent in 2011 compared to 28.8 percent in 2010) with the largest decrease on Runway 33L during the day (7.88 percent in 2011 compared to 19.33 percent in 2010). For Light Jets – Group B departures, the largest increase was on Runway 9 during the night (23.49 percent in 2011 compared to 13.67 percent in 2010) with the largest decrease on Runway 15R during the night (24.46 percent in 2011 compared to 38.26 percent in 2010). For RJ departures use on Runway 04R and Runway 22L increased between 2010 and 2011 for both day and night.

While Table H-2 presents runway use by aircraft groups, Table H-3 presents the total runway use 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-3 shows that on an average day Runway 22R has the most departures (183.38 per day) and Runway 27 has the most arrivals (169.65 per day). At night, Runway 22R has the most departures (14.65 per day) but Runway 22L has the most arrivals (21.63 per day). Overall, the Airport continued to favor a north-south operating flow in 2011 as shown with the percentage of jet departures by operating direction in Figure 6-5 of *Chapter 6, Noise Abatement.*

Table H-3 Summary of Jet and Non-Jet Aircraft Runway Use

	Runway												
	4L	4R	9	14[2]	15L	15R	22L	22R	27	32	33L	33R	Total
2011 Daily Operations													
Departures Day	18.79	24.56	152.38	0.06	0.14	10.83	7.96	168.73	28.58	--	37.22	--	449.25
Departures Night	0.30	2.87	12.51	0.00	0.00	14.48	1.40	14.65	4.22	--	5.78	--	56.21
Arrivals Day	49.53	151.04	--	--	0.01	1.33	64.83	2.42	128.55	5.73	36.62	0.84	440.91
Arrivals Night	1.04	18.61	--	--	0.00	0.08	21.63	0.05	8.13	0.04	14.96	0.02	64.55
Total Daily Operations	69.65	197.08	164.88	0.06	0.16	26.72	95.82	185.85	169.49	5.76	94.58	0.86	1010.92
2011 Annual Operations													
Departures Day	6,858	8,965	55,618	21	52	3,953	2,905	61,587	10,433	--	13,584	--	163,977
Departures Night	108	1,047	4,565	0	1	5,285	510	5,347	1,541	--	2,111	--	20,516
Arrivals Day	18,078	55,131	--	--	4	486	23,664	884	46,921	2,091	13,366	307	160,931
Arrivals Night	379	6,793	--	--	0	28	7,896	19	2,969	13	5,459	6	23,562
Total Annual Operations	25,423	71,936	60,183	21	57	9,752	34,975	67,837	61,864	2,104	34,521	313	368,987
2011 Operations Percentage													
Percentage Departures Day	4%	6%	34%	<1%	<1%	2%	2%	38%	6%	0%	7%	0%	100%
Percentage Departures Night	1%	5%	22%	0%	<1%	26%	3%	26%	8%	0%	9%	0%	100%
Percentage Arrivals Day	11%	34%	0%	0%	0%	<1%	15%	1%	29%	1%	8%	<1%	100%
Percentage Arrivals Night	2%	29%	0%	0%	<1%	<1%	34%	<1%	13%	<1%	23%	<1%	100%

Source: Massport Noise Office and HMMH 2011.

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.

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-4 lists the number of flight tracks used in the RealContours™ modeling system for 2011. Flight tracks from April of 2011 are displayed in Figures 6-6 through 6-11 in *Chapter 6, Noise Abatement*.

Table H-4 Total Count of Flight Tracks Modeled in RealContours™ (2011)

	Runway											
	4L	4R	9	14	15L	15R	22L	22R	27	32	33L	33R
Departures	6,268	9,704	57,776	18	45	8,877	3,321	63,838	11,553	0	15,080	0
Arrivals	16,496	59,110	0	0	3	485	29,934	711	47,106	1,843	17,923	252

Source: HMMH 2011, ITT NOMS data

Flight Profiles

To further 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.

RealProfiles™ was able to compute profiles based on the actual radar data for 99.7 percent of the available departure tracks and 91.7 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 is not available. For those profiles the INM database contains fixed profiles which are not modified and are used as supplied with the INM data.

Residential Sound Insulation Program

In 2011, Massport completed sound insulation of 62 residential buildings containing 114 dwelling units, resulting in a total of 5,374 residential buildings and 11,333 dwelling units that have been sound-insulated since 1986 when the program was first implemented. Table H-5 lists the yearly progress of this mitigation effort.

Table H-5 Residential Sound Insulation Program Status (1986-2011)

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
Total	5,374	11,333

Source: Massport, 2011.
1 Includes multiple units.
2 Individual units.

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 in the amount of $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. 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-6 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 dollars.

Table H-6 Schools Treated Under Massport Sound Insulation Program

Boston:		
East Boston		
East Boston High		$381,948
St. Mary's Star of the Sea		$80,901
St. Dominic Savio High		$127,879
St. Lazarus		$46,092
James Otis		$46,092
Samuel Adams		$120,650
Curtis Guild		$180,572
Dante Alighieri		$97,750
P.J. Kennedy		$127,637
Donald McKay		$231,754
Hugh Roe O'Donnell		$113,564
E Boston Central Catholic		$391,768
Manassah Bradley		$237,500
13	East Boston Schools	$2,184,107
South Boston:		
St. Augustine		$92,855
Cardinal Cushing		$47,276
Patrick Gavin		$217,077
St. Bridgid's		$112,100
Oliver Hazard Perry		$337,538
Condon School		$294,481
6	South Boston Schools	$1,101,327
Roxbury & Dorchester:		
Samuel Mason		$192,401
Dearborn Middle		$248,238
Ralph Waldo Emerson		$155,851
Lewis Middle		$202,092
Nathan Hale Elem.		$92,302
Phillis Wheatley Elem.		$290,794
Davis Ellis Elem.		$253,663
Henry L. Higginson		$119,543
8	Roxbury & Dorchester Schools	$1,554,884
27	Total Boston Schools	$4,840,318
Winthrop		
Winthrop Jr. High School		$63,756
E. B. Newton		$184,674
A. T. Cummings (Ctr.) School		$800,000
3	Total Winthrop Schools	$1,048,430
Revere		
Beachmont School		$854,864
1	Total Revere School	$854,864
Chelsea		
Shurtleff School		$292,207
Williams School		$486,258
St. Rose Elementary		$46,396
St. Stanislaus		$66,298
Chelsea High School		$524,249
5	Total Chelsea Schools	$1,415,408
36	Total Schools	$8,159,020

Source: Massport, 2011

Noise Exposed Population

Table H-7 presents the noise exposed population by community for 2011. This table includes population within the DNL 60-65 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-7 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 (INMc7.0b)[4]	2010	0	0	0	331	331	12,155
2011 (INMc7.0c)[4]	2010	0	0	0	331	331	11,600
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
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 (INMv7.0b)[4]	2010	0	0	0	0	0	0
2011 (INMv7.0c)[4]	2010	0	0	0	0	0	0

Table H-7 Noise-Exposed Population by Community (Continued)

Year	Census Data	80+ dB DNL	75-80 dB DNL	70-75 dB DNL	65-70 dB DNL[1]	Total (65+)	60-65 dB DNL
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
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 (INMc7.0b)[4]	2010	0	0	0	0	0	0
2011 (INMc7.0c)[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
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 (INMv7.0b)[4]	2010	0	0	0	0	0	0
2011 (INMv7.0c)[4]	2010	0	0	0	0	0	0

Table H-7 Noise-Exposed Population by Community (Continued)

Year	Census Data	80+ dB DNL	75-80 dB DNL	70-75 dB DNL	65-70 dB DNL[1]	Total (65+)	60-65 dB DNL
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
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 (INMv7.0b)[4]	2010	0	0	0	0	0	0
2011 (INMv7.0c)[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
2011 (INMv7.0b)[4]	2010	0	0	0	2,547	2,547	2,749
2011 (INMv7.0c)[4]	2010	0	0	0	2,547	2,547	3,123

Table H-7 Noise-Exposed Population by Community (Continued)

Year	Census Data	80+ dB DNL	75-80 dB DNL	70-75 dB DNL	65-70 dB DNL[1]	Total (65+)	60-65 dB DNL
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 (INMv7.0b)[4]	2010	0	0	130	939	1069	4,373
2011 (INMv7.0c)[4]	2010	0	0	130	939	1069	4,303
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 (INMv7.0a)[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 (INMv7.0b)[4]	2010	0	0	130	3,817	3,947	19,277
2011 (INMv7.0c)[4]	2010	0	0	130	3,817	3,947	19,026

Source: Data prepared for Massport by HMMH 2011.
Note: 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, and the
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.

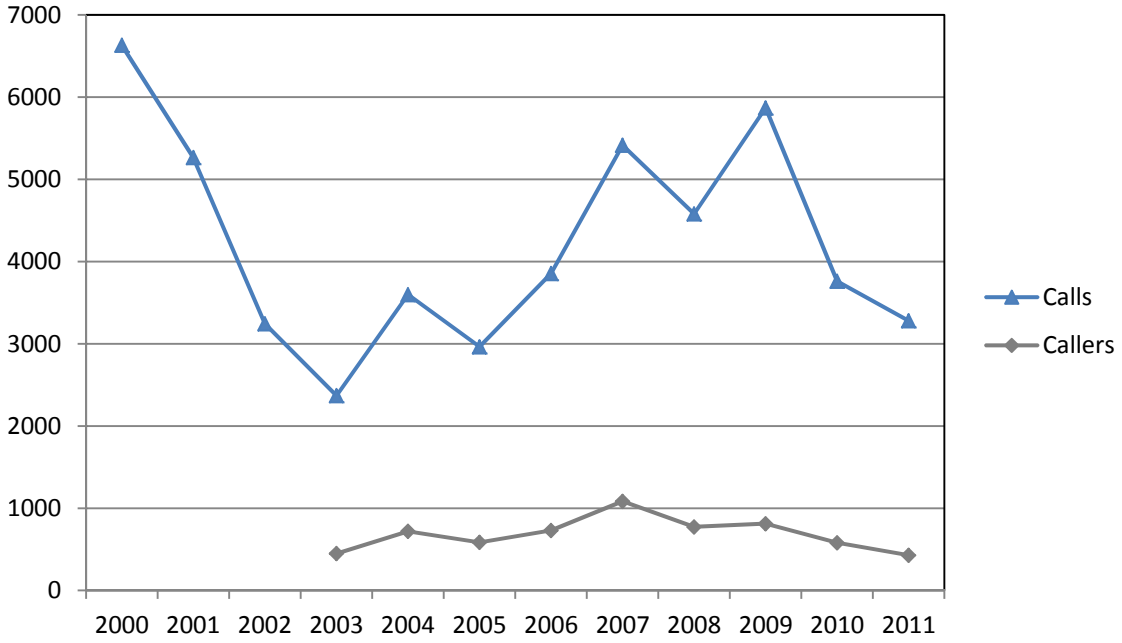
Noise Complaints

Table H-8 presents a summary by community of the total complaints made in 2011, which can be filed either by Massport's Noise Complaint Line or through a form on Massport's website. 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 2011, Massport received a total of 3,280 noise complaints from 54 communities, a decrease of 12.8 percent from 2010, when the NAO received 3,761 complaints (Figure H-13). Four communities with more than 100 annual complaints had an increase in the number of calls from 2010 and three communities with more than 100 annual complaints had a decrease in the number of calls from 2010. Four communities had more than 100 complaints from an individual caller in 2011, a decrease from five communities in 2010. As shown in Figure H-13, there are fewer callers in 2011 than there have been since 2003, when the number of callers was first reported. Massport's website, www.massport.com, provides for additional general questions and answers regarding the Noise Complaint Line. The number of complaints received in 2011 is approximately half the number received in 2000 dropping from 6,631 (the highest in the past twelve years) to 3,280 calls in 2011.

Figure H-13 Number of Callers and Complaints between 2000 and 2011



Source: Massport, HMMH 2011.
Notes: Number of callers is not available before 2003.

Table H-8 Noise Complaint Line Summary

Town	2010		2011		Change	Town	2010		2011		Change
	Calls	Callers	Calls	Callers	Calls		Calls	Callers	Calls	Callers	Calls
Amesbury	0	0	2	1	2	Marlborough	0	0	2	1	2
Andover	0	0	1	1	1	Marshfield	13	1	21	6	8
Arlington	11	7	0	0	(11)	Medford	444	53	297	13	(147)
Belmont	6	4	0	0	(6)	Medway	0	0	1	1	1
Beverly	2	2	0	0	(2)	Middleton	2	1	0	0	(2)
Boston	30	19	37	22	7	Milton	84	13	177	27	93
Braintree	1	1	3	3	2	Nahant	204	48	74	26	(130)
Brighton	3	3	0	0	(3)	Needham	1	1	0	0	(1)
Brockton	0	0	1	1	1	Newton	19	3	0	0	(19)
Brookline	2	1	0	0	(2)	Newtown	1	1	0	0	(1)
Burlington	3	2	0	0	(3)	North Easton	1	1	0	0	(1)
Cambridge	323	37	154	10	(169)	Norwell	13	1	1	1	(12)
Canton	1	1	2	2	1	Peabody	3	2	3	2	0
Charlestown	8	6	4	4	(4)	Quincy	8	5	12	9	4
Chelsea	129	17	27	9	(102)	Randolph	1	1	1	1	0
Cohasset	0	0	5	4	5	Reading	1	1	0	0	(1)
Danvers	0	0	1	1	1	Revere	92	27	66	20	(26)
Dedham	0	0	3	2	3	Roslindale	73	5	3	2	(68)
Dorchester	5	4	6	5	1	Roxbury	86	6	81	3	(5)
Duxbury	0	0	1	1	1	Salem	10	2	12	1	2
East Boston	699	51	116	34	(583)	Scituate	2	1	0	0	(2)
Easton	0	0	1	1	1	Somerville	385	74	98	45	(287)
Everett	40	15	19	4	(21)	South Boston	59	26	53	24	(6)
Framingham	3	1	1	1	(2)	South End	28	6	16	6	(12)
Hanover	0	0	1	1	1	South Hamilton	1	1	0	0	(1)
Hingham	24	7	19	3	(5)	Stoughton	5	1	3	2	(2)
Holland	0	0	2	1	2	Swampscott	0	0	5	4	5
Hull	15	11	5	3	(10)	Watertown	5	4	16	2	11
Hyde Park	2	1	3	1	1	West Roxbury	1	1	1	1	0
Jamaica Plain	158	15	63	6	(95)	Weymouth	193	4	228	7	35
Lynn	339	3	469	2	130	Wilmington	0	0	1	1	1
Malden	4	4	1	1	(3)	Winchester	8	5	2	1	(6)
Mansfield	0	0	3	2	3	Winthrop	207	70	1,147	92	940
Marblehead	1	1	8	4	7	Woburn	2	2	1	1	(1)
						Total	3,761	580	3,280	429	(1,325)

Source: Massport, HMMH 2011.

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-9 summarizes the numbers of operations by categories of aircraft operating at Logan Airport from 1990 through 2011. 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-9 Modeled Daily Operations by Commercial and General Aviation Aircraft[1] - 1990 to 2011

		1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
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	5.13	1.18	0.05
	Night	19.99	13.13	7.44	10.10	5.50	4.79	7.75	5.92	6.66	0.26	0.05	0.00
	Totals	332.39	242.02	210.78	199.50	162.40	137.19	116.21	90.85	89.96	5.39	1.23	0.05
Stage 3 Jets (All)	Day	288.89	384.49	418.99	425.70	429.40	439.81	505.08	541.43	597.28	727.09	756.24	740.75
	Night	57.25	58.29	65.47	62.80	69.00	80.16	85.06	95.54	98.59	103.66	109.77	97.04
	Totals	346.14	442.78	484.46	488.50	498.40	519.97	590.14	636.97	695.87	830.75	866.01	837.79
Air Carrier Jets	Day	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	569.18	648.95	569.99	500.70
	Night	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	96.21	99.79	101.30	83.52
	Totals	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	665.39	748.74	671.29	584.22
Regional Jets	Day	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	28.10	78.14	186.25	240.05
	Night	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	2.38	3.87	8.47	13.52
	Totals	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	30.48	82.01	194.72	253.57
Non-Jet Aircraft	Day	444.41	411.84	598.16	541.97	526.85	505.31	514.70	552.56	448.82	409.62	317.62	165.45
	Night	11.72	69.32	46.84	13.59	11.14	13.73	27.27	21.86	16.63	21.58	10.97	3.45
	Total	456.13	481.16	645.00	555.56	537.99	519.04	541.97	574.42	465.45	431.20	328.58	168.89
Total Commercial Operations	Day	1045.70	1025.22	1220.49	1157.07	1113.15	1077.52	1128.24	1178.92	1129.90	1141.84	1075.04	906.25
	Night	88.96	140.74	119.75	86.49	85.64	98.68	120.08	123.32	121.88	125.51	120.79	100.49
	Total	1134.66	1165.96	1340.24	1243.56	1198.79	1176.20	1248.32	1302.24	1251.78	1267.35	1195.82	1006.73
GA Aircraft													
Stage 2 Jets[2]	Day	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	5.25	9.89	7.29	5.15	3.65
	Night	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	0.40	0.74	0.64	0.50	0.41
	Total	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	5.65	10.63	7.93	5.65	4.08
Stage 3 Jets	Day	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	30.54	48.46	40.08	34.23	37.83
	Night	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	4.21	6.55	3.21	3.28	6.42
	Total	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	34.75	55.01	43.29	37.51	44.25
Non-Jets	Day	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	37.29	19.36	34.57	37.31	17.36
	Night	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	16.28	18.89	1.83	1.92	4.45
	Total	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	53.57	38.25	36.40	39.23	21.81
Total GA Operations	Day	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	73.08	77.71	81.94	76.68	58.84
	Night	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	20.89	26.17	5.68	5.71	11.29
	Total	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	93.97	103.88	87.62	82.39	70.13
Total	Day	1045.70	1025.22	1220.49	1157.07	1113.15	1077.52	1128.24	1252.00	1207.61	1223.78	1151.72	965.09
	Night	88.96	140.74	119.75	86.49	85.64	98.68	120.08	144.21	148.05	131.19	126.50	111.78
	Total[3]	1134.66	1165.96	1340.24	1243.56	1198.79	1176.20	1248.32	1396.21	1355.66	1354.97	1278.21	1076.86

Table H-9 Modeled Daily Operations by Commercial and General Aviation Aircraft[1] – 1990 to 2011 (Continued)

		2003	2004	2005	2006	2007	2008	2009	2010	2011
Commercial Aircraft										
Stage 2 Jets[2]	Day	0.08	0.03	0.05	0.03	0.03	0.01	0.00	0.01	0.01
	Night	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.00
	Total	0.08	0.05	0.06	0.03	0.04	0.02	0.00	0.02	0.01
Stage 3 Jets (All)	Day	717.85	772.39	765.76	767.55	748.13	699.39	668..32	674.25	684.19
	Night	92.69	113.24	113.66	114.81	118.29	114.30	103.11	107.92	109.38
	Total	810.54	885.63	879.42	882.36	866.42	813.69	771.43	782.17	793.57
Air Carrier Jets[5]	Day	461.06	518.96	505.48	490.63	472.39	443.15	421.51	521.64	571.03
	Night	72.69	89.24	91.99	92.71	96.28	89.89	82.19	93.98	99.17
	Total	533.75	608.20	597.47	583.34	568.66	533.04	503.70	615.62	670.20
Regional Jets[5]	Day	256.80	253.43	260.34	276.95	275.77	256.24	246.81	152.61	113.16
	Night	19.99	24.00	21.68	22.11	22.03	24.40	20.93	13.94	10.21
	Total	276.79	277.43	282.01	299.06	297.80	280.64	267.73	166.55	123.37
Non-Jet Aircraft	Day	135.18	133.24	148.77	140.81	145.27	132.52	136.45	138.53	135.18
	Night	2.41	3.03	3.02	3.26	3.47	4.00	5.54	5.21	4.73
	Total	137.59	136.28	151.79	144.07	148.73	136.52	141.99	143.74	139.91
Total Commercial Operations	Day	853.10	905.66	914.59	908.41	893.43	831.92	804.77	812.78	819.39
	Night	95.10	116.29	116.68	118.09	121.77	118.31	108.65	113.13	114.11
	Total	948.20	1021.95	1031.27	1026.51	1015.19	950.23	913.42	925.91	933.50
GA Aircraft										
Stage 2 Jets[2]	Day	2.84	0.94	2.29	1.90	1.24	0.36	0.09	0.27	0.08
	Night	0.26	0.14	0.25	0.17	0.19	0.03	0.01	0.04	0.00
	Total	3.10	1.08	2.54	2.07	1.43	0.38	0.10	0.30	0.08
Stage 3 Jets	Day	46.21	53.72	58.84	61.08	54.82	43.98	22.31	27.80	52.51
	Night	6.98	8.37	9.33	6.57	6.39	4.52	2.28	3.21	5.35
	Total	53.19	62.09	68.16	67.65	61.21	48.49	23.59	31.01	57.87
Non-Jets	Day	17.81	16.95	14.00	15.05	11.98	15.13	8.19	8.19	18.18
	Night	4.40	5.20	4.75	1.39	3.61	1.08	0.74	0.72	1.29
	Total	22.21	22.14	18.75	16.44	15.58	16.20	8.93	8.92	19.48
Total GA Operations	Day	66.88	71.60	75.12	78.03	68.04	59.46	29.58	36.26	70.78
	Night	11.64	13.71	14.33	8.13	10.19	5.62	3.04	3.97	6.65
	Total	78.52	85.31	89.46	86.15	78.22	65.05	32.62	40.22	77.43
Total	Day	919.98	977.27	989.71	986.43	961.46	891.39	834.35	849.03	890.16
	Night	106.74	130.00	131.02	126.22	131.96	123.93	111.69	117.10	120.76
	Total[3]	1026.72	1107.26	1120.73	1112.66	1093.42	1015.31	946.04	966.13	1010.92

Source: Massport's Noise Monitoring System and Revenue Office numbers, HMMH 2011.
Note: Data from 1991 not available.
GA General Aviation
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 Regional Jet operations were not tracked separately prior to 1999.
4 Totals prior to 1998 do not include GA operations.
5 The definition of regional jet for the EDR changed between 2009 and 2010. A regional jet in 2010 is a jet in commercial service with less than 80 seats, prior to 2010, a regional jet was a jet in commercial service with 100 seats or less.

Commercial Jet Aircraft by Part 36 Stage Category

Jet aircraft currently operating at Logan Airport are categorized by the FAA into two groups: Stage 2 and Stage 3. As described in *Chapter 6, Noise Abatement*, the designation refers to a noise classification specified in Federal Aviation Regulation (FAR) 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. Because of the substantial differences in noise between Stage 2, recertificated Stage 3, and new Stage 3 aircraft, Massport tracks operations by these separate categories to follow their trends. Table H-10 shows the percentage of commercial jet operations by stage category from 1999 through 2011. One of the most significant changes occurring after the economic downturn in 2001 was the almost immediate retirement of the recertificated 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 that are operating these aircraft. However, these aircraft still suffer from high operating costs and are being replaced wherever possible.

Table H-10 Percentage of Commercial Jet Operations by Part 36 Stage Category – 1999 to 2011

	New Stage 3[1]	Recertificated Stage 3[2]	Stage 2	Total
1999	70.0%	21.0%	9.0%	100%
2000	75.0%	24.0%	1.0%	100%
2001	86.3%	13.6%	0.1%	100%
2002	92.8%	7.2%	0.0%	100%
2003	95.8%	4.1%	0.0%	100%
2004	97.8%	2.2%	0.0%	100%
2005	98.0%	2.0%	0.0%	100%
2006	98.6%	1.4%	0.0%	100%
2007	98.9%	1.1%	0.0%	100%
2008	99.1%	0.9%	0.0%	100%
2009	99.1%	0..9%	0.0%	100%
2010	98.9%	1.1%	0.0%	100%
2011	99.5%	0.5%	0.0%	100%

Source: Massport and FAA radar data.
1 New Stage 3 aircraft are aircraft originally manufactured as a certified Stage 3 aircraft under Federal Regulation Part 36.
2 Recertificated Stage 3 aircrafts are aircrafts originally manufactured as a certified Stage 1 or 2 aircrafts under Federal Regulation Part 36 which have been either treated with hushkits or have been re-engineered to meet Stage 3 requirements.

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-11 shows this nighttime activity by different groups of aircraft. Nighttime flights by commercial jet operators have increased 1.3 percent at Logan Airport compared to 2010. Commercial non-jet operations decreased 0.5 percent from 2010 and GA traffic is up 67.5 percent at night. Overall, nighttime operations at Logan Airport increased 3.1 percent. The majority of nighttime operations (between 10:00 PM and 7:00 AM) occurred either before midnight or after 5:00 AM.

Table H-11 Modeled Nighttime Operations at Logan Airport – 1990 to 2011

	Commercial Jets	Commercial Non-Jets	General Aviation[1]	Total
1990	77.24	11.72	NA	88.96
1991	NA[2]	NA[2]	NA[2]	NA[2]
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
Change (2010 to 2011)	1.45	(0.48)	2.68	3.66
Percent Change	1.3%	(9.2%)	67.5%	3.1%

Source: Massport, HMMH, 2011.
1 General aviation data not available prior to 1999.
2 1991 data not available.

Jet Runway Use

Table H-12 presents a summary of runway use by jets. Since 2001, the radar data have been analyzed with Massport's PreFlight™ software. PreFlight™ is 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-12 Summary of Jet Aircraft Runway Use - 1990 to 2000

	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%	50%	0%	NA	1%	7%	0%	28%	NA	20%

Table H-12 Summary of Jet Aircraft Runway Use – 2001 to 2011 (Continued)

	Runway									
	4L	4R	9	14[1]	15R	22L	22R	27	32[1]	33L
2001										
Departures	0%	7%	34%	NA	4%	3%	35%	12%	NA	5%
Arrivals	5%	36%	0%	NA	1%	8%	0%	32%	NA	18%
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]

Source: HMMH 2011, 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.

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 1991 data are not available. 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.

NA Runway was not available.

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 Cumulative Noise Index (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.

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 2011 CNI remains well below the cap of 156.5 EPNL.

Table H-13 Cumulative Noise Index (EPNL) - 1990 to 2002

	Logan Airport CNI Cap - 156.5 EPNL												
Full CNI (Entire Commercial Jet Fleet)	1990 156.4	1991 155.8	1992 155.5	1993 155.3	1994 155.4	1995 155.3	1996 155.1	1997 154.8	1998 154.7	1999 154.9	2000 154.7	2001 154.1	2002 153.2
Total Passenger Jets	155.2	154.8	154.6	154.4	154.4	154.2	154.1	153.9	153.7	153.9	153.6	152.9	151.8
Total Cargo Jets	150.1	148.9	148.0	147.9	148.3	148.8	148.6	147.5	147.9	148.0	148.2	147.8	147.4
Total Daytime	152.5	152.1	152.4	152.1	152.1	151.6	151.2	150.8	150.4	150.4	149.5	149.0	148.5
Total Nighttime	154.4	153.4	152.6	152.4	152.6	152.9	152.9	152.5	152.7	153.1	153.1	152.4	151.3
Total Stage 2 Jets	NA	NA	NA	NA	151.0	150.2	149.4	149.2	147.7	147.1	124.7	121.5	114.3
Total Stage 3 Jets	NA	NA	NA	NA	153.4	153.8	153.8	153.4	153.8	154.2	154.7	154.1	153.2
Daytime Stage 2	NA	NA	NA	NA	149.0	148.5	147.6	146.5	145.2	144.1	122.6	119.3	111.2
Nighttime Stage 2	NA	NA	NA	NA	146.7	145.1	144.8	145.8	144.1	144.0	120.5	117.3	111.4
Daytime Stage 3	NA	NA	NA	NA	149.1	148.8	148.7	148.8	148.9	149.2	149.5	149.0	148.5
Nighttime Stage 3	NA	NA	NA	NA	151.4	152.1	152.2	151.5	152.1	152.5	153.1	152.4	151.3
Passenger Jet Stage 2	NA	NA	NA	NA	150.5	149.9	149.2	148.9	147.5	146.8	124.2	116.3	NA
Passenger Jet Stage 3	NA	NA	NA	NA	152.2	152.3	152.3	152.2	152.6	153.0	153.6	152.9	151.8
Cargo Jet Stage 2	NA	NA	NA	NA	141.5	137.4	136.8	137.4	139.0	134.5	114.8	119.9	114.3
Cargo Jet Stage 3	NA	NA	NA	NA	147.3	148.5	148.3	147.0	147.3	147.9	148.2	147.8	147.4
Daytime Passenger	NA	152.0	152.2	152.0	152.0	151.5	151.1	150.6	150.1	150.1	149.3	148.7	148.2
Nighttime Passenger	NA	151.6	150.9	150.6	150.8	151.0	151.0	151.1	151.2	151.6	151.6	150.8	149.4
Daytime Cargo	137.1	137.1	137.6	135.2	136.1	138.0	136.7	136.2	138.0	138.2	137.5	137.1	137.0
Nighttime Cargo	149.9	148.6	147.6	147.6	148.0	148.4	148.3	147.1	147.5	147.6	147.8	147.4	147.0
Daytime Passenger Stage 2	NA	NA	NA	NA	148.9	148.4	147.6	146.5	145.0	143.9	122.3	115.0	NA
Daytime Passenger Stage 3	NA	NA	NA	NA	149.0	148.5	148.4	148.5	148.6	149.0	149.2	148.7	148.2
Nighttime Passenger Stage 2	NA	NA	NA	NA	149.0	148.5	148.4	148.5	142.8	143.7	119.8	110.2	NA
Nighttime Passenger Stage 3	NA	NA	NA	NA	149.4	149.9	150.1	149.8	150.5	150.8	151.6	150.8	149.4
Daytime Cargo Stage 2	NA	NA	NA	NA	128.3	126.7	124.6	126.4	131.6	131.5	111.1	117.3	111.2
Daytime Cargo Stage 3	NA	NA	NA	NA	135.3	137.7	136.4	135.7	136.9	137.1	137.5	137.0	137.0
Nighttime Cargo Stage 2	NA	NA	NA	NA	141.3	137.0	136.5	137.0	138.2	131.5	112.3	116.4	111.4
Nighttime Cargo Stage 3	NA	NA	NA	NA	147.0	148.1	148.0	146.6	146.9	147.5	147.8	147.4	147.0

Table H-13 Cumulative Noise Index (EPNL) – 2003 to 2011 (Continued)

	Logan Airport CNI Cap – 156.5 EPNL									
Full CNI (Entire Commercial Jet Fleet)	2003 152.7	2004 153.4	2005 153.2	2006 152.6	2007 152.7	2008 152.9	2009 152.3	2010 151.9	2011 152.1	Change from 2010 0.2
Total Passenger Jets	151.3	152.2	152.1	151.4	151.5	151.9	151.1	150.9	150.6	(0.3)
Total Cargo Jets	147.1	147.0	146.6	146.5	146.4	146.1	145.9	145.1	146.7	1.6
Total Daytime	148.0	148.5	148.2	147.5	147.2	147.6	147.1	146.8	146.9	0.1
Total Nighttime	150.9	151.7	151.6	151.0	151.2	151.4	150.7	150.3	150.6	0.3
Total Stage 2 Jets	114.1	118.1	NA	NA	NA	NA	NA	113.6	110.8	(2.8)
Total Stage 3 Jets	152.7	153.4	153.2	152.6	152.7	152.9	152.3	151.9	152.1	0.2
Daytime Stage 2	113.7	109.4	NA	NA	NA	NA	NA	103.6	NA	NA
Nighttime Stage 2	103.2	117.5	NA	NA	NA	NA	NA	113.1	110.8	(2.3)
Daytime Stage 3	148.0	148.5	148.2	147.5	147.2	147.6	147.1	146.8	146.9	0.1
Nighttime Stage 3	150.9	151.7	151.6	151.0	151.2	151.4	150.7	150.3	150.6	0.3
Passenger Jet Stage 2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Passenger Jet Stage 3	151.3	152.2	152.1	151.4	151.5	151.9	151.1	150.9	150.6	(0.3)
Cargo Jet Stage 2	114.1	118.1	NA	NA	NA	NA	NA	113.6	110.8	(2.8)
Cargo Jet Stage 3	147.1	147.0	146.6	146.5	146.4	146.1	145.9	145.1	146.7	1.6
Daytime Passenger	147.7	148.2	147.9	147.2	146.9	147.3	146.8	146.6	146.5	(0.1)
Nighttime Passenger	148.8	150.0	150.1	149.3	149.7	150.0	149.1	149.0	148.5	(0.5)
Daytime Cargo	136.2	135.7	135.8	135.5	135.8	135.8	135.2	134.5	136.6	2.1
Nighttime Cargo	146.8	146.7	146.2	146.1	146.0	145.6	145.5	144.7	146.3	1.6
Daytime Passenger Stage 2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Daytime Passenger Stage 3	147.7	148.2	147.9	147.2	146.9	147.3	146.8	146.6	146.5	(0.1)
Nighttime Passenger Stage 2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nighttime Passenger Stage 3	148.8	150.0	150.1	149.3	149.7	150.0	149.1	149.0	148.5	(0.5)
Daytime Cargo Stage 2	113.7	109.4	NA	NA	NA	NA	NA	103.6	NA	NA
Daytime Cargo Stage 3	136.1	135.7	135.8	135.5	135.8	135.8	135.2	134.4	136.6	2.2
Nighttime Cargo Stage 2	103.2	117.5	NA	NA	NA	NA	NA	113.1	110.8	(2.3)
Nighttime Cargo Stage 3	146.8	146.7	146.2	146.1	146.0	145.6	145.5	144.7	146.3	1.6

Source: HMMH 2011

Notes: GA and non-jet aircraft are not included in the calculation.
NA - No operations by this aircraft type in the commercial fleet.
A few Stage 2 cargo Lear 25s were in this year's fleet.

Flight Track Monitoring Report

Introduction

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 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 10th 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 of 1996, and was the subject of two Community Working Group (CWG) workshops in September and October of 1996. The time period covered by this *2011 ESPR* is January 1 through December 31, 2011.

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, 2012 through December 31, 2012, and will be included in the next EDR.

FAA Air Traffic Control 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 (NAS)". Section 7.3 of the Order, subtitled "Turbojet Departure Noise Abatement Procedures" lists that all turbojet departures shall be issued the Standard Instrument Departure (SID) procedure appropriate for the departure runway. They are paraphrased from the Logan Six SID 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 the Airport near the eastern shoreline between the ends of Runways 27 and 33L. 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 BOSTON VORTAC. 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 in order to maintain the safe separation of aircraft. "MSL" is defined as feet above mean sea level and is the indicator of aircraft altitude used both by the pilot in the cockpit and the air traffic controller on the ground.

During 2010, several of the conventional-only or radar vector procedures from the Boston Logan Airport Noise Study (BLANS) CATEX[6] were implemented. There are eight new Area Navigation (RNAV) procedures for departures from Logan Airport. These eight procedures are used by Runways 4R, 9, 15R, 22L and 22R. 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.

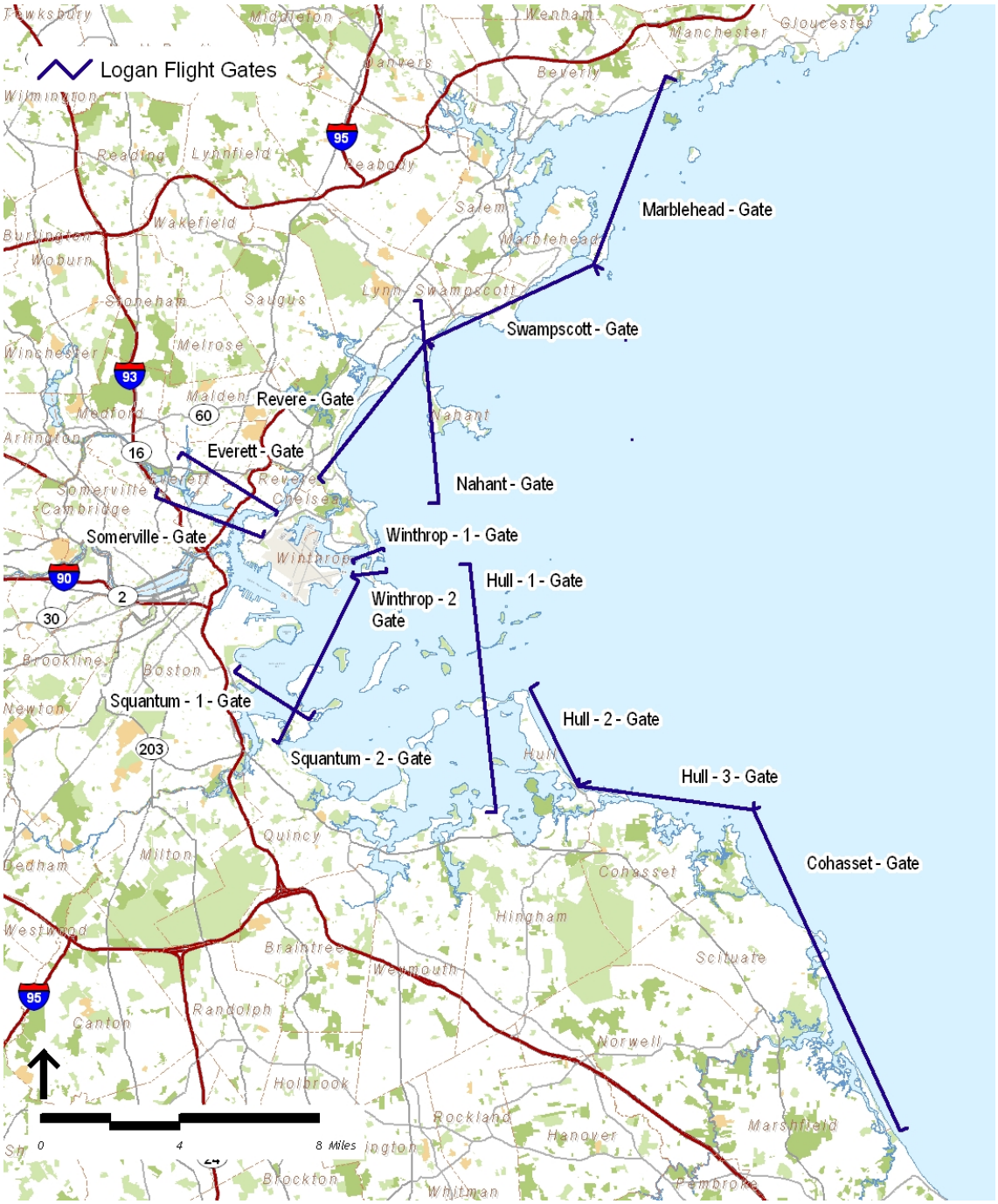
6 Federal Aviation Administration Categorical Exclusion Record of Decision, Issued October 16, 2007

- For departures, the noise abatement procedure in the Tower Order is:
  - For Runway 4R, fly heading 036 degrees until the BOS 4 DME, then turn right to a heading of 090 degrees, then expect radar vectors to assigned Route/Navaid/Fix. Aircraft that are vectored over water can expect to cross the coastline above 6,000 MSL before proceeding on course.
  - For Runway 9, the procedure is: Fly heading 093 degrees, then expect radar vectors to assigned Route/Navaid/Fix. Aircraft that are vectored over water can expect to cross the coastline above 6,000 MSL before proceeding on course.
  - For Runway 14, the procedure is: Fly heading 142 degrees until the BOS 1 DME, then turn left to heading 120 degrees, then expect radar vectors to assigned Route/Navaid/Fix. Aircraft that are vectored over water can expect to cross the coastline above 6,000 MSL before proceeding on course.
  - For Runway 15R, the procedure is: Fly heading 151 degrees until the BOS 1 DME then turn left to 120 degrees, then expect radar vectors to assigned Route/Navaid/Fix. Aircraft that are vectored over water can expect to cross the coastline above 6,000 MSL before proceeding on course.
  - For Runway 22R and 22L: Turn left to a heading of 140 degrees, then expect radar vectors to assigned Route/Navaid/Fix. Aircraft that are vectored over water can expect to cross the coastline above 6,000 MSL before proceeding on course.
- For Runway 33L: Fly heading 331 degrees until the BOS 2 DME then turn left to 316 degrees, then expect radar vectors to assigned Route/Navaid/Fix.
- For Runway 27:
  - LOGAN SIX SID: Fly heading 273 until the BOS 2.2 DME, then turn left heading 235 degrees then expect radar vectors to assigned Route/Navaid/Fix. Note that this procedure was replaced by the LOGAN FIVE effective November 18, 2010, but the initial Runway 27 departure described here did not change.
  - WYLLY ONE RNAV (for turbojet aircraft only). Climb heading 273 degrees to intercept course 235 degrees to cross WYLYY at 2300 or above. This procedure keeps most jet traffic in a well-defined flight corridor.

These brief procedural statements form the basis of the verbal instructions and flight clearances that are passed from controller to pilot in order 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 Airport 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 Logan Airport Gates



Statistical Analyses of Flight Tracks - Runway 4R

The Nahant Gate (Figure H-14) monitors aircraft after the first turn at 4 DME. The Swampscott and Marblehead Gates monitor northbound shoreline crossings, while the Hull 2, Hull 3, and Cohasset Gates monitor southbound shoreline crossings.

Table H-14 shows the dispersion of the jet departures on Runway 4R as they pass through the Nahant Gate. Table H-14 shows that Runway 4R departures were concentrated, with 96.9 percent "over the Causeway", and about 0.1 percent over the south end of the gate compared to 88.87 percent over the Causeway in 2010 and 0.3 percent over the south end of the gate. Departures through the north end of the gate decreased from 11.0 percent in 2010 to 3.0 percent in 2011.

Table H-14 Runways 4R/4L Nahant Gate Summary for 2011

	Number of Tracks Through Gate Segment	Total Number of Tracks Through Gate	Percentage of Tracks Through Gate Segment
North End of Gate	261	8,749	3.0%
Over Causeway	8,475	8,749	96.9%
South End of Gate	13	8,749	0.1%
Total	8,749	8,749	100.0%

Source: Massport, HMMH 2011.

Table H-15 shows how many of the shoreline crossings from Runway 4R were above 6,000 feet. For 2011, 98.4 percent of the flights were above 6,000 feet compared to 97.0 percent in 2010. The Swampscott gate had 34.1 percent of flights above 6,000 feet compared to 40.0 percent in 2010. The number of flights through the Swampscott gate decreased in 2011 (80 in 2010, down to 41 in 2011). 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 in order to be above 6,000 feet when crossing the Swampscott gate.

Table H-15 Runways 4R/4L Shoreline Crossings Above 6,000 Feet for 2011

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Swampscott Gate	41	14	34.1%
Marblehead Gate	3,340	3,296	98.7%
Hull 2 Gate	414	414	100.0%
Hull 3 Gate	1,404	1,387	98.8%
Cohasset Gate	897	885	98.7%
Total	6,096	5,996	98.4%

Source: Massport, HMMH 2011.

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.

Table H-16 shows 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 2011, between both gates there were a total of 51 such turns, or about 0.1 percent. This is the same as in 2010 accept the number of tracks through each gate is slightly different.

Table H-16 Runway 9 Gate Summary — Winthrop Gates 1 and 2 for 2011

	Number of Departure Tracks	Number of Tracks Through Gate	Percent Turning Before BOS 2 DME
Winthrop 1 Gate	54,035	20	<0.1%
Winthrop 2 Gate	54,035	31	0.1%
Total	54,035	51	0.1%

Source: Massport, HMMH 2011.

Table H-17 indicates that 98.4 percent of Runway 9 departures were above 6,000 feet when crossing the shoreline, as compared with 97.3 percent in 2010. The number of Runway 9 departures crossing back over the South shore increased from 38,556 in 2010 to 51,014. A decrease in the percentage above 6,000 feet occurred at the Revere gate (84.5 percent in 2010 to 48.5 percent in 2011) and the Swampscott gate (90.2 percent in 2010 to 76.6 percent in 2011). The number of crossings declined for the Revere gate (58 in 2010 to 33 in 2011) and the Swampscott gate (235 in 2010 to 145 in 2011), which contributed to the decline in percentage above 6,000 feet. The Marblehead gate had an increase in crossings (from 9,897 in 2010 to 13,122 in 2011), and an increase in the percent above 6,000 feet (from 97.7 percent in 2010 to 98.6 percent in 2011). In percentage above 6,000 feet, Hull 2 gate increased from 98.5 in 2010 to 99.1 in 2011 and Hull 3 gate decreased from 95.0 in 2010 to 94.1 in 2011. The Cohasset gate increased significantly in crossings (from 21,444 in 2010 to 34,013 in 2011) and the percent above 6,000 feet increased from 97.7 percent in 2010 to 98.8 percent in 2011.

Table H-17 Runway 9 Shoreline Crossings Above 6,000 Feet for 2011

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Revere Gate	33	16	48.5%
Swampscott Gate	145	111	76.6%
Marblehead Gate	13,122	12,934	98.6%
Hull 2 Gate	881	873	99.1%
Hull 3 Gate	2,820	2,655	94.1%
Cohasset Gate	34,013	33,597	98.8%
Total	51,014	50,186	98.4%

Source: Massport, HMMH 2011.

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.

Table H-18 indicates that 99.4 percent of Runway 15R departures were above 6,000 feet when crossing the shoreline, as compared with 96.2 percent in 2010. At 96.3 percent, the percent above 6,000 feet for the Swampscott decreased in 2011 as it was 98.1 in 2010. The Marblehead gate had a decrease in crossings (from 2,180 in 2010 to 1,866 in 2011) and a slight increase in the percent above 6,000 feet (from 99.6 percent in 2010 to 99.8 percent in 2011). The Hull 2 gate decreased its percentage from 95.9 percent in 2010 to 95.7 percent in 2011, and the Hull 3 gate increased from 92.2 percent in 2010 to 92.8 percent in 2011). The Cohasset gate had an increase in crossings (from 3,050 in 2010 to 4,563 in 2011) and the percent above 6,000 feet increased from 97.6 percent to 99.6 percent.

Table H-18 Runway 15R Shoreline Crossings Above 6,000 Feet for 2011

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Swampscott Gate	54	52	96.3%
Marblehead Gate	1,866	1,863	99.8%
Hull 2 Gate	23	22	95.7%
Hull 3 Gate	236	219	92.8%
Cohasset Gate	4,563	4,545	99.6%
Total	6,742	6,701	99.4%

Source: Massport, HMMH 2011.

Statistical Analyses of Flight Tracks - Runways 22R/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.

Table H-19 shows the dispersion of the jet departures from Runways 22R-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. Unlike in 2010, when over 90 percent of the flights were over the first two segments of this gate, only 79.0 percent of the flights were over these two segments in 2011. This is due to an increase in flights over the third segment from 8.9 percent in 2010 to 20.9 percent in 2011.

Table H-19 Runways 22R/22L Squantum 2 Gate Summary for 2011

	Number of Tracks Through Gate Segment	Total Number of Tracks Through Gate	Percentage of Tracks Through Gate Segment
0 - 12,000 ft	20,590	56,748	36.3%
12,000 - 14,000 ft	24,207	56,748	42.7%
14,000 - 21,000 ft	11,888	56,748	20.9%
21,000 - 27,000 ft	63	56,748	0.1%
Total	56,748	56,748	100.0%

Source: Massport, HMMH 2011.
Note: Percentages sum to more than 100 percent due to rounding.

Table H-20 shows that 98.0 percent of the tracks were north of the Hull peninsula as they passed through the Hull 1 Gate, which is an increase from 2010 (96.7 percent).

Table H-20 Runways 15R/22R/22L Gate Summary – North of Hull Peninsula for 2011

	Number of Tracks Through Gate	Number of Tracks North of Hull Peninsula	Percentage of Tracks North of Hull Peninsula
Hull 1 Gate	64,814	63,530	98.0%

Source: Massport, HMMH 2011.

Table H-21 indicates that 99.4 percent of Runway 22R/22L departures were above 6,000 feet when crossing the shoreline, as compared with 97.2 percent in 2010. For the Revere gate, the percent above 6,000 feet decreased from 97.7 percent in 2010 to 97.5 percent in 2011. The Swampscott gate also decreased from 99.7 percent in 2010 to 99.5 percent in 2011. The Marblehead gate had an increase in crossings (from 8,385 in 2010 to 14,791 in 2011) and an increase in the percent above 6,000 feet (from 99.5 percent in 2010 to 99.9 percent in 2011). The Hull 2 gate decreased in percent above 6,000 feet from 97.0 percent in 2010 to 96.6 percent. The Hull 3 gate increased in percent above 6,000 feet from 94.9 in 2010 to 96.2 percent in 2011. The number of crossings for the Cohasset gate increased (11,800 in 2010 versus 34,102 in 2011) and the percentage increased from 97.7 percent in 2010 to 99.3 percent in 2011.

Table H-21 Runways 22R/22L Shoreline Crossings Above 6,000 Feet for 2011

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Revere Gate	40	39	97.5%
Swampscott Gate	409	407	99.5%
Marblehead Gate	14,791	14,778	99.9%
Hull 2 Gate	58	56	96.6%
Hull 3 Gate	1,422	1,368	96.2%
Cohasset Gate	34,102	33,859	99.3%
Total	50,822	50,507	99.4%

Source: Massport, HMMH 2011.

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 (EIS), Massport has been providing on-going radar flight track data and analysis to the FAA with respect to the new procedure.

For the first time since 1997 when flight track monitoring began, each gate (Gates A-E) averaged over 68 percent for an annual average. In addition, since the WYLYY EIGHT was published in March, every recorded month had 68 percent or greater for each gate. 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. These last two months would have captured the additional flights using the WYLYY NINE after the October 20th modification. The FAA had discussed this 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[7].

Massport will continue to provide Table H-22 in the subsequent annual reports. Table H-22 presents the results for the Runway 27 corridor complied for 2011. The average percentage of tracks through the corridor was 59.6 percent, an increase from 53.5 percent for 2010 and an increase from 50.2 percent for 2009.

Table H-22 Runway 27 Corridor Percent of Tracks Through Each Gate for 2011

Month	Total # of Tracks	Total # of Tracks Through All Gates	Percent of Tracks Through All Gates	Gate A 1,400 ft[1]	Gate B 2,200 ft[1]	Gate C 2,900 ft[1]	Gate D 4,700 ft[1]	Gate E 6,300 ft[1]	Average Percent Through Each Gate
January	2,643	1,434	54.3%	60.3%	84.1%	94.6%	97.1%	95.0%	86.2%
February	1,801	947	52.6%	59.3%	83.2%	94.9%	97.5%	96.0%	86.2%
March	2,261	1,373	60.7%	72.6%	81.9%	91.7%	96.0%	93.0%	87.0%
April	1,210	782	64.6%	78.5%	82.4%	88.4%	92.2%	88.8%	86.1%
May	345	227	65.8%	76.5%	78.3%	90.7%	91.6%	91.6%	85.7%
June	473	284	60.0%	80.1%	78.2%	87.9%	90.9%	85.0%	84.4%
July[2]									
August[2]									
September[2]									
October	650	413	63.5%	74.0%	83.5%	89.7%	94.2%	92.0%	86.7%
November	197	133	67.5%	78.7%	86.3%	92.9%	99.0%	91.9%	89.7%
December	1,376	934	67.9%	79.2%	84.1%	93.5%	97.8%	95.0%	89.9%
Average[2]	996	594	59.6%	73.2%	82.5%	91.6%	95.1%	92.0%	86.9%

Source: Massport, HMMH 2011
Gray shading indicates the Percentage rounds up to 68% or greater.
1 Width of Each Gate in Feet.
2 Runway 33L completely closed July 1 - Sept. 30, RSA project, reduced use of Runway 27 departures. Excluded from overall average.

7 Logan Airport Runway 27 Advisory Committee Meeting - January 23, 2012 meeting minutes

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 2 DME would pass through the Somerville Gate. Turns to the right prior to the BOS 2 DME would pass through the Everett Gate. Table H-23 shows the results of the analyses. The table indicates that in 2011 8.0 percent of tracks turned prior to reaching the BOS 2 DME. This is an increase compared to 2010 when 6.2 percent of departures turned early before reaching 2 DME. The total number of tracks decreased from 25,047 in 2010 to 12,894 in 2011. This large decrease in tracks occurred because Runway 33L was closed for 3 months during 2011.

Table H-23 Runway 33L Gates — Passages Below 3,000 Feet for 2011

	Number of Departure Tracks	Number of Tracks Turning Before BOS 2 DME	Percentage of Tracks Turning Before BOS 2 DME
Everett Gate	12,894	134	1.0%
Somerville Gate	12,894	900	7.0%
Total	12,894	1,034	8.0%

Source: Massport, HMMH 2011.

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TECHNICAL MEMORANDUM

Subject:	Runway 22R Departure Analysis
Prepared for:	Flavio Leo; Massport
Prepared by:	Robert Mentzer Jr., Sean Doyle, Chris Waite; HMMH
Date:	12/20/2011
Reference:	HMMH Project 304090.002.005

This memorandum is in response to a request from Massport to analyze Runway 22R departures at Logan International Airport (BOS) under HMMH's on-call contract with the Noise Office. The request was to compare jet departures from Runway 22R at BOS from December 2009 to October 2010 and from December 2010 to October 2011. This request was a result of inquiries from the South Boston community who were experiencing more overflights than in the past. Since the implementation of area navigation (RNAV) procedures, departures from Runway 22R were appearing to remain on runway heading longer than they had before, thereby resulting in increased overflights in the Farragut Road area.

1. BACKGROUND

A Categorical Exclusion/Record of Decision (CATEX/ROD[1]) for the Boston Overflight Noise Study was issued in October 2007. The CATEX/ROD approved the development of an RNAV-based Standard Instrument Departure (SID) procedure and an updated conventional vector route for non-RNAV equipped aircraft for Runways 22R/L along with similar improvements for other runways at BOS.

The FAA began design of the proposed procedures in early 2009. For 22L/R, the aircraft would depart and turn to a vector heading as they did before, and then join the RNAV procedure north of Hull. The procedure was designed and submitted to FAA in March of 2009. However, the FAA National RNAV office determined that the Vector to RNAV procedure for 22R/L was not feasible due to inadequate Distance Measuring Equipment (DME) coverage in the area.

Following that determination, FAA began the development of a full RNAV SID from Runway 22R/L which would be successful in meeting the spirit and intent of the CATEX/ROD. These were completed and submitted in June of 2009 and the procedures were published and implemented for Runway 22R/L in November of 2010.

[1] Boston Overflight Noise Study – Phase 1 RNAV Design Updates, June 17, 2009

A total of eight RNAV SIDs are published for BOS: (BLIZZR, BRUWN, CELTK, HYLND, LBSTA, PATSS, REVSS, and SSOXS). Each of the RNAV procedures developed for Runway 22R consists of a heading to altitude (VA) segment and direct to fix (DF) segment which instruct the aircraft to turn to the fix TJAYY any time after reaching 520 feet MSL.

2. RUNWAY 22R DEPARTURE EVALUATION

Radar data from the Massport Noise and Operations Monitoring System (NOMS) was used for this analysis. The conventional vector (pre-RNAV) departures were represented by a data set from December 2009 to October 2010. During this 335-day period, 218 days had departures from Runway 22R, including 43,335 jet operations. The RNAV departures were represented by a data set from December 2010 to October 2011, also 335 days in length. Out of this sample, 219 days had departures from Runway 22R and included 46,575 jet operations, 3,240 more than the pre-RNAV set. This increase is probably due to the Runway 15R/33L Runway Safety Area construction in 2011 which closed Runway 15R/33L for several months.

Figure 1 shows the area surrounding Logan Airport on which this analysis focuses. Three reference points were used to evaluate the changes in departures and are shown in Figure 1. The three sites are:

- The Marine Park Ball Field
- A private residence at 73 Farragut Road
- RMT3, one of the noise monitoring stations operated by Massport

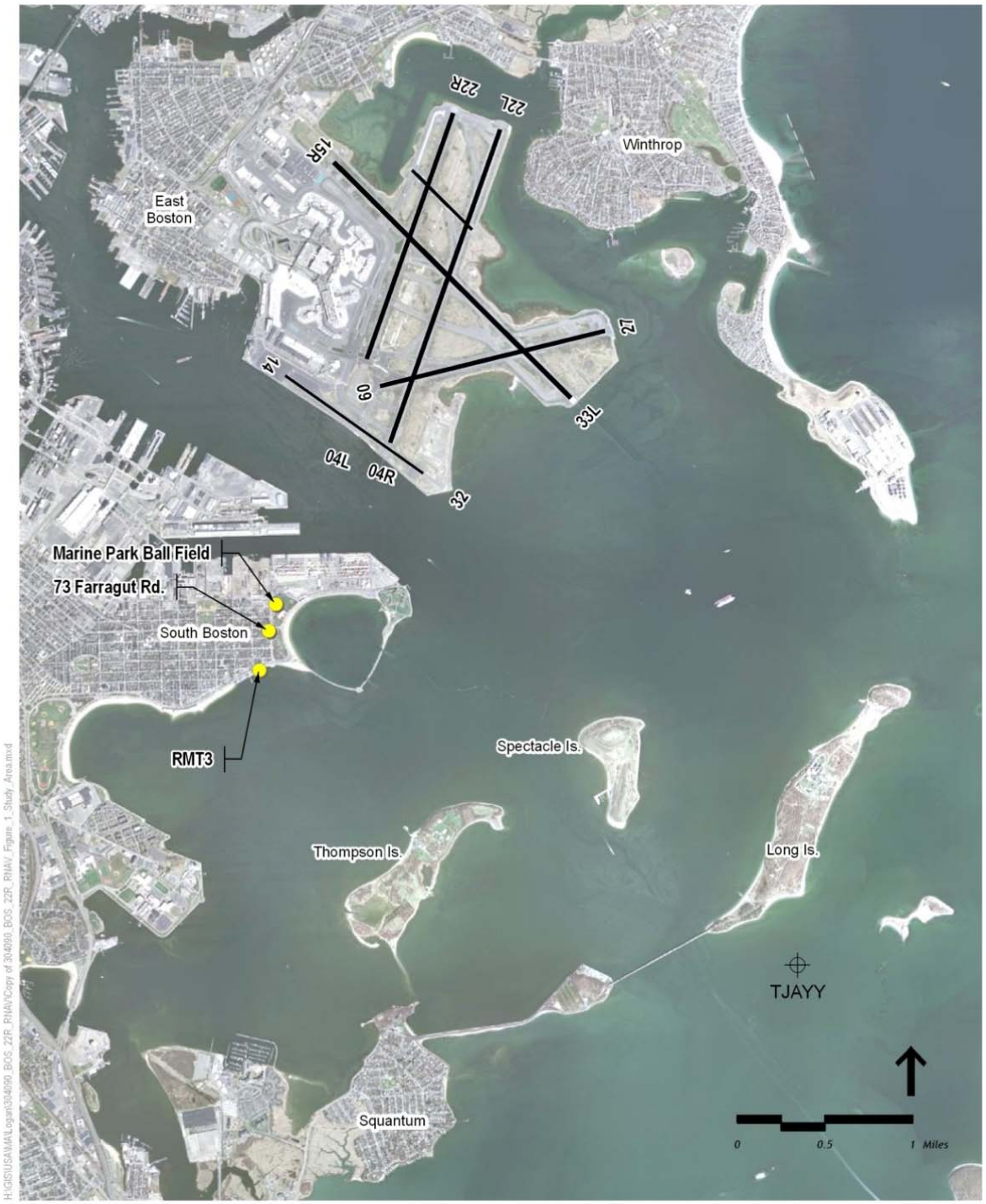
For reference, Figure 1 also shows the location of TJAYY, the first waypoint aircraft must fly-by when on the new RNAV departure procedure.

2.1 Density Plots

Figure 2 shows a plot of the density of aircraft departures off of Runway 22R from December 2009 to October 2010, before RNAV procedures were implemented. The figure indicates that the majority of flights turn immediately after reaching the northern shore of Boston Inner Harbor and pass over Castle Island, Spectacle Island and approximately one mile north of waypoint TJAYY over Long Island.

Figure 3 shows a comparable density plot of aircraft departing Runway 22R from December 2010 to October 2011, after RNAV procedures were implemented. It shows the bulk of the aircraft making a more gradual turn after reaching the northern edge of Boston Inner Harbor, passing to the west of Castle Island and over the southern edge of Spectacle Island heading towards a fly-by of the TJAYY waypoint.

The highest density of departure tracks for both pre-RNAV and RNAV procedures occurs over the water and not over the three reference points. As shown in Figure 2 and 3 there is, however, a consolidation and small shift in the central track densities between the pre-RNAV and RNAV operations, which could quite conceivably account for the perceived increase in the number of over-flights with RNAV operations.



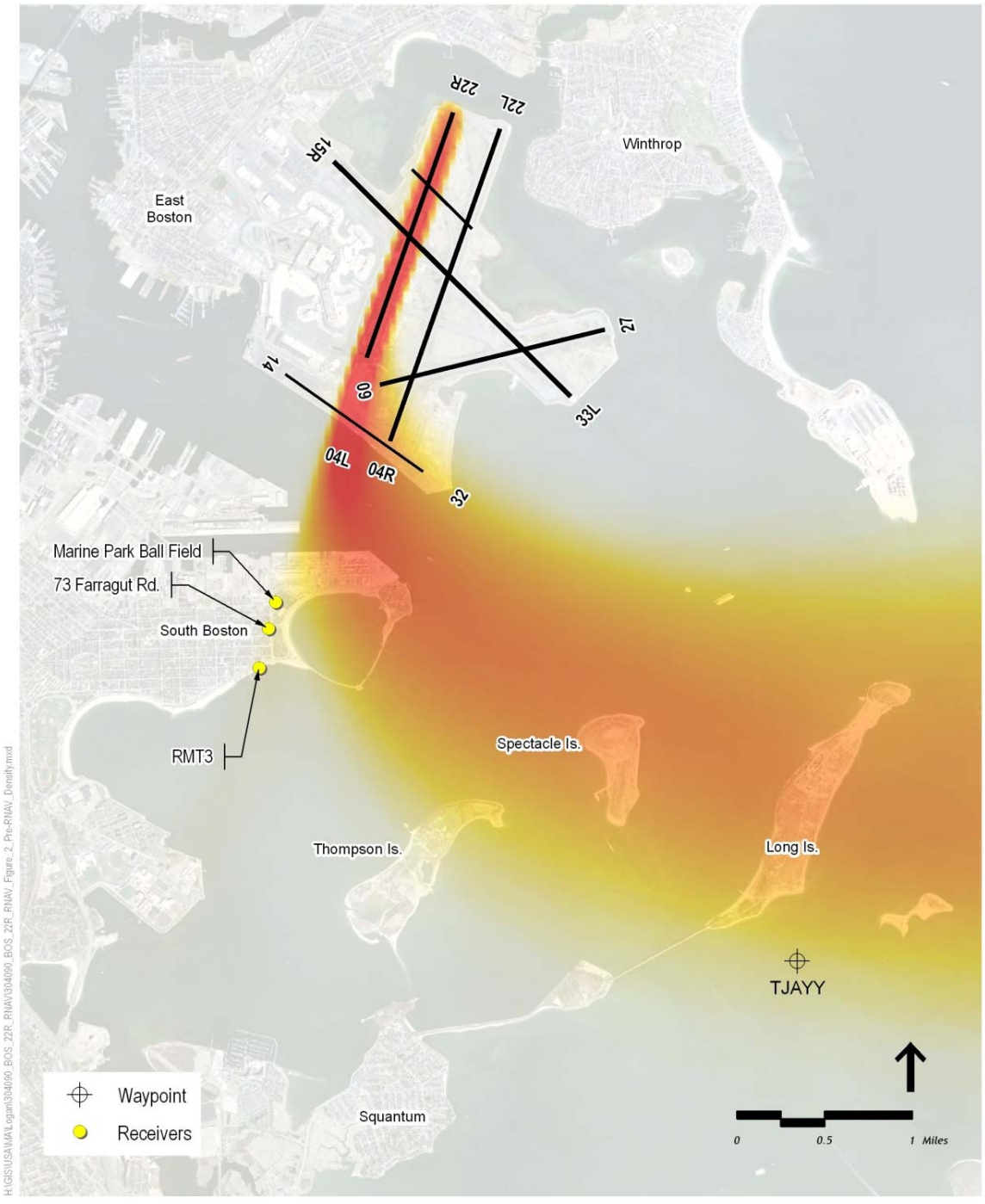
Source: Harris Miller Miller & Hanson Inc. 2010, Massport NOMS / ERA Multi-Lat, Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Project Area and Modeling Locations

Waypoint

Receivers

Figure 1

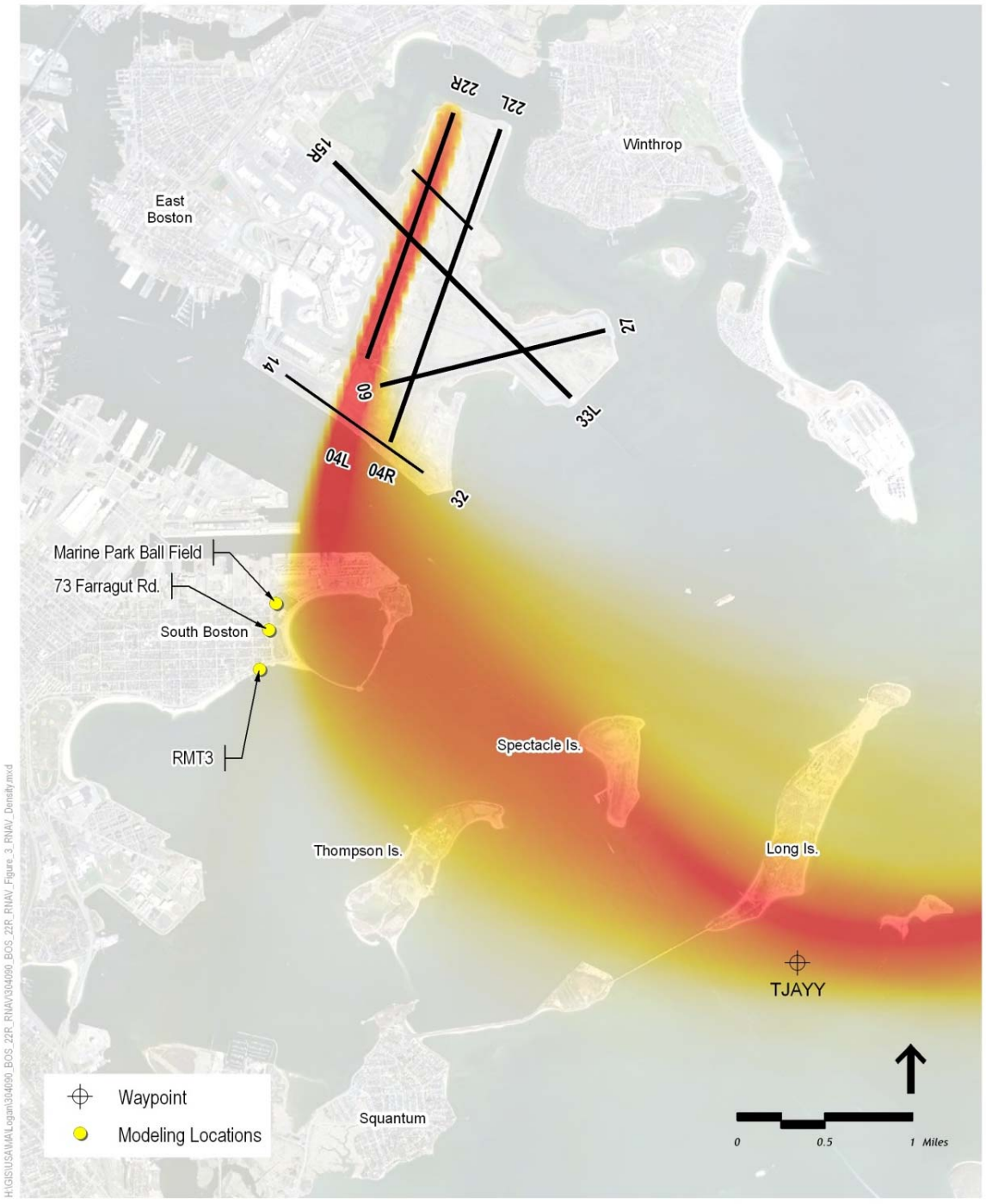


Source: Harris Miller Miller & Hanson Inc. 2010, Massport NOMS / ERA Multi-Lat, Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Low Medium High

BOS pre-RNAV (December 2009-October 2010)
Runway 22R Departure Track Density Plot
(43,335 Flight Tracks)

Figure 2



Source: Harris Miller Miller & Hanson Inc. 2010, Massport NOMS / ERA Multi-Lat, Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Low Medium High

BOS RNAV (December 2010-October 2011)
Runway 22R Departure Track Density Plot
(46,575 Flight Tracks)

Figure 3

2.2 Point of Closest Approach

To compare the two scenarios more quantitatively, a Point of Closest Approach (POCA) analysis was completed to determine whether there were any trends or specific airline or aircraft types that were not turning as soon as they had prior to the implementation of the RNAV procedure. The slant distance which is the direct distance between the aircraft and the location, was used for this analysis. The slant distance was used since it will reflect changes in both track position and altitude. The following tables compare airlines and aircraft departing Runway 22R during each period. Table 1 reports the operators with the highest numbers of departures from Runway 22R and Table 2 reports the aircraft types with the highest numbers of departures from Runway 22R. The tables are sorted from the largest to smallest difference in slant distance.

Table 1. Point of Closest Approach by Operators to 73 Farragut Rd.

Operator ICAO	Operator Name	Operations		Slant Distance (ft.)		
		Pre-RNAV	RNAV	Pre-RNAV	RNAV	Difference
EGF	AMERICAN EAGLE AIRLINES Inc.	2,847	1,551	5,042	3,177	-1,865
UAL	UNITED AIRLINES Inc.	2,240	2,201	4,852	3,330	-1,522
JZA	AIR CANADA JAZZ	1,030	1,035	4,616	3,443	-1,173
ACA	AIR CANADA	601	671	4,419	3,300	-1,119
FLG	PINNACLE AIRLINES Inc.	226	203	4,476	3,371	-1,105
AAL	AMERICAN AIRLINES Inc.	2,883	2,947	3,926	2,859	-1,067
CHQ	CHAUTAUQUA AIRLINES Inc.	346	401	4,232	3,200	-1,032
AWI	AIR WISCONSIN AIRLINES Corp.	1,055	1,007	3,824	2,853	-971
VRD	VIRGIN AMERICA Inc.	555	529	3,433	2,496	-937
ICE	ICELANDAIR	102	153	3,499	2,604	-895
NKS	SPIRIT AIRLINES Inc.	377	486	4,094	3,208	-886
JBU	JETBLUE AIRWAYS Corp.	7,411	9,582	4,139	3,272	-867
UPS	UPS Airlines	137	176	5,274	4,448	-826
RPA	REPUBLIC AIRLINES	897	681	4,529	3,712	-817
TCF	SHUTTLE AMERICA Corp.	461	599	4,692	3,890	-802
ASA	ALASKA AIRLINES Inc.	204	197	3,469	2,683	-786
DAL	DELTA AIR LINES Inc.	4,086	4,262	4,245	3,545	-701
BAW	BRITISH AIRWAYS	314	343	3,166	2,476	-690
BTA	EXPRESSJET AIRLINES Inc.	250	196	2,902	2,223	-679
CPZ	COMPASS AIRLINES	146	224	4,241	3,640	-601
TRS	AIRTRAN AIRWAYS Inc.	2,032	2,072	3,811	3,236	-575
EJA	NETJETS AVIATION Inc.	572	611	4,975	4,406	-569
COA	CONTINENTAL AIRLINES Inc.	1,377	1,523	3,884	3,372	-511
COM	COMAIR Inc.	1,581	1,166	3,473	3,021	-452
FDX	FEDEX EXPRESS	347	409	3,692	3,319	-373
MES	MESABA AIRLINES	166	408	3,272	2,909	-362
EIN	AER LINGUS	176	187	3,410	3,062	-347
AWE	AMERICA WEST AIRLINES Inc.	5,280	5,420	4,819	4,486	-332
SWA	SOUTHWEST AIRLINES Co.	1,908	2,785	4,828	4,644	-184
	Total	39,607	42,025			
	Average			4,111	3,317	-795

Table 2. Point of Closest Approach by Aircraft to 73 Farragut Rd.						
Aircraft ICAO	Aircraft Description	Operations		Slant Distance (ft.)		
		Pre-RNAV	RNAV	Pre-RNAV	RNAV	Difference
E135	Embraer RJ135	2894	1335	5037	3137	-1901
MD88	McDonnell Douglas MD-88	1242	385	4012	2275	-1737
B752	Boeing 757-200	3489	4075	4338	2693	-1645
B763	Boeing 767-300	237	165	4207	2834	-1373
F2TH	Dassault Falcon 2000	131	149	4749	3700	-1049
CRJ2	Bombardier CRJ400	1904	1577	4076	3061	-1014
CARJ	Canadair Regional Jet	55	161	3786	2869	-917
A320	Airbus A320	6045	6812	4206	3318	-888
B734	Boeing 737-400	217	277	3865	2986	-880
E145	Embraer RJ145	606	657	3744	2904	-840
B733	Boeing 737-300	135	188	4519	3693	-827
E170	Embraer 170	1900	1770	4517	3721	-796
H25B	Raytheon Hawker 850XP	239	231	4264	3492	-772
GLF4	Gulfstream GIV	195	167	4448	3713	-736
E190	Embraer 195	6353	7091	4533	3835	-699
CRJ1	Bombardier CRJ100	1593	664	3930	3245	-685
B712	Boeing 717-200	1573	1622	3780	3104	-676
C56X	Cessna 560XL Citation Excel	263	303	5549	4874	-675
A306	Airbus A300-600	196	201	5333	4665	-668
A319	Airbus A319	3885	5953	4798	4142	-657
CL30	Bombardier Challenger 300	103	122	5249	4600	-648
A343	Airbus A340-300	213	221	2778	2163	-615
B772	Boeing 777-200	185	139	3711	3108	-603
B735	Boeing 737-500	527	501	3965	3412	-552
BE40	Raytheon Hawker 400	218	224	4998	4467	-531
CL60	Bombardier Challenger 600	155	151	4274	3767	-508
C750	Cessna 750 Citation X	189	198	4392	3890	-502
A333	Airbus A330-300	148	148	3325	2874	-451
B744	Boeing 747-400	218	295	2628	2178	-450
C560	Cessna 560 Citation	151	129	4979	4530	-448
A346	Airbus A340-600	61	107	2841	2404	-437
B739	Boeing 737-900	33	109	3292	2869	-423
A332	Airbus A330-200	160	207	3395	2974	-420
B738	Boeing 737-800	2255	2732	3562	3156	-407
C680	Cessna 680 Citation Sovereign	119	112	5514	5121	-393
CRJ7	Bombardier CRJ700	211	1415	3946	3569	-377
CRJ9	Bombardier CRJ900	534	853	3173	2843	-330
DC10	McDonnell Douglas DC-10	197	250	3054	2739	-315
A321	Airbus A321	156	158	4070	3771	-299
B737	Boeing 737-700	2529	3271	4637	4494	-143
Total		41,514	45,125			
Average				4,137	3,430	-707

Across all operators and aircraft types the RNAV procedures result in a decreased slant distance at the reference location. Airlines such as American Eagle and United are near the top of the list due to the type of aircraft in their fleet. The E135 aircraft and the B752 aircraft have some of the largest differences and these dominate the respective fleets. The change in B752 departures is discussed in more detail and can be seen in Figure 11 in Section 2.5. The B722 aircraft of FedEx are not RNAV equipped, which is why FedEx is near the bottom of the list. Air Lingus is near the bottom due to the fact that its flights are all long haul operations.

One notable distinction to identify in the data shown in Table 1 is the smaller overall changes between the pre-RNAV and RNAV time periods for America West (AWE) and Southwest (SWA) airlines. These small differences between the two time periods are not due to the type of aircraft in their fleet but the fact that they are not using the RNAV procedure when it is available to them. This is evident in comparing AWE or SWA flights between the two periods. SWA flights can be seen in Figure 10 in Section 2.4.

In Table 2, the E135, MD88 and B752 are the aircraft types with the largest differences. This suggests that these aircraft types do not perform as well as others to turn to the TJAYY point. They appear to be making a long slow turn to TJAYY to get onto a 93 degree heading to the next fix. The B737 aircraft is at the bottom the list, not because it is not RNAV-equipped like the DC10 but because the primary operator, Southwest, is not flying the procedure.

2.2.1 Overall POCA Changes with RNAV implementation

At each of the modeled locations shown on Figure 1 the mean, average and peak slant distances all show a decrease of between 700' and 1,250' and are summarized in Table 3.

Table 3. Change in Slant Distance for Point of Closet Approach between RNAV and Pre-RNAV operations

Site	Mean Change (ft.)	Average Change (ft.)	Peak Change (ft.)
Marine Park Ball Field	-787	-700	-950
73 Farragut Rd.	-876	-784	-1,200
Noise Monitor RMT3	-987	-893	-1,250

2.3 DNL Evaluation

RealContours™[2] was run on just the Runway 22R jet departures to evaluate possible changes in noise levels due to the implementation of the RNAV. All Runway 22R jet departures were modeled within each time period and adjusted to represent average day conditions. Figure 7 compares partial DNL contour lines for aircraft departing off of Runway 22R before and after the implementation of the RNAV procedures. The pre-RNAV DNL contours (blue) are several hundred feet west of the RNAV DNL contours (orange). The contour is also slightly larger along the start of takeoff roll and extends further out into Boston Harbor. The differences in the size of the contour are due to the

[2] RealContours™ is a pre-processor for the FAA's INM model which converts radar data into model tracks. This allows the actual radar tracks to be modeled instead of a sampled average.

number of departures modeled and the mix of aircraft types during the two time periods. The RNAV set (46,575 departures) does include a higher number of departures than in the pre-RNAV set (43,335 departures). The increase in operations is most likely due to the closure of Runway 15R-33L during part of 2011.

To allow for the comparison between two sets which are similar the RNAV set was normalized to represent the noise contours with the same number of operations as the Pre-RNAV DNL contours. Figure 8 displays the pre-RNAV DNL contours compared to the normalized RNAV DNL contours (yellow). The reduction in the contour size when compared to the original RNAV DNL contour in Figure 7 is very small and as shown in Table 4 resulted in a reduction of 0.2dB at those sites.

The shift of the contour towards South Boston and the elongation of the contour into Boston Harbor reflect the changes in flight paths due to the implementation of the RNAV procedures. The RNAV reduces the spread of the track dispersion and in turn reduces the width and elongates the contour along the flight path.

Table 4 presents the partial DNL results of the modeling at each of the locations evaluated. As shown in Figure 1 each of the three sites are successively farther away from the runway end. The partial DNLs decrease as the majority of aircraft turn to the desired fix. The implementation of the RNAV procedures have resulted in aircraft turning more gradually from runway heading and falling closer to the modeling locations resulting in almost a DNL 4 dB increase at each site.

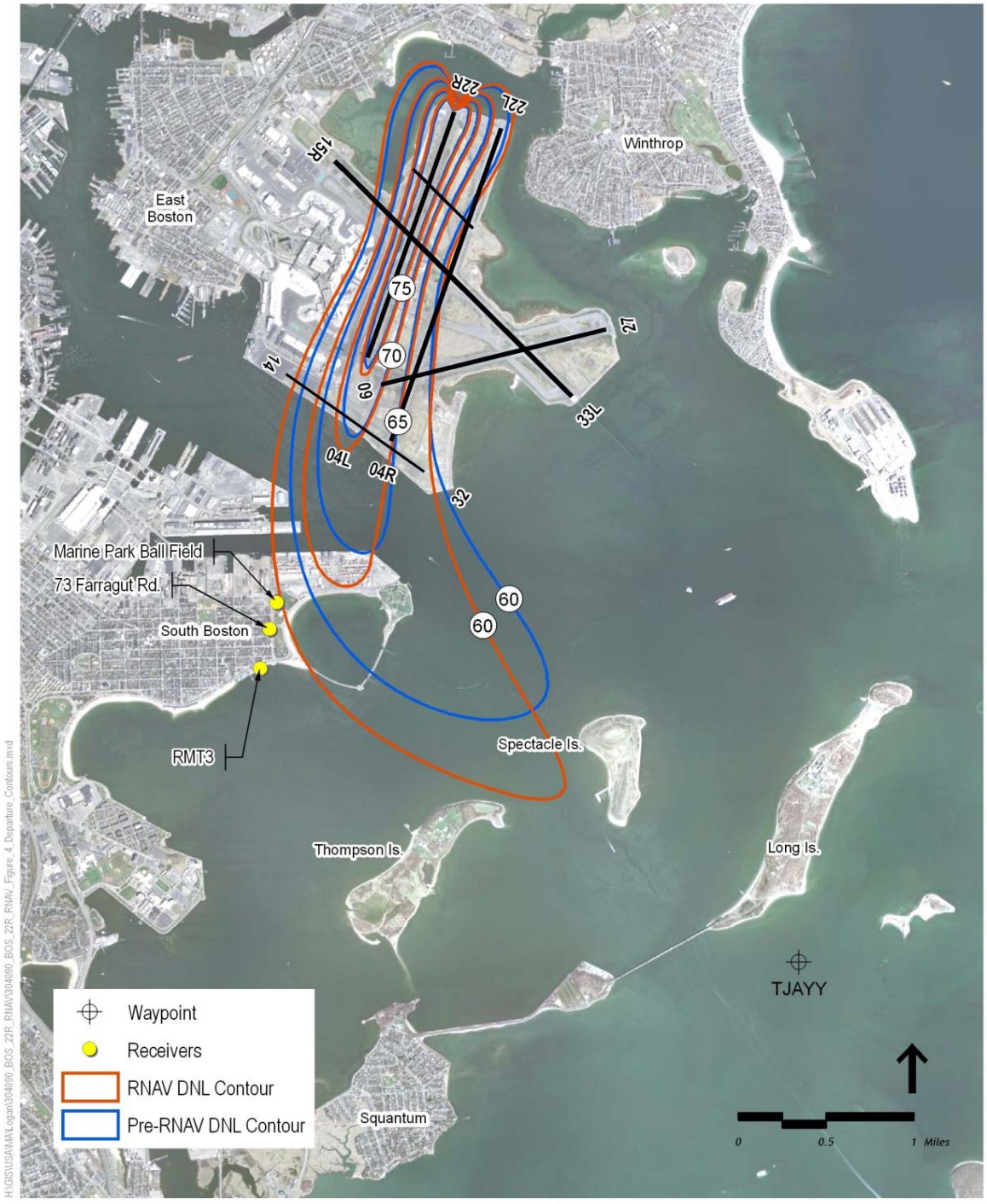
Table 4. Partial DNL levels at Selected Sites for Runway 22R Departures

Site		Un-Normalized		Normalized	
	Pre-RNAV	RNAV	Change	RNAV	Change
Marine Park Ball Field	55.4	59.3	3.9	59.1	3.7
73 Farragut Rd.	53.7	57.6	3.9	57.4	3.7
Noise Monitor RMT3	51.5	55.2	3.7	55.0	3.5
Normalized levels correct for difference the difference in overall operations between the two time periods to provide for the best representation of differences due to the departure route changes.					

Table 5 displays the modeled noise levels at each of the selected sites from the 2010 EDR. The modeling for the 2010 EDR overlaps the majority of the pre-RNAV period (10 of the 11 months). The 2010 EDR results were adjusted at each site to include the RNAV period 22R departures instead of the pre-RNAV period 22R departures. This was done to evaluate the amount of change on an annual average basis which would include noise contributed from all of the other operations at Logan Airport. As other operations at the airport contribute to noise levels at these locations the increase due to the shift of the RNAV tracks is minimized and is equal to or less than 1.5 dB at each of the sites.

Table 5. Annual Average DNL levels at Selected Sites

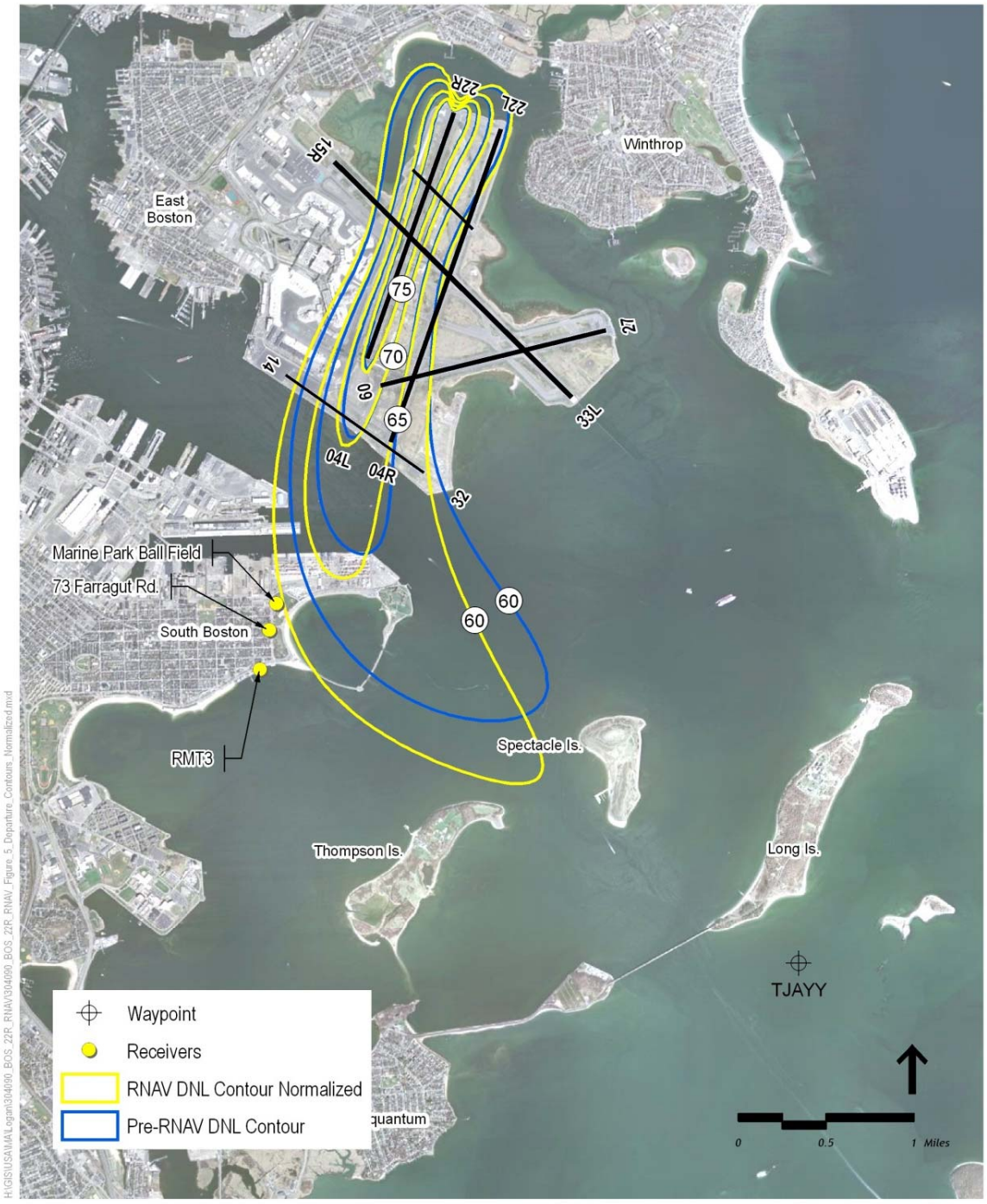
Site	2010 EDR	2010 EDR adjusted for RNAV	Change
Marine Park Ball Field	60.5	62.0	1.5
73 Farragut Rd.	60.7	61.8	1.0
Noise Monitor RMT3	59.4	60.2	0.8



Source: Harris Miller Miller & Hanson Inc. 2010, Massport NOMS / ERA Multi-Lat, Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Runway 22R Departure Partial DNL contours, BOS pre-RNAV (December 2009-October 2010) vs BOS RNAV (December 2010-October 2011)

Figure 7



Source: Harris Miller Miller & Hanson Inc. 2010, Massport NOMS / ERA Multi-Lat, Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Runway 22R Departure Partial DNL contours, BOS pre-RNAV (December 2009-October 2010) vs BOS RNAV (December 2010-October 2011) Operations Normalized
Figure 8

2.4 Track Comparisons

The following figures display differences between the pre-RNAV and RNAV time periods for two airlines and aircraft types at Logan Airport.

Figure 9 displays the typical change in flights between the pre-RNAV and RNAV time periods. These are JetBlue A320 departures and you can see the aircraft turning to 140 degrees using the standard LOGAN SID (orange tracks) during the pre-RNAV period. The flights typically stay east of Pleasure Bay. The green tracks are the JetBlue departures during the RNAV period and you can clearly see the shift over Pleasure Bay and the concentration of the tracks along the RNAV route.

Figure 9 - JetBlue A320 Departures from the pre-RNAV Time Period (Orange) and RNAV Time Period (Green)

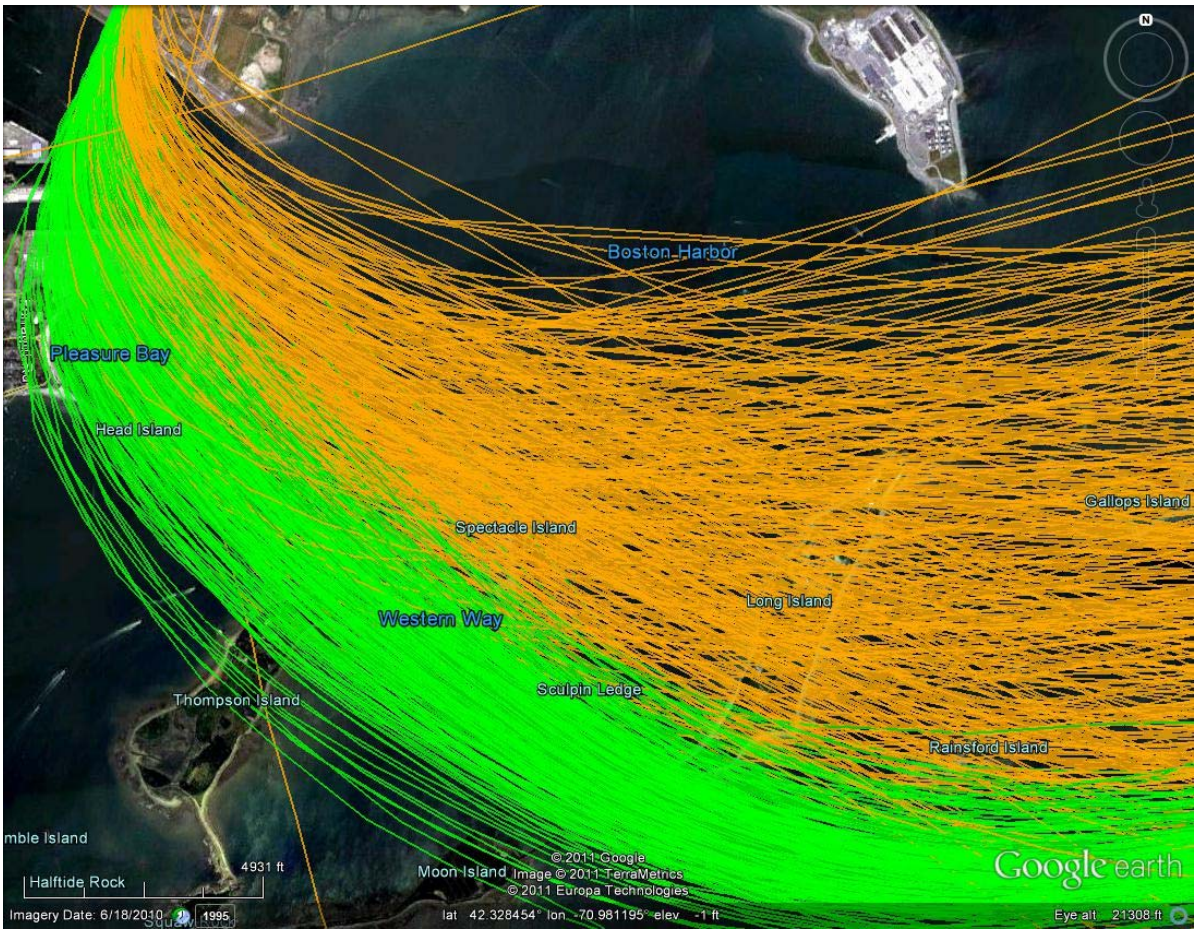
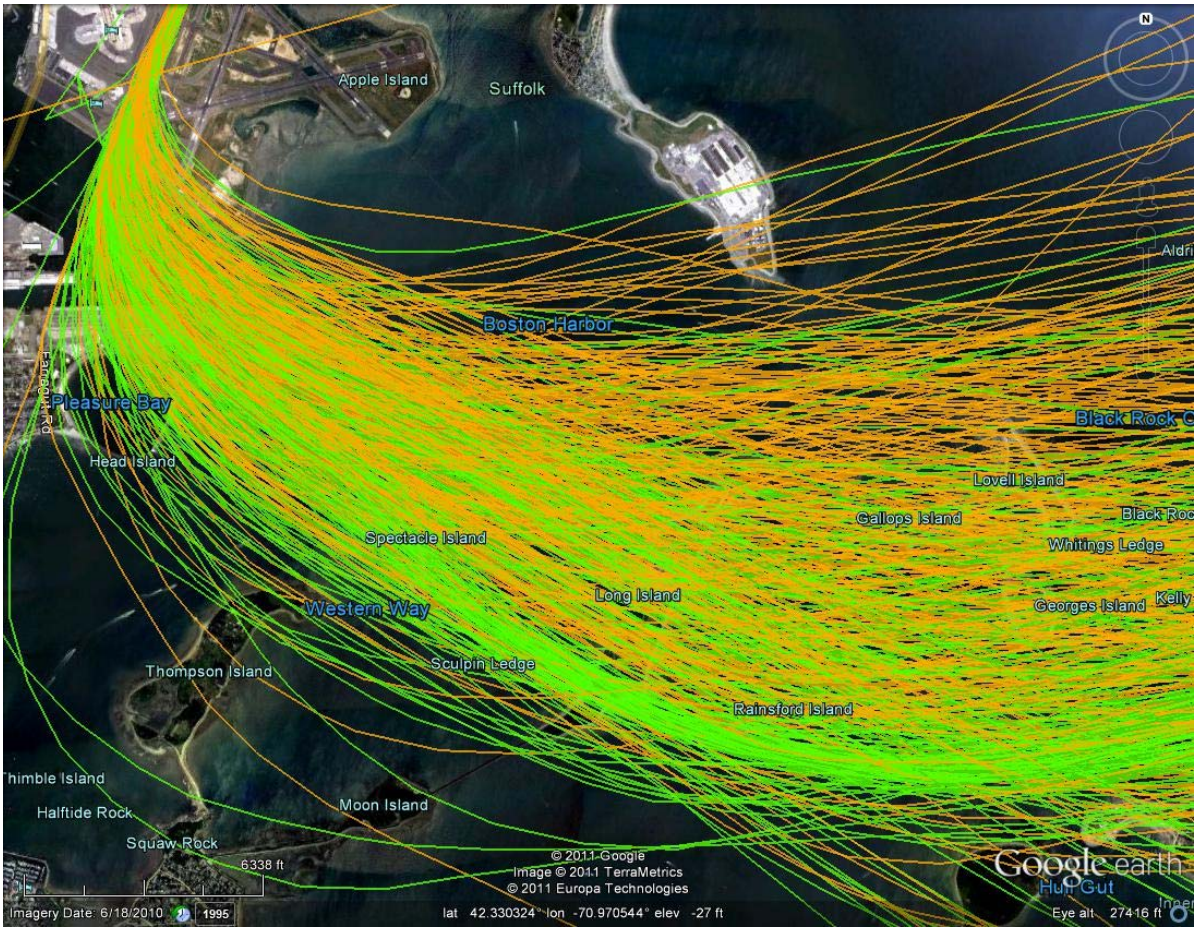


Figure 10 displays the Southwest departures (B737 & B733 aircraft) during both time periods. Unlike Figure 9, the majority of the flights follow the standard LOGAN SID during both periods and you can clearly see most of Pleasure Bay to the left of the graphic. The pre-RNAV tracks are orange and the RNAV time period tracks are green. There are some flights that follow the RNAV and can be seen as the concentrated green band near the bottom of the graphic.

Figure 10 - Southwest B737 and B733 Departures from the pre-RNAV Time Period (Orange) and RNAV Time Period (Green)

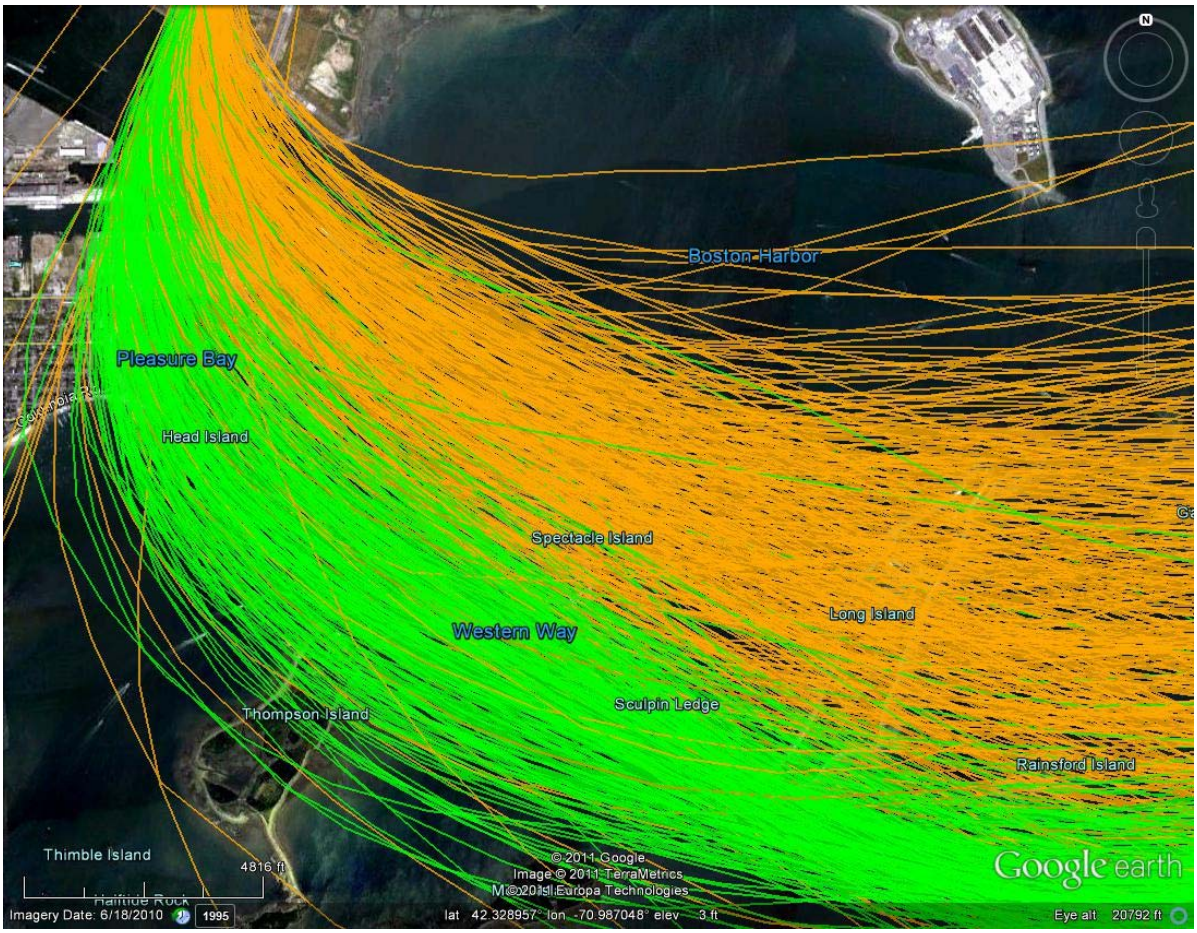


2.5 Boeing 757-200 Case Study

Figure 11 displays the change in flights between the pre-RNAV and RNAV time periods for Boeing 757-200 (B752) aircraft which has one of the largest shifts in slant distance at 73 Farragut Rd. The B752 departures are turning to 140 degrees using the standard LOGAN SID (orange tracks) during the pre-RNAV period. The flights typically stay east of Pleasure Bay. The green tracks are the B752 departures during the RNAV period and you can clearly see the shift over Please Bay and the concentration of the tracks along the RNAV route.

The B752 aircraft has one of the largest shifts in slant distance (1,645 feet) and one of the higher levels of operations between the two time periods. In the pre-RNAV period there were 3,489 departures with an average slant distance of 4,338 feet at 73 Farragut Rd. During the RNAV period there were 4,075 departures with an average slant distance of 2,693. The B752 is also not dominated by one airline; AAL, UAL and DAL are the major operators of the B752 in this analysis with AAL having the largest percentage of these flights.

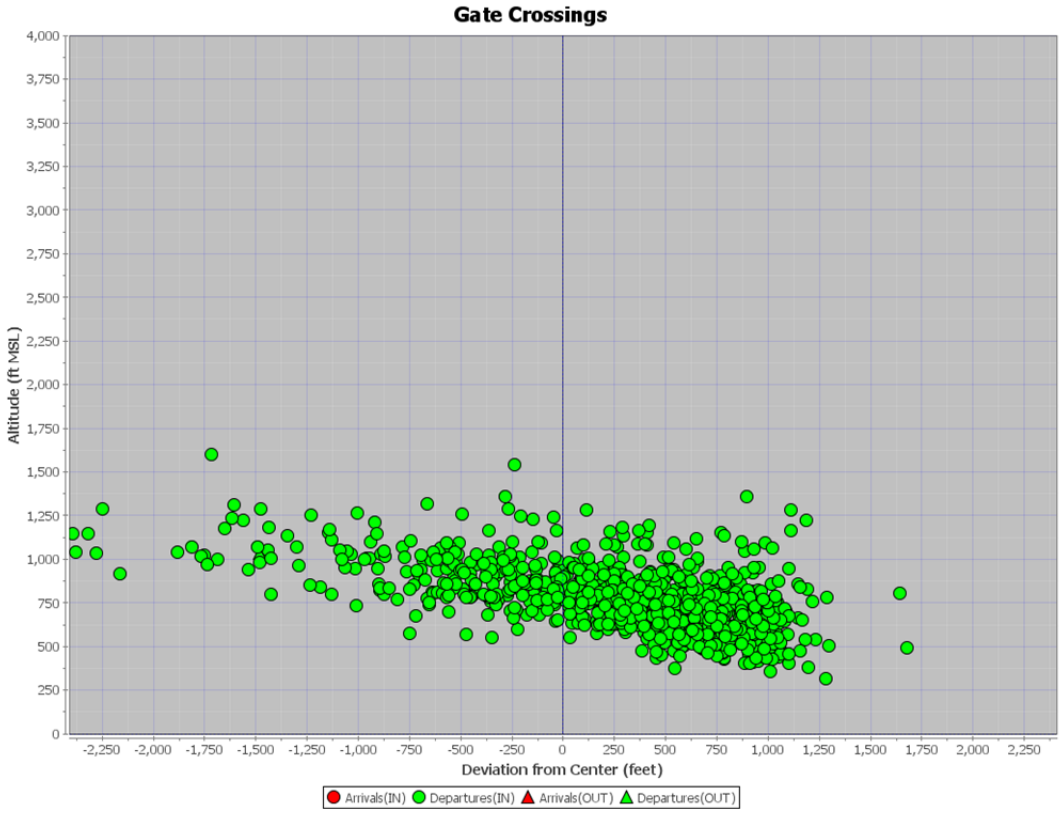
Figure 11 - B752 Departures pre-RNAV Time Period (Orange) and RNAV Time Period (Green)



As shown in Figure 11, B752 aircraft prior to the implementation of the RNAV turned to a 140 degree heading after takeoff from Runway 22R. This resulted in the aircraft turning as it crossed Runway 14-32 and the shoreline at the airport, whereas during the RNAV period, the flights are concentrated along runway heading as they cross Runway 14-32 and the airport shoreline. This difference is evident in the top of the Figure 11graphic near the airport where the green RNAV flight tracks are concentrated as they cross the airport shoreline.

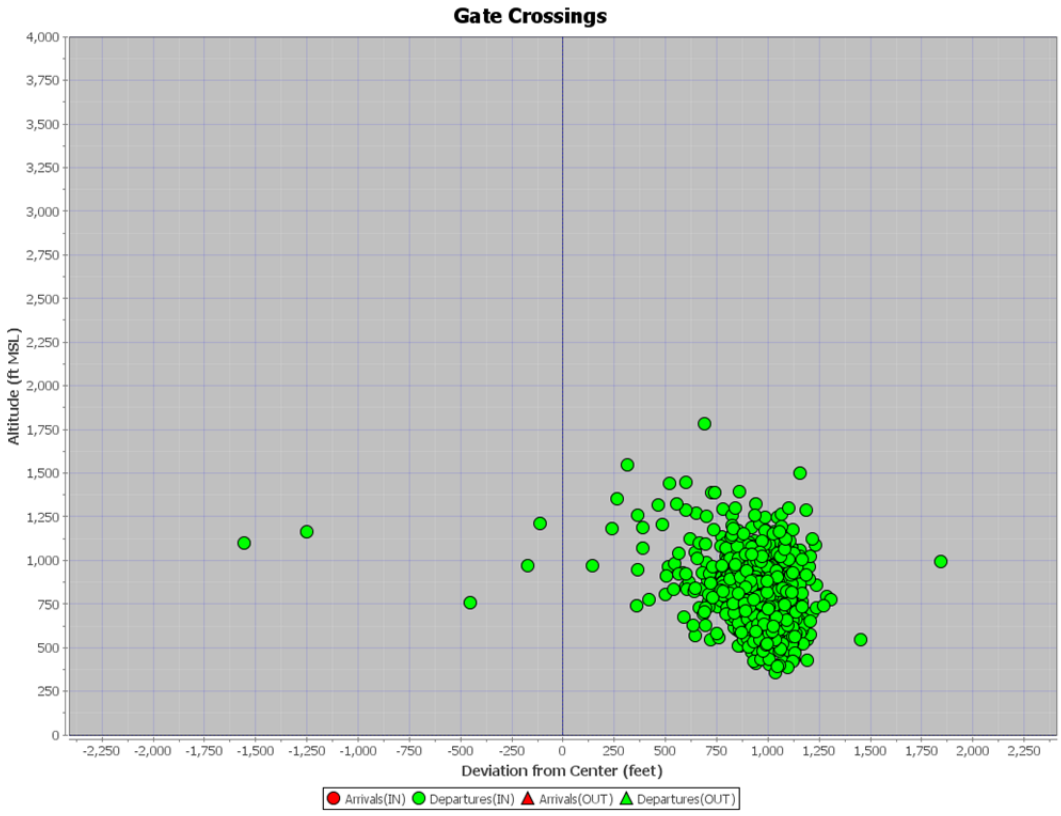
To capture this, a gate placed along the shoreline shows this difference in the B752 departures. Figure 12 shows the spread of the departures as the B752 aircraft turn out over the harbor as the cross the airport shoreline. The Runway 22R extended centerline lies at approximately 1,000 feet to the right of the gate center. The majority of the B752 departures are above 520 feet MSL and the spread indicates that many of the aircraft have turned from runway heading as soon as they are able to.

Figure 12 - B752 pre-RNAV Time Period Departures at Shoreline Gate



In contrast, Figure 13 shows the same gate with B752 departures during the RNAV period. The concentration of the departures along the runway centerline is due to the aircraft systems following the RNAV procedures. The RNAV procedure indicates the aircraft can turn any time after 520 feet MSL however the majority of the flights are still on runway heading and above 520' MSL. The gate crossings in Figure 13 indicate that the B752 aircraft are engaging the turn to TJAYY later than they have too.

Figure 13 - B752 RNAV Time Period Departures at Shoreline Gate



3. CONCLUSIONS

The overall result of initiating the RNAV SID procedure to Runway 22R departures has caused the majority of operations, regardless of aircraft type or operator, to fall closer to the three reference locations at Marine Park, 73 Farragut Road and the noise measurement site RMT3. This has resulted in an increase in aircraft overflights and modeled noise levels at these sites due to Runway 22R departures only by almost 4 dB. On an annual average basis combined with the other operations at the airport the increases are on the order of 1 to 1.5 dB. This has also resulted in a shift in the DNL contour closer to the South Boston community.

This is a result of the aircraft flying the RNAV procedure engaging the turn to TJAYY later than they turned when flying the LOGAN SID. This may be due to the aircraft performance and how the aircraft FMS system fly's the procedure. The pilot will fly the procedure following the systems directions to reach the fly-by point.

The RNAV procedure is flown by each aircraft's FMS system and depends on aircraft performance. Since the conformance to the RNAV is aircraft dependent and the aircraft cannot turn prior to reaching 520' MSL but can turn *at any altitude* after 520' MSL this analysis demonstrates that many aircraft types fly a longer gradual turn (lower bank angle) to a fly-by of the TJAYY fix compared to the sharper turn to the 140 degree heading that they used to do.

The standard LOGAN SID instructs the aircraft to turn to a 140 degree heading and pilots turn to this heading as soon as they can do this safely after liftoff. Each aircraft type has different performance

characteristics but most aircraft departing Runway 22R prior to the RNAV procedure turned to this heading and were east of Pleasure Bay.

Runway 22R does have an obstacle departure procedure minimum of 900' MSL before turning *RIGHT, which* if not correctly programmed in the FMS, could cause the aircraft to remain on runway heading longer than described in the RNAV procedure.

Solutions to this problem may be to encourage the use of a steeper bank angle, add an additional fix or shift TJAYY slightly north to keep aircraft over Spectacle Island.

Another option that could be explored would be to switch to a heading to intercept (VI) segment followed by a course to fix (CF) segment. In a VI-CF procedure a fly-by point would be added no closer than 1nautical mile to the arrival end of Runway 22R. This would place a fly–by point just north of the container terminal; aircraft would turn before this point and head to TJAYY thereby passing much closer to Castle Island and avoiding the South Boston community.

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Air Quality/ Emissions Reduction

This appendix provides the following detailed information and 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 v5.1.3
  - Table I-4 2011 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type
  - Table I-5 2030 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Idle Time-in-Mode by Aircraft Type

- Ground Service Equipment (GSE)/Alternative Fuels Conversion
  - Table I-6 Ground Service Equipment Alternative Fuel Conversion Summary (kg/day)

- Motor Vehicle Emissions
  - Table I-7 MOBILE6.2.03 Input File for 2011
  - Table I-8 MOBILE6.2.03 Output Files for 2011
  - Table I-9 MOBILE6.2.03 Input File for 2030
  - Table I-10 MOBILE6.2.03 Output Files for 2030

- Fuel Storage and Handling
  - Table I-11 Fuel Throughput by Fuel Category for 2011 (gallons)

- Stationary Sources
  - Table I-12 Stationary Source Fuel Throughput by Fuel Category for 2011 (gallons)

- 1993 – 1999 Emissions Inventories
  - Table I-13 Estimated Volatile Organic Compounds (VOC) Emissions (in kg/day) at Logan Airport
  - Table I-14 Estimated Nitrogen Oxides (NO_X) Emissions (in kg/day) at Logan Airport
  - Table I-15 Estimated Carbon Monoxide (CO) Emissions (in kg/day) at Logan Airport

- Greenhouse Gas (GHG) Emissions Inventory for 2011
  - Table I-16 Logan Airport Greenhouse Gas (GHG) Inventory Input Data and Information for 2011
  - Table I-17 Greenhouse Gas (GHG) Emission Factors
  - Table I-18 Greenhouse Gas (GHG) Emissions (MMT CO_2 Eq) for 2011
  - Table I-19 Logan Airport Greenhouse Gas (GHG) Emissions Compared to Massachusetts Totals
  - Table I-20 Comparison of Estimated Total Greenhouse Gas (GHG) Emissions (MMT of CO_2eq) at Logan Airport – 2007 through 2011

- Greenhouse Gas (GHG) Emissions Inventory for 2030
  - Table I-21 Logan Airport Greenhouse Gas (GHG) Inventory Input Data and Information for 2030
  - Table I-22 GHG Emissions (MMT CO_2 Eq) for 2030

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** 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** 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	0.075 ppm	3-year average of the fourth-highest maximum 8-hour average.
Carbon Monoxide (CO)	8-hour	9.0 ppm	No more than once per year.
	1-hour	35 ppm	
Nitrogen Dioxide (NO_2)	Annual Average	0.053 ppm	3-year average of the 98th percentile of the daily maximum 1-hour average.
	1-hour	0.100 ppm	
Sulfur Dioxide (SO_2)	3-hour	5 ppm	3-hour standard: No more than once per year
	1-hour	0.075 ppm	1-hour standard: Three-year average of the 98th percentile.
Particulate Matter (PM_{10})	24-hour	150 $\mu g/m^3$	3-year average of the 98th percentile.
Particulate Matter ($PM_{2.5}$)	Annual Arithmetic Mean	15 $\mu g/m^3$	**3-year average of the 98th percentile.**
	24-hour	35 $\mu g/m^3$	
Lead (Pb)	**Calendar Quarter**	**0.15 $\mu g/m^3$**	Rolling 3-month average not to be exceeded.

Source: U.S. EPA, 2012, http://www.epa.gov/air/criteria.html
Note: ppm - parts per million; $\mu g/m^3$ - 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 fire fighting 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 5.1.3

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 5.1.3 (EDMS v5.1.3), was used in support of the *2011 Environmental Status and Planning Report* (*2011 ESPR*) air quality analysis.

Table I-4 contains the data that was used in EDMS v5.1.3 to represent actual conditions at Logan Airport in 2011. This data includes aircraft type, engine, landing takeoff cycles (LTOs), and taxi times. The aircraft are divided into four categories: air carrier, cargo, commuter, and GA. Table I-5 contains the projected fleet mix, LTOs, and taxi times for the year 2030.

Table I-4 2011 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 A310-200 Series	CF6-80A3	200	AC SATA	25.17
Airbus A319-100 Series	CFM56-5A4	23	AC ACA	25.17
Airbus A319-100 Series	V2522-A5	100	AC BAW	25.17
Airbus A319-100 Series	CFM56-5A5	4,666	AC DAL	25.17
Airbus A319-100 Series	CFM56-5B5/P	565	AC Frontier	25.17
Airbus A319-100 Series	V2524-A5	1,172	AC Spirit	25.17
Airbus A319-100 Series	V2522-A5	919	AC UAL	25.17
Airbus A319-100 Series	CFM56-5B6/P	7,388	AC USA	25.17
Airbus A319-100 Series	CFM56-5B6/P	800	AC Virgin America	25.17
Airbus A320-200 Series	CFM56-5-A1	39	AC ACA	25.17
Airbus A320-200 Series	V2527-A5	124	AC BAW	25.17
Airbus A320-200 Series	CFM56-5A3	2,523	AC DAL	25.17
Airbus A320-200 Series	V2527-A5	15,647	AC JBU	25.17
Airbus A320-200 Series	V2527-A5	355	AC Spirit	25.17
Airbus A320-200 Series	V2527-A5	2,332	AC UAL	25.17
Airbus A320-200 Series	CFM56-5B4/P	1,956	AC USA	25.17
Airbus A320-200 Series	V2527-A5	713	AC Virgin America	25.17
Airbus A321-100 Series	CFM56-5B3/P	606	AC USA	25.17
Airbus A330-200 Series	CF6-80E1A4 Low emissions	260	AC AZA	25.17
Airbus A330-200 Series	CF6-80E1A2 1862M39	295	AC EIN	25.17
Airbus A330-200 Series	PW4168A Talon II	11	AC SWR	25.17
Airbus A330-300 Series	PW4168A Talon II	369	AC DAL	25.17
Airbus A330-300 Series	PW4168A Talon II	121	AC DLH	25.17
Airbus A330-300 Series	CF6-80E1A4 Standard	270	AC EIN	25.17
Airbus A330-300 Series	Trent 772 Improved traverse	17	AC SWR	25.17
Airbus A330-300 Series	PW4168A Talon II	6	AC USA	25.17
Airbus A340-300 Series	CFM56-5C2	244	AC AFR	25.17
Airbus A340-300 Series	CFM56-5C4/P SAC	211	AC DLH	25.17
Airbus A340-300 Series	CFM56-5C4/P SAC	212	AC Iberia	25.17
Airbus A340-300 Series	CFM56-5C4	334	AC SWR	25.17
Airbus A340-300 Series	CFM56-5C4/P SAC	51	AC VIR	25.17
Airbus A340-600 Series	Trent 556-61 Phase 5 tiled	267	AC DLH	25.17
Airbus A340-600 Series	Trent 556-61 Phase 5 tiled	10	AC Iberia	25.17
Airbus A340-600 Series	Trent 556-61 Phase 5 tiled	292	AC VIR	25.17
Boeing 717-200 Series	BR700-715A1-30	4,533	AC TRS	25.17
Boeing 737-300 Series	CFM56-3-B1	594	AC SWA	25.17
Boeing 737-300 Series	CFM56-3-B1	67	AC USA	25.17
Boeing 737-400 Series	CFM56-3B-2	5	AC Empresa Peru (charter)	25.17
Boeing 737-400 Series	CFM56-3B-2	18	AC Miami Air (charter)	25.17
Boeing 737-400 Series	CFM56-3C-1	40	AC Other Charter (domestic)	25.17
Boeing 737-400 Series	CFM56-3B-2	990	AC USA	25.17
Boeing 737-500 Series	CFM56-3C-1	1,431	AC COA	25.17
Boeing 737-500 Series	CFM56-3-B1	215	AC SWA	25.17
Boeing 737-700 Series	CFM56-7B22	12	AC Aeromexico (charter)	25.17
Boeing 737-700 Series	CFM56-7B22	50	AC Astraeus	25.17

Table I-4 2011 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 737-700 Series	CFM56-7B24	492	AC COA	25.17
Boeing 737-700 Series	CFM56-7B26/2	1	AC DAL	25.17
Boeing 737-700 Series	CFM56-7B22	18	AC Empresa Peru (charter)	25.17
Boeing 737-700 Series	CFM56-7B22	109	AC Sun Country	25.17
Boeing 737-700 Series	CFM56-7B24	7,897	AC SWA	25.17
Boeing 737-700 Series	CFM56-7B22	1,902	AC TRS	25.17
Boeing 737-800 Series	CFM56-7B26	4,651	AC AAL	25.17
Boeing 737-800 Series	CFM56-7B27	4	AC Aeromexico (charter)	25.17
Boeing 737-800 Series	CFM56-7B26	872	AC ASA	25.17
Boeing 737-800 Series	CFM56-7B26	2,545	AC COA	25.17
Boeing 737-800 Series	CFM56-7B26	1,483	AC DAL	25.17
Boeing 737-800 Series	CFM56-7B26	70	AC Miami Air (charter)	25.17
Boeing 737-800 Series	CFM56-7B26	147	AC Sun Country	25.17
Boeing 737-900 Series	CFM56-7B26	6	AC ASA	25.17
Boeing 737-900 Series	CFM56-7B27	416	AC COA	25.17
Boeing 747-400 Series	PW4056 Reduced emissions	261	AC AFR	25.17
Boeing 747-400 Series	RB211-524H	477	AC BAW	25.17
Boeing 747-400 Series	CF6-80C2B1F 1862M39	267	AC DLH	25.17
Boeing 747-400 Series	CF6-80C2B1F 1862M39	17	AC VIR	25.17
Boeing 757-200 Series	RB211-535E4B Phase 5	5,689	AC AAL	25.17
Boeing 757-200 Series	RB211-535E4	24	AC COA	25.17
Boeing 757-200 Series	PW2037	3,004	AC DAL	25.17
Boeing 757-200 Series	PW2037	7	AC Empresa Peru (charter)	25.17
Boeing 757-200 Series	RB211-535E4	464	AC ICE	25.17
Boeing 757-200 Series	PW2037	118	AC TACV-Cabo Verde	25.17
Boeing 757-200 Series	PW2037	4,379	AC UAL	25.17
Boeing 757-200 Series	RB211-535E4	10	AC USA	25.17
Boeing 757-300 Series	RB211-535E4B Phase 5	1	AC COA	25.17
Boeing 757-300 Series	PW2040	4	AC DAL	25.17
Boeing 767-200 Series	CF6-80A1	8	AC AAL	25.17
Boeing 767-200 Series	CF6-80C2B4F 1862M39	1	AC COA	25.17
Boeing 767-200 Series	CF6-80C2B2 1862M39	7	AC USA	25.17
Boeing 767-300 Series	CF6-80C2B6 1862M39	123	AC AAL	25.17
Boeing 767-300 Series	CF6-80C2B6 1862M39	39	AC AZA	25.17
Boeing 767-300 Series	RB211-524H	6	AC BAW	25.17
Boeing 767-300 Series	CF6-80A2	279	AC DAL	25.17
Boeing 767-300 Series	PW4060 Reduced emissions	44	AC UAL	25.17
Boeing 767-400 ER	CF6-80C2B8FA 1862M39	2	AC COA	25.17
Boeing 767-400 ER	CF6-80C2B7F 1862M39	357	AC DAL	25.17
Boeing 777-200 Series	Trent 892	8	AC AAL	25.17
Boeing 777-200 Series	GE90-90B DAC I	1	AC AFR	25.17
Boeing 777-200 Series	GE90-94B DAC II	3	AC AZA	25.17
Boeing 777-200 Series	GE90-90B DAC I	374	AC BAW	25.17
Boeing 777-200 Series	GE90-92B DAC I	5	AC COA	25.17
Boeing 777-200 Series	Trent 892	1	AC DAL	25.17
Boeing 777-200 Series	GE90-90B DAC II	26	AC Other Charter (international)	25.17
Boeing 777-200 Series	PW4077	2	AC UAL	25.17
Boeing DC-9-50 Series	JT8D-17 Reduced emissions	385	AC DAL	25.17
Boeing MD-82	JT8D-217 Environmental Kit	42	AC AAL	25.17
Boeing MD-83	JT8D-219 Environmental Kit	25	AC AAL	25.17
Boeing MD-83	JT8D-219 Environmental Kit	60	AC Allegiant Air (charter)	25.17

Table I-4 2011 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 MD-83	JT8D-219 Environmental Kit	16	AC USA Jet (charter)	25.17
Boeing MD-88	JT8D-219 Environmental Kit	5	AC Allegiant Air (charter)	25.17
Boeing MD-88	JT8D-219 Environmental Kit	1,125	AC DAL	25.17
Boeing MD-90	V2525-D5	158	AC DAL	25.17
Bombardier Challenger 300	AE3007A1 Type 2	13	AC Business Jet Solutions (charter)	25.17
Bombardier Challenger 300	AE3007A1 Type 2	8	AC Key Air (charter)	25.17
Bombardier Challenger 600	ALF 502L-2	4	AC Business Jet Solutions (charter)	25.17
Bombardier Challenger 600	ALF 502L-2	6	AC Jet Charter (charter)	25.17
Bombardier Learjet 35	TFE731-2-2B	2	AC Jet Charter (charter)	25.17
Bombardier Learjet 40	TFE731-2-2B	7	AC Business Jet Solutions (charter)	25.17
Bombardier Learjet 45	TFE731-2-2B	4	AC Business Jet Solutions (charter)	25.17
Bombardier Learjet 60	TFE731-2/2A	7	AC Business Jet Solutions (charter)	25.17
Bombardier Learjet 60	TFE731-2/2A	2	AC Jet Charter (charter)	25.17
Dassault Falcon 2000	PW308C Annular	5	AC Jet Charter (charter)	25.17
Embraer ERJ170	CF34-8E5A1 LEC	1,686	AC ACA	25.17
Embraer ERJ190	CF34-10E	334	AC ACA	25.17
Embraer ERJ190	CF34-10E	16,317	AC JBU	25.17
Embraer ERJ190	CF34-10E	7,205	AC USA	25.17
Gulfstream G400	TAY Mk611-8	6	AC Key Air (charter)	25.17
Gulfstream G500	BR700-710A1-10	5	AC ACM Aviation (charter)	25.17
Israel IAI-1126 Galaxy	PW306A Annular	10	AC ACM Aviation (charter)	25.17
Raytheon Hawker 800	TFE731-3	5	AC ACM Aviation (charter)	25.17
Total Air Carrier Aircraft LTOs		**115,116**		
Cargo Aircraft				
Airbus A300F4-600 Series	CF6-80C2A5F 1862M39	231	Cargo FDX	25.17
Airbus A300F4-600 Series	PW4158 Reduced smoke	542	Cargo UPS	25.17
Airbus A310-200 Series	JT9D-7R4E, -7R4E1	13	Cargo FDX	25.17
Boeing 727-200 Series	JT8D-15 Reduced emissions	113	Cargo Capital Cargo International	25.17
Boeing 727-200 Series	JT8D-15 Reduced emissions	208	Cargo FDX	25.17
Boeing 757-200 Series	RB211-535E4	25	Cargo FDX	25.17
Boeing 757-200 Series	PW2040	36	Cargo UPS	25.17
Boeing 767-300 ER	CF6-80C2B6F	92	Cargo UPS	25.17
Boeing DC-10-10 Series	CF6-6D	956	Cargo FDX	25.17
Boeing DC-8 Series 70	CFM56-2-C5	33	Cargo Air Transport International	25.17
Boeing DC-8 Series 70	CFM56-2-C5	246	Cargo DHL Airways	25.17
Boeing MD-11	CF6-80C2D1F 1862M39	52	Cargo FDX	25.17
Bombardier Challenger 600	CF34-3B	11	Cargo FDX	25.17
Bombardier Learjet 25	CJ610-6	1	Cargo Royal Air Freight	25.17
Bombardier Learjet 35	TFE731-2-2B	2	Cargo Royal Air Freight	25.17
Cessna 208 Caravan	PT6A-114	45	Cargo AirNet	25.17
Cessna 310	TIO-540-J2B2	2	Cargo Royal Air Freight	25.17
Piper PA-31 Navajo	TIO-540-J2B2	277	Cargo AirNet	25.17
Raytheon Beech Baron 58	TIO-540-J2B2	47	Cargo AirNet	25.17
Total Cargo Aircraft LTOs		**2,932**		

Table I-4 2011 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
Commuter Aircraft				
Bombardier CRJ-100	CF34-3A1 LEC II	684	Comm Delta (Comair)	25.17
Bombardier CRJ-100	CF34-3B	1,569	Comm JZA	25.17
Bombardier CRJ-200	CF34-3B	6	Comm Atlantic Southeast Airlines	25.17
Bombardier CRJ-200	CF34-3B	43	Comm Delta (Comair)	25.17
Bombardier CRJ-200	CF34-3B	753	Comm Delta (Pinnacle)	25.17
Bombardier CRJ-200	CF34-3B	1,505	Comm JZA	25.17
Bombardier CRJ-200	CF34-3B	3,249	Comm US Airways Express	25.17
Bombardier CRJ-700	CF34-8C1	2,370	Comm Atlantic Southeast Airlines	25.17
Bombardier CRJ-700	CF34-8C1	1,300	Comm Delta (Comair)	25.17
Bombardier CRJ-700	CF34-8C1	771	Comm EGF	25.17
Bombardier CRJ-700	CF34-8C1	75	Comm Horizon	25.17
Bombardier CRJ-700	CF34-8C1	130	Comm Mesa	25.17
Bombardier CRJ-900	CF34-8C5 LEC	168	Comm Atlantic Southeast Airlines	25.17
Bombardier CRJ-900	CF34-8C5 LEC	1,827	Comm Delta (Comair)	25.17
Bombardier CRJ-900	CF34-8C5 LEC	1,558	Comm Delta (Mesaba)	25.17
Bombardier CRJ-900	CF34-8C5 LEC	127	Comm JZA	25.17
Bombardier de Havilland Dash 8 Q100	PW120A	147	Comm JZA	25.17
Bombardier de Havilland Dash 8 Q100	PW120A	665	Comm US Airways (Piedmont)	25.17
Bombardier de Havilland Dash 8 Q300	PW123	53	Comm JZA	25.17
Bombardier de Havilland Dash 8 Q400	PW150A	595	Comm Colgan	25.17
Bombardier de Havilland Dash 8 Q400	PW150A	1,571	Comm Porter Airlines	25.17
Cessna 402	TIO-540-J2B2	16,439	Comm Hyannis Air Service	25.17
Cessna 402	TIO-540-J2B2	825	Comm Island Airlines	25.17
Cessna 402	TIO-540-J2B2	618	Comm Twin Cities Air Service	25.17
Dassault Falcon 2000	PW308C Annular	91	Comm Hyannis Air Service	25.17
Embraer ERJ135	AE3007A1/3 Type 3	3,662	Comm EGF	25.17
Embraer ERJ145	AE3007A1E Type 3	1,474	Comm Chautaugua	25.17
Embraer ERJ145	AE3007A1E Type 3	619	Comm Continental Express	25.17
Embraer ERJ145	AE3007A1E Type 3	4	Comm EGF	25.17
Embraer ERJ145	AE3007A1E Type 3	303	Comm Trans States	25.17
Embraer ERJ170	CF34-8E5 LEC	788	Comm Delta (Compass Airlines)	25.17
Embraer ERJ170	CF34-8E5 LEC	1,634	Comm Republic Airlines	25.17
Embraer ERJ170	CF34-8E5 LEC	1,974	Comm Shuttle America	25.17
Embraer ERJ190	CF34-10E6 SAC	564	Comm Republic Airlines	25.17
Gulfstream G400	TAY Mk611-8	8	Comm Colgan	25.17
Saab 340-B-Plus	CT7-9B	4,147	Comm Colgan	25.17
Total Commuter Aircraft LTOs		**52,316**		
General Aviation Aircraft				
Bombardier Challenger 300	AE3007A1 Type 2	338	GA	25.17
Bombardier Challenger 300	AE3007A1 Type 2	155	GA Bombardier Business Jet	25.17
Bombardier Challenger 600	CF34-3B	714	GA	25.17
Bombardier Challenger 600	ALF 502L-2	48	GA Bombardier Business Jet	25.17
Bombardier Challenger 600	ALF 502L-2	35	GA Executive Jet	25.17
Bombardier Learjet 35	TFE731-2-2B	278	GA	25.17
Bombardier Learjet 40	TFE731-2-2B	102	GA Bombardier Business Jet	25.17
Bombardier Learjet 45	TFE731-2-2B	288	GA	25.17
Bombardier Learjet 45	TFE731-2-2B	41	GA Bombardier Business Jet	25.17
Bombardier Learjet 60	TFE731-2/2A	297	GA	25.17
Bombardier Learjet 60	TFE731-2/2A	50	GA Bombardier Business Jet	25.17

Table I-4 2011 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 172 Skyhawk	TSIO-360C	23	GA Angel Flight	25.17
Cessna 182	IO-360-B	73	GA Angel Flight	25.17
Cessna 208 Caravan	PT6A-114	242	GA Wiggins	25.17
Cessna 402	TIO-540-J2B2	343	GA Hyannis Air Service	25.17
Cessna 525 CitationJet	JT15D-1 series	120	GA Citationshares	25.17
Cessna 550 Citation II	JT15D-4 series	348	GA	25.17
Cessna 560 Citation Excel	JT15D-5, -5A, -5B	447	GA	25.17
Cessna 560 Citation Excel	JT15D-5, -5A, -5B	125	GA Citationshares	25.17
Cessna 560 Citation Excel	JT15D-5, -5A, -5B	29	GA Executive Jet	25.17
Cessna 560 Citation V	JT15D-5, -5A, -5B	316	GA	25.17
Cessna 560 Citation V	JT15D-5, -5A, -5B	216	GA Netjets Aviation	25.17
Cessna 560 Citation XLS	JT15D-5, -5A, -5B	95	GA General Aviation Flying Service	25.17
Cessna 560 Citation XLS	JT15D-5, -5A, -5B	760	GA Netjets Aviation	25.17
Cessna 680 Citation Sovereign	PW308C Annular	72	GA Citationshares	25.17
Cessna 680 Citation Sovereign	PW308C Annular	41	GA Executive Jet	25.17
Cessna 680 Citation Sovereign	PW308C Annular	346	GA Netjets Aviation	25.17
Cessna 750 Citation X	AE3007C Type 1	264	GA	25.17
Cessna 750 Citation X	AE3007C Type 1	16	GA Citationshares	25.17
Cessna 750 Citation X	AE3007C Type 1	19	GA Executive Jet	25.17
Cessna 750 Citation X	AE3007C Type 1	47	GA Flight Options	25.17
Cessna 750 Citation X	AE3007C Type 1	484	GA Netjets Aviation	25.17
Cirrus SR22	TIO-540-J2B2	66	GA Angel Flight	25.17
Dassault Falcon 2000	PW308C Annular	349	GA	25.17
Dassault Falcon 2000	PW308C Annular	17	GA Executive Jet	25.17
Dassault Falcon 2000	PW308C Annular	17	GA General Aviation Flying Service	25.17
Dassault Falcon 2000	PW308C Annular	183	GA Netjets Aviation	25.17
Dassault Falcon 50	TFE731-3	243	GA	25.17
Dassault Falcon 50	TFE731-3	14	GA Executive Jet	25.17
Dassault Falcon 900	TFE731-3	326	GA	25.17
Dassault Falcon 900	TFE731-3	14	GA Executive Jet	25.17
Embraer ERJ135	AE3007A1/3 Type 3	31	GA Flight Options	25.17
Gulfstream G400	TAY Mk611-8	740	GA	25.17
Gulfstream G400	TAY Mk611-8	68	GA Executive Jet	25.17
Gulfstream G400	TAY Mk611-8	27	GA General Aviation Flying Service	25.17
Gulfstream G400	TAY Mk611-8	143	GA Netjets Aviation	25.17
Gulfstream G500	BR700-710A1-10	444	GA	25.17
Gulfstream G500	BR700-710A1-10	33	GA Executive Jet	25.17
Gulfstream G500	BR700-710A1-10	47	GA Netjets Aviation	25.17
Israel IAI-1126 Galaxy	PW306A Annular	201	GA Netjets Aviation	25.17
Mooney M20-K	TSIO-360C	51	GA Angel Flight	25.17
Piaggio P.180 Avanti	PT6A-66	270	GA Wanair	25.17
Pilatus PC-12	PT6A-67B	939	GA	25.17
Pilatus PC-12	PT6A-67B	42	GA Netjets Aviation	25.17
Piper PA-32 Cherokee Six	TIO-540-J2B2	60	GA Angel Flight	25.17
Raytheon Beech 99	PT6A-36	4	GA Wiggins	25.17
Raytheon Beech Baron 58	TIO-540-J2B2	217	GA	25.17
Raytheon Beech Baron 58	TIO-540-J2B2	58	GA Angel Flight	25.17
Raytheon Beech Bonanza 36	TIO-540-J2B2	96	GA Angel Flight	25.17
Raytheon Beechjet 400	JT15D-5, -5A, -5B	838	GA	25.17
Raytheon Beechjet 400	JT15D-5, -5A, -5B	148	GA Flight Options	25.17
Raytheon Beechjet 400	JT15D-5, -5A, -5B	95	GA Netjets Aviation	25.17

Table I-4 2011 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 800	TFE731-3	937	GA	25.17
Raytheon Hawker 800	TFE731-3	19	GA Executive Jet	25.17
Raytheon Hawker 800	TFE731-3	44	GA Flight Options	25.17
Raytheon Hawker 800	TFE731-3	32	GA General Aviation Flying Service	25.17
Raytheon Hawker 800	TFE731-3	249	GA Netjets Aviation	25.17
Raytheon Super King Air 200	PT6A-42	258	GA	25.17
Rockwell Commander 700	IO-360-B	38	GA Angel Flight	25.17
Total General Aviation Aircraft LTOs		**14,130**		
Total Fleet LTOs		**184,494**		

Source: KBE and Massport.
Notes: Due to rounding of the operations (1 LTO = 2 Operations) there may be some differences (+/-) between the values reported here and those reported in *Chapter 2, Activity Levels.*
Aircraft taxi times are based on Logan Airport data obtained from the FAA Aviation System Performance Metrics (ASPM) database for 2011.

Table I-5 2030 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	V2522-A5	82	AC	20.02
Airbus A319-100 Series	CFM56-5B6/P	19,495	AC	20.02
Airbus A320-200 Series	V2527-A5	33,656	AC	20.02
Airbus A321-100 Series	CFM56-5B3/P	2,591	AC	20.02
Airbus A330-200 Series	CF6-80E1A2 1862M39	335	AC	20.02
Airbus A330-300 Series	PW4168A Talon II	8,205	AC	20.02
Airbus A340-300 Series	CFM56-5C4	268	AC	20.02
Airbus A340-600 Series	Trent 556-61 Phase 5 tiled	402	AC	20.02
Boeing 717-200 Series	BR700-715A1-30	3,119	AC	20.02
Boeing 737-400 Series	CFM56-3B-2	75	AC	20.02
Boeing 737-700 Series	CFM56-7B22	34	AC	20.02
Boeing 737-700 Series	CFM56-7B24	19,494	AC	20.02
Boeing 737-800 Series	CFM56-7B26	34,187	AC	20.02
Boeing 737-800 Series	CFM56-7B26	221	AC	20.02
Boeing 737-900 Series	CFM56-7B27	6,211	AC	20.02
Boeing 747-400 Series	RB211-524H	335	AC	20.02
Boeing 757-200 Series	RB211-535E4B Phase 5	634	AC	20.02
Boeing 757-200 Series	PW2037	76	AC	20.02
Boeing 767-300 Series	CF6-80C2B6 1862M39	1,219	AC	20.02
Boeing 767-300 Series	CF6-80A2	21	AC	20.02
Boeing 767-400 ER	CF6-80C2B7F 1862M39	216	AC	20.02
Boeing 777-300 Series	GE90-90B DAC I	1,091	AC	20.02
Boeing MD-83	JT8D-219 Environmental Kit	102	AC	20.02
Embraer ERJ190	CF34-10E	24,292	AC	20.02
Total Air Carrier Aircraft LTOs		**156,361**		
Cargo Aircraft				
Airbus A300F4-600 Series	PW4158 Reduced smoke	1,233	Cargo	20.02
Boeing 757-200 Series	PW2040	1,016	Cargo	20.02
Boeing 767-300 ER	CF6-80C2B6F	150	Cargo	20.02
Boeing MD-11	CF6-80C2D1F 1862M39	1,267	Cargo	20.02
Cessna 208 Caravan	PT6A-114	152	Cargo	20.02
Total Cargo Aircraft LTOs		**3,818**		
Commuter Aircraft				
Bombardier CRJ-200	CF34-3B	6,469	Comm	20.02
Bombardier CRJ-700	CF34-8C1	5,101	Comm	20.02
Bombardier CRJ-900	CF34-8C5 LEC	5,144	Comm	20.02
Bombardier de Havilland Dash 8 Q100	PW120A	786	Comm	20.02
Bombardier de Havilland Dash 8 Q300	PW123	786	Comm	20.02
Bombardier de Havilland Dash 8 Q400	PW150A	8,747	Comm	20.02
Cessna 402	TIO-540-J2B2	17,997	Comm	20.02
Embraer ERJ135	AE3007A1/3 Type 3	1,247	Comm	20.02
Embraer ERJ145	AE3007A1E Type 3	1,032	Comm	20.02
Embraer ERJ170	CF34-8E5 LEC	13,748	Comm	20.02
Saab 340-B-Plus	CT7-9B	2,677	Comm	20.02
Total Commuter Aircraft LTOs		**63,734**		

Table I-5 2030 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				
Bombardier Challenger 300	AE3007A1 Type 2	429	GA	20.02
Bombardier Challenger 600	CF34-3B	645	GA	20.02
Bombardier Global Express	BR700-710A2-20	219	GA	20.02
Bombardier Learjet 35	TFE731-2-2B	212	GA	20.02
Bombardier Learjet 40	TFE731-2-2B	123	GA	20.02
Bombardier Learjet 45	TFE731-2-2B	265	GA	20.02
Bombardier Learjet 60	TFE731-2/2A	282	GA	20.02
Cessna 182	IO-360-B	92	GA	20.02
Cessna 208 Caravan	PT6A-114	304	GA	20.02
Cessna 525 CitationJet	JT15D-1 series	205	GA	20.02
Cessna 550 Citation II	JT15D-4 series	260	GA	20.02
Cessna 560 Citation Excel	JT15D-5, -5A, -5B	470	GA	20.02
Cessna 560 Citation XLS	JT15D-5, -5A, -5B	1,361	GA	20.02
Cessna 650 Citation III	TFE731-3	89	GA	20.02
Cessna 680 Citation Sovereign	PW308C Annular	602	GA	20.02
Cessna 750 Citation X	AE3007C Type 1	813	GA	20.02
Cirrus SR22	TIO-540-J2B2	171	GA	20.02
Dassault Falcon 2000	PW308C Annular	492	GA	20.02
Dassault Falcon 50	TFE731-3	194	GA	20.02
Dassault Falcon 900	TFE731-3	258	GA	20.02
Embraer ERJ135	AE3007A1/3 Type 3	89	GA	20.02
Gulfstream G150	TFE731-3	107	GA	20.02
Gulfstream G400	TAY Mk611-8	801	GA	20.02
Gulfstream G500	BR700-710A1-10	411	GA	20.02
Israel IAI-1126 Galaxy	PW306A Annular	388	GA	20.02
Piaggio P.180 Avanti	PT6A-66	344	GA	20.02
Pilatus PC-12	PT6A-67B	754	GA	20.02
Piper PA-32 Cherokee Six	TIO-540-J2B2	71	GA	20.02
Piper PA-34 Seneca	IO-360-B	67	GA	20.02
Raytheon Beech 1900-C	PT6A-67D	79	GA	20.02
Raytheon Beech Baron 58	TIO-540-J2B2	341	GA	20.02
Raytheon Beech Bonanza 36	TIO-540-J2B2	82	GA	20.02
Raytheon Beechjet 400	JT15D-5, -5A, -5B	868	GA	20.02
Raytheon Hawker 4000 Horizon	PW308A Annular	75	GA	20.02
Raytheon Hawker 800	TFE731-3	1,071	GA	20.02
Raytheon Super King Air 200	PT6A-42	194	GA	20.02
Raytheon Super King Air 300	PT6A-60A	226	GA	20.02
Total General Aviation Aircraft LTOs		**13,454**		
Total Fleet LTOs		**237,367**		

Source: KBE and Massport.
Notes: Due to rounding of the operations (1 LTO = 2 Operations) there may be some differences (+/-) between the values reported here and those reported in *Chapter 2, Activity Levels.* Aircraft taxi times are based on the Total Airspace and Airport Modeler (TAAM).

Ground Service Equipment/Alternative Fuels Conversion

For the 2011 analyses, GSE emissions were calculated using EDMS emission factors which are based on the EPA NONROAD2005 model in combination with the 2012 GSE time-in-mode survey and the GSE fuel types obtained from the Logan Airport Vehicle Aerodrome Permit Application. In this way, the most up-to-date GSE fleet operational, conversion and emissions characteristics are used.

Table I-6 Ground Service Equipment Alternative Fuel Conversion Summary (kg/day)

Year	Pollutant	Percent Reduction	Calculated Emissions without Reduction	Reduction from AFVs	Calculated Emissions with Reduction
2000	Volatile Organic Compounds (VOCs)	13.72%	178	24	154
	Oxides of Nitrogen (NO_x)	9.87%	369	36	333
	Carbon Monoxide (CO)	12.88%	6,124	789	5,335
2001	VOCs	13.72%	166	23	143
	NO_x	9.87%	338	33	305
	CO	12.88%	5,960	768	5,193
2002	VOCs	13.6%	286	39	247
	NO_x	8.0%	350	28	322
	CO	16.3%	6,174	1,004	5,170
2003	VOCs	13.8%	263	36	227
	NO_x	8.0%	316	25	291
	CO	16.4%	5,692	934	4,758
2004	VOCs	11.9%	212	25	187
	NO_x	6.6%	357	24	333
	CO	15.4%	4,236	650	3,586
2005	VOCs	12.2%	203	25	178
	NO_x	6.9%	335	23	312
	CO	15.4%	4,175	643	3,531
	$PM_{10}/PM_{2.5}$	9.9%	11	1	10
2006	VOCs	10.7%	86	9	77
	NO_x	7.5%	324	24	300
	CO	13.8%	1,841	255	1,586
	$PM_{10}/PM_{2.5}$	10.8%	10	1	9
2007	VOCs	8.2%	85	7	78
	NO_x	5.1%	315	16	299
	CO	10.4%	2,124	220	1,904
	$PM_{10}/PM_{2.5}$	5.9%	10	<1	10
2008	VOCs	8.3%	72	6	66
	NO_x	4.8%	270	13	257
	CO	10.2%	1,792	183	1,609
	$PM_{10}/PM_{2.5}$	5.6%	16	<1	15
2009	VOCs	8.2%	61	5	56
	NO_x	4.8%	230	11	219
	CO	10.0%	1,516	152	1364
	$PM_{10}/PM_{2.5}$	3.5%	14	<1	14

Table I-6 Ground Service Equipment Alternative Fuel Conversion Summary (kg/day) (Continued)

Year	Pollutant	Percent Reduction	Calculated Emissions without Reduction	Reduction from AFVs	Calculated Emissions with Reduction
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

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 and 2011 analysis used EDMS v5.1.3, which used emission factors from the EPA NONROAD2005 Model.

Motor Vehicle Emissions

The same methods used in the *2010 EDR* were also employed to calculate motor vehicle emissions in this *2011 ESPR*. In the *2011 ESPR*, 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, MOBILE6.2.03 was used to obtain vehicle emissions at idle to estimate parking and curbside motor vehicle emissions.[1] 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 MOBILE6.2.03 for 2011 are included as Tables I-7 and I-8. The input and output files of MOBILE6.2.03 for 2030 are included as Tables I-9 and I-10.

1 Idle emissions factors in grams per hour are determined by multiplying the emissions factors at 2.5 miles per hour by 2.5, in accordance with EPA guidance (*MOBILE6 Refers to Mobile5 User Information Sheet* #5 EPA, July 30, 1993).

Table I-7 MOBILE6.2.03 Input File for 2011

```
* Calendar Year 2011 Generic MOBILE6 input file for Mesoscale Build/No-Build Analyses
* Filename MA11_ALL.INP created by Craig Woleader, MADEP 617-348-4046, craig.woleader@state.ma.us and Marc Bennett, MADEP 617-292-5597,
marc.bennett@state.ma.us
* revised 12/2/05 to include actual diesel rebuild effects
* revised 12/17/08 to include new IM program for 2011
* revised 6/21/12 by Wayne Arner, KBE, for specific speeds
*
**********     Header Section     **********
MOBILE6 INPUT FILE
*
PARTICULATES      :
POLLUTANTS        : HC CO NOX CO2
DATABASE OUTPUT   :
WITH FIELDNAMES   :
AGGREGATED OUTPUT :
EMISSIONS TABLE   : MA11_MES.tb1 REPLACE
REPORT FILE       : MA11_MES.out REPLACE
*
RUN DATA
**********     Run Section #1     **********
> *** Summer 2011 ***

* Pollutant output format
EXPRESS HC AS VOC :
EXPAND BUS EFS    :

* Mass. specific user inputs -- require external data file
REG DIST          : 2005_REG.D
I/M DESC FILE     : 09NEWIM.D

* Set Diesel Rebuild effects to 10% as per EPA
REBUILD EFFECTS   : 0.10

STAGE II REFUELING :
91 3 84. 84.

* Inputs for LEV II
94+ LDG IMP       : MA_LEV2.D
T2 EXH PHASE-IN   : LEV2EXH.D
T2 EVAP PHASE-IN  : LEV2EVAP.D
T2 CERT           : LEV2CERT.D

* Meteorological inputs
MIN/MAX TEMP      : 70.4 93.7

* Fuel inputs
FUEL RVP          : 6.8
FUEL PROGRAM      : 2 N

DIESEL FRACTIONS  :
0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.003  0.003
0.002  0.002  0.002  0.002  0.001  0.001  0.001  0.000  0.001  0.001
0.003  0.001  0.002  0.000  0.015
0.001  0.001  0.001  0.001  0.001  0.001  0.001  0.001  0.001  0.001
0.001  0.001  0.001  0.000  0.001  0.001  0.001  0.001  0.001  0.001
0.002  0.002  0.003  0.003  0.006
0.001  0.001  0.001  0.001  0.001  0.001  0.001  0.001  0.001  0.001
0.001  0.001  0.001  0.000  0.001  0.001  0.001  0.001  0.001  0.001
0.002  0.002  0.003  0.003  0.006
0.005  0.005  0.005  0.005  0.005  0.005  0.005  0.005  0.005  0.005
0.005  0.005  0.006  0.005  0.012  0.012  0.017  0.015  0.014  0.016
0.017  0.014  0.018  0.016  0.021
0.005  0.005  0.005  0.005  0.005  0.005  0.005  0.005  0.005  0.005
0.005  0.005  0.006  0.005  0.012  0.012  0.017  0.015  0.014  0.016
0.017  0.014  0.018  0.016  0.021
0.176  0.176  0.176  0.176  0.176  0.176  0.176  0.176  0.170  0.207
```

Table I-7 MOBILE6.2.03 Input File for 2011

```
0.202   0.206   0.243   0.176   0.285   0.267   0.212   0.255   0.295   0.249
0.251   0.188   0.175   0.182   0.186
0.385   0.385   0.385   0.385   0.385   0.385   0.385   0.385   0.407   0.433
0.467   0.464   0.480   0.375   0.472   0.480   0.366   0.400   0.344   0.285
0.333   0.314   0.253   0.208   0.197
0.674   0.674   0.674   0.674   0.674   0.674   0.674   0.674   0.634   0.664
0.719   0.717   0.744   0.715   0.565   0.810   0.803   0.644   0.654   0.605
0.525   0.389   0.356   0.376   0.108
0.830   0.830   0.830   0.830   0.830   0.830   0.830   0.830   0.845   0.860
0.840   0.819   0.813   0.610   0.686   0.570   0.733   0.607   0.729   0.685
0.725   0.631   0.350   0.305   0.186
0.884   0.884   0.884   0.884   0.884   0.884   0.884   0.884   0.840   0.887
0.931   0.917   0.914   0.923   0.901   0.908   0.898   0.903   0.876   0.804
0.844   0.782   0.702   0.679   0.554
0.977   0.977   0.977   0.977   0.977   0.977   0.977   0.977   0.972   0.953
0.993   0.992   0.992   0.990   0.981   0.976   0.975   0.959   0.982   0.965
0.963   0.945   0.902   0.875   0.857
0.972   0.972   0.972   0.972   0.972   0.972   0.972   0.972   0.955   0.984
0.995   0.992   0.991   0.995   0.993   0.993   0.995   0.992   0.986   0.995
0.981   0.993   0.971   0.982   0.977
1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000
1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000
1.000   1.000   1.000   1.000   1.000
0.786   0.786   0.786   0.786   0.786   0.786   0.786   0.786   0.917   0.884
0.925   0.968   0.961   0.972   0.985   0.971   0.941   0.905   0.965   0.940
0.907   0.964   0.609   0.880   1.000


**********  Scenario Section  **********

SCENARIO RECORD  : 2011 Idle Scenario - Summer (multiply g/mi by 2.5 mph to get g/hr)
CALENDAR YEAR    : 2011
EVALUATION MONTH  : 7
PARTICULATE EF   : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE    : 10
DIESEL SULFUR    : 15
AVERAGE SPEED    : 2.5 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD  : 2011 5 mph - Summer
CALENDAR YEAR    : 2011
EVALUATION MONTH  : 7
PARTICULATE EF   : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE    : 10
DIESEL SULFUR    : 15
AVERAGE SPEED    : 5 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD  : 2011 10 mph - Summer
CALENDAR YEAR    : 2011
EVALUATION MONTH  : 7
PARTICULATE EF   : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE    : 10
DIESEL SULFUR    : 15
AVERAGE SPEED    : 10 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD  : 2011 15 mph - Summer
CALENDAR YEAR    : 2011
EVALUATION MONTH  : 7
PARTICULATE EF   : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE    : 10
DIESEL SULFUR    : 15
AVERAGE SPEED    : 15 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD  : 2011 20 mph - Summer
CALENDAR YEAR    : 2011
EVALUATION MONTH  : 7
PARTICULATE EF   : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
```

Table I-7 MOBILE6.2.03 Input File for 2011

```
PARTICLE SIZE     : 10
DIESEL SULFUR     : 15
AVERAGE SPEED     : 20 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD   : 2011 25 mph - Summer
CALENDAR YEAR     : 2011
EVALUATION MONTH  : 7
PARTICULATE EF    : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE     : 10
DIESEL SULFUR     : 15
AVERAGE SPEED     : 25 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD   : 2011 30 mph - Summer
CALENDAR YEAR     : 2011
EVALUATION MONTH  : 7
PARTICULATE EF    : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE     : 10
DIESEL SULFUR     : 15
AVERAGE SPEED     : 30 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD   : 2011 35 mph - Summer
CALENDAR YEAR     : 2011
EVALUATION MONTH  : 7
PARTICULATE EF    : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE     : 10
DIESEL SULFUR     : 15
AVERAGE SPEED     : 35 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD   : 2011 50 mph - Summer
CALENDAR YEAR     : 2011
EVALUATION MONTH  : 7
PARTICULATE EF    : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE     : 10
DIESEL SULFUR     : 15
AVERAGE SPEED     : 50 Arterial 0.0 100.0 0.0 0.0

**********    End of This Run    **********
END OF RUN
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
*******************************************************************************
* MOBILE6.2.03 (24-Sep-2003)                                                  *
* Input file: MA11_ALL.INP (file 1, run 1). *
*******************************************************************************
* *** Summer 2011 ***

* Reading Registration Distributions from the following external
* data file: 2005_REG.D
  M 49 Warning:
            1.00    MYR sum not = 1. (will normalize)
  M 49 Warning:
           0.998    MYR sum not = 1. (will normalize)
  M 49 Warning:
           0.998    MYR sum not = 1. (will normalize)
  M 49 Warning:
           0.998    MYR sum not = 1. (will normalize)
  M 49 Warning:
            1.00    MYR sum not = 1. (will normalize)
  M 49 Warning:
            1.00    MYR sum not = 1. (will normalize)
  M 49 Warning:
           0.999    MYR sum not = 1. (will normalize)
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
 M 49 Warning:
          0.998    MYR sum not = 1. (will normalize)
 M 49 Warning:
          1.00     MYR sum not = 1. (will normalize)
 M 49 Warning:
          0.999    MYR sum not = 1. (will normalize)
 M 49 Warning:
          1.00     MYR sum not = 1. (will normalize)
 M 49 Warning:
          1.00     MYR sum not = 1. (will normalize)
 M 49 Warning:
          1.00     MYR sum not = 1. (will normalize)
 M 49 Warning:
          1.00     MYR sum not = 1. (will normalize)

* Reading I/M program description records from the following external
* data file: 09NEWIM.D
* 15 Year Exemption Age
* New Annual OBD Exhaust I/M program for Light Duty MY 1996 through 2007 vehicles <=8,500 lb GVWR
* New Annual OBD Exhaust I/M program for Light Duty and Medium duty MY 2008 and later <=14,000 lb GVWR
* New Annual OBD Evap I/M program for Light Duty MY 1996 through 2007 vehicles <=8,500 lb GVWR
* New Annual OBD Evap I/M program for for Light Duty and Medium duty MY 2008 and later <=14,000 lb GVWR
 M601 Comment:
          User has enabled STAGE II REFUELING.

* Reading 94+ LEV IMPLEMENTATION SCHEDULE from the following external
* data file: MA_LEV2.D

 Reading User Supplied Tier2 Exhaust bin phase-in fractions

   Data read from file: LEV2EXH.D

 Reading User Supplied Tier2 EVAP phase-in fractions

   Data read from file: LEV2EVAP.D

 Reading User Supplied Tier2 50K certification standards

   Data read from file: LEV2CERT.D

 M616 Comment:
          User has supplied post-1999 sulfur levels.
 M614 Comment:
          User supplied diesel sale fractions.

*############################
* 2011 Idle Scenario - Summer (multiply g/mi by 2.5 mph to get g/hr)
* File 1, Run 1, Scenario 1.
*############################

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
* from the external data file PMDDR2.CSV
  M583 Warning:
          The user supplied arterial average speed of  2.5
          will be used for all hours of the day. 100% of VMT
          has been assigned to the arterial/collector roadway
          type for all hours of the day and all vehicle types.
*** I/M credits for Tech1&2 vehicles were read from the following external
    data file: TECH12.D
  M 48 Warning:
           there are no sales for vehicle class HDGV8b
 HDDV DEFEAT DEVICE EFFECTS ARE PRESENT. THE REBUILD FRACTION IS 0.10.

* Reading Ammonia (NH3) Basic Emission Rates
* from the external data file PMNH3BER.D

* Reading Ammonia (NH3) Sulfur Deterioration Rates
* from the external data file PMNH3SDR.D

 LEV phase-in data read from file MA_LEV2.D
                 Calendar Year:  2011
                       Month:  July
                    Altitude:  Low
            Minimum Temperature:  70.4 (F)
            Maximum Temperature:  93.7 (F)
              Absolute Humidity:  75. grains/lb
            Fuel Sulfur Content:  30. ppm

            Exhaust I/M Program:  Yes
              Evap I/M Program:  Yes
                 ATP Program:  No
              Reformulated Gas:  Yes

      Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
           GVWR:             <6000    >6000    (All)
                  ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
   VMT Distribution:   0.3163   0.3987   0.1568           0.0368   0.0002   0.0014   0.0858   0.0038   1.0000
 Fuel Economy (mpg):     24.1     18.5     14.2     17.1      9.9     31.6     18.4      7.3     50.0     16.3
 ---------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :     2.982    2.077    2.344    2.152    3.246    0.609    0.539    1.098    12.12    2.400
    Composite CO  :    14.34    11.47    12.98    11.90    29.49    4.174    1.598    6.583   120.29   13.260
    Composite NOX :     0.783    0.675    1.011    0.770    0.978    0.907    0.554    9.134    1.12    1.500
    Composite CO2 :   368.1    478.7    623.7    519.6    895.5    322.4    553.9   1401.7    177.4   559.89
 ---------------------------------------------------------------------------------------------------------------------------
        Veh. Type:    GasBUS     URBAN    SCHOOL
                   ------   ------   ------
         VMT Mix:    0.0003   0.0009   0.0015
 Fuel Economy (mpg):      6.4      4.3      6.2
---------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :     2.425     0.931     1.341
    Composite CO  :    47.72     10.308     6.109
    Composite NOX :     1.532    15.483    10.750
    Composite CO2 :  1375.1    2342.5    1646.7
---------------------------------------------------------------------------------------------------------------------------

*############################
* 2011 5 mph - Summer
* File 1, Run 1, Scenario 2.
*############################

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
 M583 Warning:
        The user supplied arterial average speed of  5.0
        will be used for all hours of the day. 100% of VMT
        has been assigned to the arterial/collector roadway
        type for all hours of the day and all vehicle types.
 M 48 Warning:
         there are no sales for vehicle class HDGV8b

LEV phase-in data read from file MA_LEV2.D
               Calendar Year:  2011
                    Month:  July
                  Altitude:  Low
          Minimum Temperature:  70.4 (F)
          Maximum Temperature:  93.7 (F)
           Absolute Humidity:   75. grains/lb
          Fuel Sulfur Content:   30. ppm

          Exhaust I/M Program:  Yes
            Evap I/M Program:  Yes
               ATP Program:  No
            Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
          GVWR:           <6000    >6000    (All)
                  ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3163   0.3987   0.1568           0.0368   0.0002   0.0014   0.0858   0.0038   1.0000
Fuel Economy (mpg):     24.1     18.5     14.2     17.1     9.9     31.6     18.4     7.3     50.0     16.3
 ---------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :     1.100    0.828    1.005    0.878    1.528   0.549    0.483    0.965    8.36    1.008
    Composite CO  :     8.47     7.28     8.20     7.54     23.56   3.523    1.339    5.374    71.17   8.471
    Composite NOX :     0.663    0.589    0.878    0.670    1.003   0.818    0.499    8.244    1.05    1.331
    Composite CO2 :   368.1    478.7    623.7    519.6    895.5   322.4    553.9    1401.7    177.4   559.89
 ---------------------------------------------------------------------------------------------------------------
       Veh. Type:   GasBUS    URBAN    SCHOOL
                  ------   ------   ------
        VMT Mix:   0.0003   0.0009   0.0015
Fuel Economy (mpg):      6.4      4.3      6.2
---------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :    1.455    0.818    1.178
    Composite CO  :   38.13     8.414    4.987
    Composite NOX :    1.572   13.893    9.628
    Composite CO2 :  1375.1   2342.5   1646.7
---------------------------------------------------------------------------------------------------------------

*##########################
* 2011 10 mph - Summer
* File 1, Run 1, Scenario 3.
*##########################

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
 M583 Warning:
        The user supplied arterial average speed of 10.0
        will be used for all hours of the day. 100% of VMT
        has been assigned to the arterial/collector roadway
        type for all hours of the day and all vehicle types.
 M 48 Warning:
         there are no sales for vehicle class HDGV8b

LEV phase-in data read from file MA_LEV2.D
              Calendar Year:  2011
                   Month:  July
                Altitude:  Low
          Minimum Temperature:  70.4 (F)
          Maximum Temperature:  93.7 (F)
           Absolute Humidity:  75. grains/lb
          Fuel Sulfur Content:  30. ppm

          Exhaust I/M Program:  Yes
            Evap I/M Program:  Yes
               ATP Program:  No
            Reformulated Gas:  Yes

    Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
          GVWR:            <6000    >6000    (All)
                 ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3163   0.3987   0.1568          0.0368   0.0002   0.0014   0.0858   0.0038   1.0000
Fuel Economy (mpg):     24.1     18.5     14.2     17.1      9.9     31.6     18.4      7.3     50.0     16.3
 ---------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
   Composite VOC :     0.625    0.487    0.604    0.520    0.925   0.455    0.395    0.757     5.51    0.607
   Composite CO  :     5.79     5.28     5.92     5.46    15.68    2.626    0.982    3.705    36.49    5.901
   Composite NOX :     0.513    0.476    0.714    0.543    1.054   0.683    0.416    6.897     1.00    1.099
   Composite CO2 :   368.1    478.7    623.7    519.6    895.5   322.4    553.9   1401.7    177.4   559.89
 ---------------------------------------------------------------------------------------------------------------
       Veh. Type:    GasBUS    URBAN    SCHOOL
                 ------   ------   ------
        VMT Mix:   0.0003   0.0009   0.0015
Fuel Economy (mpg):      6.4      4.3      6.2
---------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
   Composite VOC :     0.957    0.642    0.925
   Composite CO  :    25.37     5.802    3.439
   Composite NOX :     1.652   11.488    7.930
   Composite CO2 :  1375.1    2342.5   1646.7
---------------------------------------------------------------------------------------------------------------

*##########################
* 2011 15 mph - Summer
* File 1, Run 1, Scenario 4.
*##########################

* Reading PM Gas Carbon ZML Levels
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
 M583 Warning:
        The user supplied arterial average speed of 15.0
        will be used for all hours of the day. 100% of VMT
        has been assigned to the arterial/collector roadway
        type for all hours of the day and all vehicle types.
 M 48 Warning:
         there are no sales for vehicle class HDGV8b

LEV phase-in data read from file MA_LEV2.D
              Calendar Year:  2011
                    Month:  July
                 Altitude:  Low
          Minimum Temperature:  70.4 (F)
          Maximum Temperature:  93.7 (F)
           Absolute Humidity:  75. grains/lb
          Fuel Sulfur Content:  30. ppm

          Exhaust I/M Program:  Yes
            Evap I/M Program:  Yes
               ATP Program:  No
            Reformulated Gas:  Yes

    Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
         GVWR:           <6000    >6000    (All)
                ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
 VMT Distribution:   0.3163   0.3987   0.1568           0.0368   0.0002   0.0014   0.0858   0.0038   1.0000
Fuel Economy (mpg):     24.1     18.5     14.2     17.1      9.9     31.6     18.4      7.3     50.0     16.3
 ---------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
   Composite VOC :     0.511    0.395    0.487    0.421    0.699   0.387    0.332    0.608     4.54    0.491
   Composite CO  :      5.03     4.65     5.22     4.81    11.02   2.071    0.761    2.674    25.25    4.996
   Composite NOX :     0.423    0.405    0.613    0.463    1.105   0.591    0.360    5.976     1.01    0.949
   Composite CO2 :   368.1    478.7    623.7    519.6    895.5   322.4    553.9   1401.7    177.4   559.89
 ---------------------------------------------------------------------------------------------------------------
       Veh. Type:   GasBUS    URBAN    SCHOOL
                ------   ------   ------
        VMT Mix:   0.0003   0.0009   0.0015
Fuel Economy (mpg):      6.4      4.3      6.2
---------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
   Composite VOC :    0.723    0.515    0.742
   Composite CO  :    17.83    4.187    2.481
   Composite NOX :    1.732    9.843    6.769
   Composite CO2 :  1375.1   2342.5   1646.7
---------------------------------------------------------------------------------------------------------------

*##########################
* 2011 20 mph - Summer
* File 1, Run 1, Scenario 5.
*##########################
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
 M583 Warning:
        The user supplied arterial average speed of 20.0
        will be used for all hours of the day. 100% of VMT
        has been assigned to the arterial/collector roadway
        type for all hours of the day and all vehicle types.
 M 48 Warning:
         there are no sales for vehicle class HDGV8b

LEV phase-in data read from file MA_LEV2.D
              Calendar Year:  2011
                   Month:  July
                Altitude:  Low
          Minimum Temperature:  70.4 (F)
          Maximum Temperature:  93.7 (F)
           Absolute Humidity:  75. grains/lb
          Fuel Sulfur Content:  30. ppm

          Exhaust I/M Program:  Yes
            Evap I/M Program:  Yes
               ATP Program:  No
            Reformulated Gas:  Yes

    Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
         GVWR:           <6000    >6000    (All)
                  ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
 VMT Distribution:   0.3163   0.3987   0.1568           0.0368   0.0002   0.0014   0.0858   0.0038   1.0000
Fuel Economy (mpg):     24.1     18.5     14.2     17.1      9.9     31.6     18.4      7.3     50.0     16.3
 ---------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
   Composite VOC :     0.448    0.342    0.422    0.365    0.562   0.337    0.286    0.499     4.09    0.424
   Composite CO  :     4.59     4.29     4.82     4.44     8.18    1.719    0.621    2.019    20.08    4.474
   Composite NOX :     0.376    0.369    0.561    0.423    1.156   0.530    0.322    5.359     1.06    0.861
   Composite CO2 :    368.1    478.7    623.7    519.6    895.5   322.4    553.9   1401.7    177.4   559.89
 ---------------------------------------------------------------------------------------------------------------
       Veh. Type:    GasBUS     URBAN    SCHOOL
                  ------   ------   ------
        VMT Mix:    0.0003   0.0009   0.0015
Fuel Economy (mpg):      6.4      4.3      6.2
---------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
   Composite VOC :     0.576    0.423    0.609
   Composite CO  :    13.24     3.162    1.874
   Composite NOX :     1.811    8.743    5.992
   Composite CO2 :  1375.1    2342.5    1646.7
---------------------------------------------------------------------------------------------------------------

*##########################
* 2011 25 mph - Summer
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
* File 1, Run 1, Scenario 6.
*##########################

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
 M583 Warning:
        The user supplied arterial average speed of 25.0
        will be used for all hours of the day. 100% of VMT
        has been assigned to the arterial/collector roadway
        type for all hours of the day and all vehicle types.
 M 48 Warning:
         there are no sales for vehicle class HDGV8b

LEV phase-in data read from file MA_LEV2.D
                Calendar Year:  2011
                      Month:  July
                   Altitude:  Low
             Minimum Temperature:  70.4 (F)
             Maximum Temperature:  93.7 (F)
              Absolute Humidity:   75. grains/lb
             Fuel Sulfur Content:   30. ppm

             Exhaust I/M Program:  Yes
               Evap I/M Program:  Yes
                  ATP Program:  No
               Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
          GVWR:           <6000    >6000    (All)
                    ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3163   0.3987   0.1568           0.0368   0.0002   0.0014   0.0858   0.0038   1.0000
Fuel Economy (mpg):     24.1     18.5     14.2     17.1      9.9     31.6     18.4      7.3     50.0     16.3
 ---------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :     0.414    0.316    0.388    0.337    0.479   0.301    0.252    0.418     3.81    0.387
    Composite CO  :      4.40     4.14     4.66     4.29     6.42   1.491    0.530    1.596    16.91    4.214
    Composite NOX :     0.348    0.347    0.530    0.398    1.207   0.491    0.298    4.972     1.12    0.807
    Composite CO2 :     368.1    478.7    623.7    519.6    895.5   322.4    553.9   1401.7    177.4   559.89
 ---------------------------------------------------------------------------------------------------------------
        Veh. Type:    GasBUS     URBAN    SCHOOL
                    ------   ------   ------
         VMT Mix:   0.0003   0.0009   0.0015
Fuel Economy (mpg):      6.4      4.3      6.2
---------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :     0.487    0.354    0.511
    Composite CO  :     10.39    2.499    1.481
    Composite NOX :     1.891    8.051    5.504
    Composite CO2 :    1375.1   2342.5   1646.7
---------------------------------------------------------------------------------------------------------------
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
* ##########################
* 2011 30 mph - Summer
* File 1, Run 1, Scenario 7.
* ##########################

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
 M583 Warning:
        The user supplied arterial average speed of 30.0
        will be used for all hours of the day. 100% of VMT
        has been assigned to the arterial/collector roadway
        type for all hours of the day and all vehicle types.
 M 48 Warning:
         there are no sales for vehicle class HDGV8b

LEV phase-in data read from file MA_LEV2.D
               Calendar Year:  2011
                     Month:  July
                  Altitude:  Low
          Minimum Temperature:  70.4 (F)
          Maximum Temperature:  93.7 (F)
           Absolute Humidity:  75. grains/lb
          Fuel Sulfur Content:  30. ppm

          Exhaust I/M Program:  Yes
            Evap I/M Program:  Yes
                ATP Program:  No
            Reformulated Gas:  Yes

    Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
          GVWR:            <6000    >6000    (All)
                  ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
 VMT Distribution:   0.3163   0.3987   0.1568           0.0368   0.0002   0.0014   0.0858   0.0038   1.0000
Fuel Economy (mpg):     24.1     18.5     14.2     17.1      9.9     31.6     18.4      7.3     50.0     16.3
 ---------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
   Composite VOC :     0.392    0.300    0.368    0.319    0.423    0.274    0.227    0.358     3.60    0.362
   Composite CO  :     4.36     4.12     4.62     4.26     5.32    1.343    0.471    1.320    14.61    4.111
   Composite NOX :     0.328    0.332    0.509    0.382    1.258    0.471    0.286    4.769     1.17    0.776
   Composite CO2 :    368.1    478.7    623.7    519.6    895.5    322.4    553.9   1401.7    177.4   559.89
 ---------------------------------------------------------------------------------------------------------------
       Veh. Type:   GasBUS    URBAN    SCHOOL
                  ------   ------   ------
        VMT Mix:   0.0003   0.0009   0.0015
Fuel Economy (mpg):      6.4      4.3      6.2
---------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
   Composite VOC :     0.427    0.304    0.438
   Composite CO  :     8.61     2.067    1.225
   Composite NOX :     1.971    7.689    5.248
   Composite CO2 :  1375.1    2342.5    1646.7
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
---------------------------------------------------------------------------------------------------------------------

*##########################
* 2011 35 mph - Summer
* File 1, Run 1, Scenario 8.
*##########################

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
 M583 Warning:
        The user supplied arterial average speed of 35.0
        will be used for all hours of the day. 100% of VMT
        has been assigned to the arterial/collector roadway
        type for all hours of the day and all vehicle types.
 M 48 Warning:
         there are no sales for vehicle class HDGV8b

LEV phase-in data read from file MA_LEV2.D
               Calendar Year:  2011
                     Month:  July
                  Altitude:  Low
          Minimum Temperature:  70.4 (F)
          Maximum Temperature:  93.7 (F)
           Absolute Humidity:  75. grains/lb
          Fuel Sulfur Content:  30. ppm

          Exhaust I/M Program:  Yes
            Evap I/M Program:  Yes
               ATP Program:  No
            Reformulated Gas:  Yes

    Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
         GVWR:           <6000    >6000    (All)
                  ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
 VMT Distribution:   0.3163   0.3987   0.1568           0.0368   0.0002   0.0014   0.0858   0.0038   1.0000
Fuel Economy (mpg):     24.1     18.5     14.2     17.1      9.9     31.6     18.4      7.3     50.0     16.3
 ---------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
   Composite VOC :     0.376    0.288    0.353    0.307    0.385   0.254    0.208    0.314     3.44    0.344
   Composite CO  :     4.43     4.18     4.69     4.33     4.66    1.247    0.433    1.143    12.91    4.125
   Composite NOX :     0.316    0.325    0.499    0.374    1.308   0.467    0.283    4.728     1.22    0.767
   Composite CO2 :   368.1    478.7    623.7    519.6    895.5   322.4    553.9   1401.7    177.4   559.89
 ---------------------------------------------------------------------------------------------------------------------
       Veh. Type:   GasBUS    URBAN    SCHOOL
                  ------   ------   ------
        VMT Mix:   0.0003   0.0009   0.0015
Fuel Economy (mpg):      6.4      4.3      6.2
---------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
   Composite VOC :    0.386    0.266    0.384
   Composite CO  :     7.54     1.790    1.061
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
    Composite NOX :    2.050    7.616    5.196
    Composite CO2 :  1375.1   2342.5   1646.7
-------------------------------------------------------------------------------------------------------------------

*##########################
* 2011 50 mph - Summer
* File 1, Run 1, Scenario 9.
*##########################

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
 M583 Warning:
        The user supplied arterial average speed of 50.0
        will be used for all hours of the day. 100% of VMT
        has been assigned to the arterial/collector roadway
        type for all hours of the day and all vehicle types.
 M 48 Warning:
         there are no sales for vehicle class HDGV8b

LEV phase-in data read from file MA_LEV2.D
              Calendar Year:  2011
                   Month:  July
                Altitude:  Low
          Minimum Temperature:  70.4 (F)
          Maximum Temperature:  93.7 (F)
           Absolute Humidity:   75. grains/lb
          Fuel Sulfur Content:   30. ppm

          Exhaust I/M Program:  Yes
            Evap I/M Program:  Yes
               ATP Program:  No
            Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
          GVWR:              <6000    >6000     (All)
                    ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3163   0.3987   0.1568           0.0368   0.0002   0.0014   0.0858   0.0038   1.0000
Fuel Economy (mpg):     24.1     18.5     14.2     17.1      9.9     31.6     18.4      7.3     50.0     16.3
 ---------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
    Composite VOC :     0.350    0.274    0.333    0.291    0.322   0.221    0.177    0.241    3.24    0.318
    Composite CO  :     5.26     4.94     5.48     5.09     4.36    1.156    0.397    0.974    10.68    4.776
    Composite NOX :     0.332    0.345    0.522    0.395    1.461   0.556    0.338    5.622    1.34    0.867
    Composite CO2 :   368.1    478.7    623.7    519.6    895.5   322.4    553.9   1401.7    177.4   559.89
 ---------------------------------------------------------------------------------------------------------------
       Veh. Type:   GasBUS    URBAN    SCHOOL
                    ------   ------   ------
         VMT Mix:   0.0003   0.0009   0.0015
Fuel Economy (mpg):      6.4      4.3      6.2
---------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
    Composite VOC :    0.324    0.205    0.295
    Composite CO  :    7.05     1.525    0.904
    Composite NOX :    2.290    9.212    6.323
    Composite CO2 :  1375.1   2342.5   1646.7
-------------------------------------------------------------------------------------------------------------------
 ********************************************************************************
* MOBILE6.2.03 (24-Sep-2003)                                                    *
* Input file: MA11_ALL.INP (file 1, run 1). *
 ********************************************************************************

*##########################
* 2011 Idle Scenario - Summer (multiply g/mi by 2.5 mph to get g/hr)
* File 1, Run 1, Scenario 1.
*##########################

                    Calendar Year:  2011
                           Month:  July
          Gasoline Fuel Sulfur Content:   30. ppm
           Diesel Fuel Sulfur Content:   15. ppm
                Particle Size Cutoff: 10.00 Microns
                  Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
          GVWR:           <6000    >6000    (All)
                 ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3163   0.3987   0.1568          0.0368   0.0002   0.0014   0.0858   0.0038   1.0000
 -------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
           Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
          GASPM:   0.0039   0.0037   0.0037   0.0037   0.0258   ------   ------   ------   0.0205   0.0043
        ECARBON:   ------   ------   ------   ------   ------   0.0776   0.0139   0.0817   ------   0.0071
        OCARBON:   ------   ------   ------   ------   ------   0.0219   0.0200   0.0408   ------   0.0035
            SO4:   0.0005   0.0006   0.0006   0.0006   0.0013   0.0002   0.0003   0.0009   0.0002   0.0006
  Total Exhaust PM:   0.0044   0.0043   0.0043   0.0043   0.0271   0.0996   0.0342   0.1234   0.0207   0.0155
          Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125
           Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0080   0.0080   0.0248   0.0040   0.0094
        Total PM:   0.0249   0.0249   0.0249   0.0249   0.0482   0.1202   0.0547   0.1608   0.0372   0.0375
            SO2:   0.0067   0.0087   0.0115   0.0095   0.0164   0.0030   0.0052   0.0131   0.0033   0.0091
            NH3:   0.1012   0.1016   0.1017   0.1016   0.0451   0.0068   0.0068   0.0270   0.0113   0.0925
 -------------------------------------------------------------------------------------------------------------------
       Veh. Type:   GasBUS    URBAN    SCHOOL
                  ------   ------   ------
        VMT Mix:   0.0003   0.0009   0.0015
 -------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
           Lead:   0.0000   ------   ------
          GASPM:   0.0349   ------   ------
        ECARBON:   ------   0.1046   0.0623
        OCARBON:   ------   0.0822   0.0490
            SO4:   0.0013   0.0015   0.0011
  Total Exhaust PM:   0.0362   0.1882   0.1124
          Brake:   0.0125   0.0125   0.0125
           Tire:   0.0120   0.0120   0.0120
        Total PM:   0.0607   0.2128   0.1369
            SO2:   0.0253   0.0218   0.0153
            NH3:   0.0451   0.0270   0.0270
 -------------------------------------------------------------------------------------------------------------------

*##########################
* 2011 5 mph - Summer
* File 1, Run 1, Scenario 2.
*##########################

                    Calendar Year:  2011
                           Month:  July
          Gasoline Fuel Sulfur Content:   30. ppm
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
            Diesel Fuel Sulfur Content:   15. ppm
                Particle Size Cutoff: 10.00 Microns
                  Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
          GVWR:           <6000    >6000    (All)
                 ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3163   0.3987   0.1568          0.0368   0.0002   0.0014   0.0858   0.0038   1.0000
-------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
          Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
         GASPM:   0.0039   0.0037   0.0037   0.0037   0.0258   ------   ------   ------   0.0205   0.0043
        ECARBON:   ------   ------   ------   ------   ------   0.0776   0.0139   0.0817   ------   0.0071
        OCARBON:   ------   ------   ------   ------   ------   0.0219   0.0200   0.0408   ------   0.0035
           SO4:   0.0005   0.0006   0.0006   0.0006   0.0013   0.0002   0.0003   0.0009   0.0002   0.0006
  Total Exhaust PM:   0.0044   0.0043   0.0043   0.0043   0.0271   0.0996   0.0342   0.1234   0.0207   0.0155
         Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125
          Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0080   0.0080   0.0248   0.0040   0.0094
        Total PM:   0.0249   0.0249   0.0249   0.0249   0.0482   0.1202   0.0547   0.1608   0.0372   0.0375
           SO2:   0.0067   0.0087   0.0115   0.0095   0.0164   0.0030   0.0052   0.0131   0.0033   0.0091
           NH3:   0.1012   0.1016   0.1017   0.1016   0.0451   0.0068   0.0068   0.0270   0.0113   0.0925
-------------------------------------------------------------------------------------------------------------------
       Veh. Type:   GasBUS    URBAN    SCHOOL
                 ------   ------   ------
        VMT Mix:   0.0003   0.0009   0.0015
-------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
          Lead:   0.0000   ------   ------
         GASPM:   0.0349   ------   ------
        ECARBON:   ------   0.1046   0.0623
        OCARBON:   ------   0.0822   0.0490
           SO4:   0.0013   0.0015   0.0011
  Total Exhaust PM:   0.0362   0.1882   0.1124
         Brake:   0.0125   0.0125   0.0125
          Tire:   0.0120   0.0120   0.0120
        Total PM:   0.0607   0.2128   0.1369
           SO2:   0.0253   0.0218   0.0153
           NH3:   0.0451   0.0270   0.0270
-------------------------------------------------------------------------------------------------------------------

*############################
* 2011 10 mph - Summer
* File 1, Run 1, Scenario 3.
*############################

                    Calendar Year:  2011
                        Month:  July
            Gasoline Fuel Sulfur Content:   30. ppm
             Diesel Fuel Sulfur Content:   15. ppm
                Particle Size Cutoff: 10.00 Microns
                  Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
          GVWR:           <6000    >6000    (All)
                 ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3163   0.3987   0.1568          0.0368   0.0002   0.0014   0.0858   0.0038   1.0000
-------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
          Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
         GASPM:   0.0039   0.0037   0.0037   0.0037   0.0258   ------   ------   ------   0.0205   0.0043
        ECARBON:   ------   ------   ------   ------   ------   0.0776   0.0139   0.0817   ------   0.0071
        OCARBON:   ------   ------   ------   ------   ------   0.0219   0.0200   0.0408   ------   0.0035
           SO4:   0.0005   0.0006   0.0006   0.0006   0.0013   0.0002   0.0003   0.0009   0.0002   0.0006
  Total Exhaust PM:   0.0044   0.0043   0.0043   0.0043   0.0271   0.0996   0.0342   0.1234   0.0207   0.0155
         Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125
          Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0080   0.0080   0.0248   0.0040   0.0094
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
        Total PM:   0.0249   0.0249   0.0249   0.0249   0.0482   0.1202   0.0547   0.1608   0.0372   0.0375
           SO2:   0.0067   0.0087   0.0115   0.0095   0.0164   0.0030   0.0052   0.0131   0.0033   0.0091
           NH3:   0.1012   0.1016   0.1017   0.1016   0.0451   0.0068   0.0068   0.0270   0.0113   0.0925
-------------------------------------------------------------------------------------------------------------------------------
       Veh. Type:   GasBUS    URBAN    SCHOOL
                    ------   ------   ------
        VMT Mix:   0.0003   0.0009   0.0015
-------------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
           Lead:   0.0000   ------   ------
          GASPM:   0.0349   ------   ------
        ECARBON:   ------   0.1046   0.0623
        OCARBON:   ------   0.0822   0.0490
           SO4:   0.0013   0.0015   0.0011
  Total Exhaust PM:   0.0362   0.1882   0.1124
          Brake:   0.0125   0.0125   0.0125
           Tire:   0.0120   0.0120   0.0120
        Total PM:   0.0607   0.2128   0.1369
           SO2:   0.0253   0.0218   0.0153
           NH3:   0.0451   0.0270   0.0270
-------------------------------------------------------------------------------------------------------------------------------

*############################
* 2011 15 mph - Summer
* File 1, Run 1, Scenario 4.
*############################

                      Calendar Year:  2011
                              Month:  July
            Gasoline Fuel Sulfur Content:   30. ppm
             Diesel Fuel Sulfur Content:   15. ppm
                 Particle Size Cutoff: 10.00 Microns
                    Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
          GVWR:           <6000    >6000    (All)
                    ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3163   0.3987   0.1568           0.0368   0.0002   0.0014   0.0858   0.0038   1.0000
-------------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
           Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
          GASPM:   0.0039   0.0037   0.0037   0.0037   0.0258   ------   ------   ------   0.0205   0.0043
        ECARBON:   ------   ------   ------   ------   ------   0.0776   0.0139   0.0817   ------   0.0071
        OCARBON:   ------   ------   ------   ------   ------   0.0219   0.0200   0.0408   ------   0.0035
           SO4:   0.0005   0.0006   0.0006   0.0006   0.0013   0.0002   0.0003   0.0009   0.0002   0.0006
  Total Exhaust PM:   0.0044   0.0043   0.0043   0.0043   0.0271   0.0996   0.0342   0.1234   0.0207   0.0155
          Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125
           Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0080   0.0080   0.0248   0.0040   0.0094
        Total PM:   0.0249   0.0249   0.0249   0.0249   0.0482   0.1202   0.0547   0.1608   0.0372   0.0375
           SO2:   0.0067   0.0087   0.0115   0.0095   0.0164   0.0030   0.0052   0.0131   0.0033   0.0091
           NH3:   0.1012   0.1016   0.1017   0.1016   0.0451   0.0068   0.0068   0.0270   0.0113   0.0925
-------------------------------------------------------------------------------------------------------------------------------
       Veh. Type:   GasBUS    URBAN    SCHOOL
                    ------   ------   ------
        VMT Mix:   0.0003   0.0009   0.0015
-------------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
           Lead:   0.0000   ------   ------
          GASPM:   0.0349   ------   ------
        ECARBON:   ------   0.1046   0.0623
        OCARBON:   ------   0.0822   0.0490
           SO4:   0.0013   0.0015   0.0011
  Total Exhaust PM:   0.0362   0.1882   0.1124
          Brake:   0.0125   0.0125   0.0125
           Tire:   0.0120   0.0120   0.0120
        Total PM:   0.0607   0.2128   0.1369
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
          SO2:   0.0253   0.0218   0.0153
          NH3:   0.0451   0.0270   0.0270
 ---------------------------------------------------------------------------------------------------------------------

 *##########################
 * 2011 20 mph - Summer
 * File 1, Run 1, Scenario 5.
 *##########################

                     Calendar Year:  2011
                          Month:  July
              Gasoline Fuel Sulfur Content:   30. ppm
               Diesel Fuel Sulfur Content:   15. ppm
                   Particle Size Cutoff: 10.00 Microns
                     Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
          GVWR:           <6000    >6000    (All)
                 ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3163   0.3987   0.1568          0.0368   0.0002   0.0014   0.0858   0.0038   1.0000
 ---------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
          Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
         GASPM:   0.0039   0.0037   0.0037   0.0037   0.0258   ------   ------   ------   0.0205   0.0043
        ECARBON:   ------   ------   ------   ------   ------   0.0776   0.0139   0.0817   ------   0.0071
        OCARBON:   ------   ------   ------   ------   ------   0.0219   0.0200   0.0408   ------   0.0035
           SO4:   0.0005   0.0006   0.0006   0.0006   0.0013   0.0002   0.0003   0.0009   0.0002   0.0006
  Total Exhaust PM:   0.0044   0.0043   0.0043   0.0043   0.0271   0.0996   0.0342   0.1234   0.0207   0.0155
          Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125
           Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0080   0.0080   0.0248   0.0040   0.0094
         Total PM:   0.0249   0.0249   0.0249   0.0249   0.0482   0.1202   0.0547   0.1608   0.0372   0.0375
           SO2:   0.0067   0.0088   0.0115   0.0095   0.0164   0.0030   0.0052   0.0131   0.0033   0.0091
           NH3:   0.1012   0.1016   0.1017   0.1016   0.0451   0.0068   0.0068   0.0270   0.0113   0.0925
 ---------------------------------------------------------------------------------------------------------------------
       Veh. Type:   GasBUS    URBAN    SCHOOL
                  ------   ------   ------
         VMT Mix:   0.0003   0.0009   0.0015
 ---------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
          Lead:   0.0000   ------   ------
         GASPM:   0.0349   ------   ------
        ECARBON:   ------   0.1046   0.0623
        OCARBON:   ------   0.0822   0.0490
           SO4:   0.0013   0.0015   0.0011
  Total Exhaust PM:   0.0362   0.1882   0.1124
          Brake:   0.0125   0.0125   0.0125
           Tire:   0.0120   0.0120   0.0120
         Total PM:   0.0607   0.2128   0.1369
           SO2:   0.0253   0.0218   0.0153
           NH3:   0.0451   0.0270   0.0270
 ---------------------------------------------------------------------------------------------------------------------

 *##########################
 * 2011 25 mph - Summer
 * File 1, Run 1, Scenario 6.
 *##########################

                     Calendar Year:  2011
                          Month:  July
              Gasoline Fuel Sulfur Content:   30. ppm
               Diesel Fuel Sulfur Content:   15. ppm
                   Particle Size Cutoff: 10.00 Microns
                     Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
          GVWR:           <6000    >6000    (All)
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
                ------  ------  ------  ------  ------  ------  ------  ------  ------  ------
 VMT Distribution:   0.3163  0.3987  0.1568          0.0368  0.0002  0.0014  0.0858  0.0038  1.0000
-------------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
          Lead:  0.0000  0.0000  0.0000  0.0000  0.0000  ------  ------  ------  0.0000  0.0000
        GASPM:  0.0039  0.0038  0.0038  0.0038  0.0257  ------  ------  ------  0.0205  0.0044
      ECARBON:  ------  ------  ------  ------  ------  0.0776  0.0139  0.0817  ------  0.0071
      OCARBON:  ------  ------  ------  ------  ------  0.0219  0.0200  0.0408  ------  0.0035
          SO4:  0.0004  0.0005  0.0005  0.0005  0.0015  0.0002  0.0003  0.0009  0.0001  0.0006
 Total Exhaust PM:  0.0043  0.0043  0.0043  0.0043  0.0272  0.0996  0.0342  0.1234  0.0206  0.0155
        Brake:  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125
         Tire:  0.0080  0.0080  0.0080  0.0080  0.0085  0.0080  0.0080  0.0248  0.0040  0.0094
      Total PM:  0.0249  0.0249  0.0249  0.0249  0.0483  0.1202  0.0547  0.1608  0.0372  0.0375
          SO2:  0.0067  0.0088  0.0115  0.0095  0.0163  0.0030  0.0052  0.0131  0.0033  0.0092
          NH3:  0.1012  0.1016  0.1017  0.1016  0.0451  0.0068  0.0068  0.0270  0.0113  0.0925
-------------------------------------------------------------------------------------------------------------------------
      Veh. Type:  GasBUS   URBAN   SCHOOL
                ------  ------  ------
       VMT Mix:  0.0003  0.0009  0.0015
-------------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
          Lead:  0.0000  ------  ------
        GASPM:  0.0347  ------  ------
      ECARBON:  ------  0.1046  0.0623
      OCARBON:  ------  0.0822  0.0490
          SO4:  0.0015  0.0015  0.0011
 Total Exhaust PM:  0.0363  0.1882  0.1124
        Brake:  0.0125  0.0125  0.0125
         Tire:  0.0120  0.0120  0.0120
      Total PM:  0.0608  0.2128  0.1369
          SO2:  0.0253  0.0218  0.0153
          NH3:  0.0451  0.0270  0.0270
-------------------------------------------------------------------------------------------------------------------------

*############################
* 2011 30 mph - Summer
* File 1, Run 1, Scenario 7.
*############################

                    Calendar Year:  2011
                         Month:  July
              Gasoline Fuel Sulfur Content:  30. ppm
               Diesel Fuel Sulfur Content:  15. ppm
                  Particle Size Cutoff: 10.00 Microns
                    Reformulated Gas:  Yes

    Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
         GVWR:           <6000    >6000    (All)
                ------  ------  ------  ------  ------  ------  ------  ------  ------  ------
 VMT Distribution:   0.3163  0.3987  0.1568          0.0368  0.0002  0.0014  0.0858  0.0038  1.0000
-------------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
          Lead:  0.0000  0.0000  0.0000  0.0000  0.0000  ------  ------  ------  0.0000  0.0000
        GASPM:  0.0040  0.0038  0.0038  0.0038  0.0255  ------  ------  ------  0.0205  0.0044
      ECARBON:  ------  ------  ------  ------  ------  0.0776  0.0139  0.0817  ------  0.0071
      OCARBON:  ------  ------  ------  ------  ------  0.0219  0.0200  0.0408  ------  0.0035
          SO4:  0.0003  0.0005  0.0005  0.0005  0.0017  0.0002  0.0003  0.0009  0.0001  0.0005
 Total Exhaust PM:  0.0043  0.0043  0.0043  0.0043  0.0273  0.0996  0.0342  0.1234  0.0206  0.0155
        Brake:  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125
         Tire:  0.0080  0.0080  0.0080  0.0080  0.0085  0.0080  0.0080  0.0248  0.0040  0.0094
      Total PM:  0.0248  0.0249  0.0249  0.0249  0.0483  0.1202  0.0547  0.1608  0.0371  0.0375
          SO2:  0.0067  0.0088  0.0115  0.0096  0.0162  0.0030  0.0052  0.0131  0.0033  0.0092
          NH3:  0.1012  0.1016  0.1017  0.1016  0.0451  0.0068  0.0068  0.0270  0.0113  0.0925
-------------------------------------------------------------------------------------------------------------------------
      Veh. Type:  GasBUS   URBAN   SCHOOL
                ------  ------  ------
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
        VMT Mix:   0.0003   0.0009   0.0015
-------------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
           Lead:   0.0000   ------   ------
          GASPM:   0.0346   ------   ------
        ECARBON:   ------   0.1046   0.0623
        OCARBON:   ------   0.0822   0.0490
            SO4:   0.0017   0.0015   0.0011
  Total Exhaust PM:   0.0364   0.1882   0.1124
          Brake:   0.0125   0.0125   0.0125
           Tire:   0.0120   0.0120   0.0120
       Total PM:   0.0609   0.2128   0.1369
            SO2:   0.0252   0.0218   0.0153
            NH3:   0.0451   0.0270   0.0270
-------------------------------------------------------------------------------------------------------------------------------

*############################
* 2011 35 mph - Summer
* File 1, Run 1, Scenario 8.
*############################

                    Calendar Year:  2011
                            Month:  July
          Gasoline Fuel Sulfur Content:   30. ppm
           Diesel Fuel Sulfur Content:   15. ppm
                Particle Size Cutoff: 10.00 Microns
                  Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
          GVWR:           <6000    >6000    (All)
                 ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3163   0.3987   0.1568           0.0368   0.0002   0.0014   0.0858   0.0038   1.0000
-------------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
           Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
          GASPM:   0.0040   0.0039   0.0039   0.0039   0.0254   ------   ------   ------   0.0205   0.0044
        ECARBON:   ------   ------   ------   ------   ------   0.0776   0.0139   0.0817   ------   0.0071
        OCARBON:   ------   ------   ------   ------   ------   0.0219   0.0200   0.0408   ------   0.0035
            SO4:   0.0002   0.0004   0.0004   0.0004   0.0019   0.0002   0.0003   0.0009   0.0001   0.0005
  Total Exhaust PM:   0.0043   0.0043   0.0043   0.0043   0.0273   0.0996   0.0342   0.1234   0.0206   0.0155
          Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125
           Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0080   0.0080   0.0248   0.0040   0.0094
       Total PM:   0.0248   0.0249   0.0248   0.0249   0.0484   0.1202   0.0547   0.1608   0.0371   0.0375
            SO2:   0.0067   0.0088   0.0115   0.0096   0.0162   0.0030   0.0052   0.0131   0.0033   0.0092
            NH3:   0.1012   0.1016   0.1017   0.1016   0.0451   0.0068   0.0068   0.0270   0.0113   0.0925
-------------------------------------------------------------------------------------------------------------------------------
      Veh. Type:   GasBUS    URBAN    SCHOOL
                 ------   ------   ------
        VMT Mix:   0.0003   0.0009   0.0015
-------------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
           Lead:   0.0000   ------   ------
          GASPM:   0.0345   ------   ------
        ECARBON:   ------   0.1046   0.0623
        OCARBON:   ------   0.0822   0.0490
            SO4:   0.0019   0.0015   0.0011
  Total Exhaust PM:   0.0364   0.1882   0.1124
          Brake:   0.0125   0.0125   0.0125
           Tire:   0.0120   0.0120   0.0120
       Total PM:   0.0610   0.2128   0.1369
            SO2:   0.0251   0.0218   0.0153
            NH3:   0.0451   0.0270   0.0270
-------------------------------------------------------------------------------------------------------------------------------

*############################
* 2011 50 mph - Summer
```

Table I-8 MOBILE6.2.03 Output Files for 2011

```
* File 1, Run 1, Scenario 9.
*##########################

                    Calendar Year:  2011
                           Month:  July
          Gasoline Fuel Sulfur Content:  30. ppm
            Diesel Fuel Sulfur Content:  15. ppm
                Particle Size Cutoff: 10.00 Microns
                  Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
          GVWR:           <6000    >6000    (All)
                 ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.3163   0.3987   0.1568           0.0368   0.0002   0.0014   0.0858   0.0038   1.0000
 ---------------------------------------------------------------------------------------------------------------
  Composite Emission Factors (g/mi):
           Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
          GASPM:   0.0040   0.0039   0.0039   0.0039   0.0254   ------   ------   ------   0.0205   0.0044
        ECARBON:   ------   ------   ------   ------   ------   0.0776   0.0139   0.0817   ------   0.0071
        OCARBON:   ------   ------   ------   ------   ------   0.0219   0.0200   0.0408   ------   0.0035
            SO4:   0.0002   0.0004   0.0004   0.0004   0.0019   0.0002   0.0003   0.0009   0.0001   0.0005
  Total Exhaust PM:   0.0043   0.0043   0.0043   0.0043   0.0273   0.0996   0.0342   0.1234   0.0206   0.0155
           Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125
            Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0080   0.0080   0.0248   0.0040   0.0094
        Total PM:   0.0248   0.0249   0.0248   0.0249   0.0484   0.1202   0.0547   0.1608   0.0371   0.0375
             SO2:   0.0067   0.0088   0.0115   0.0096   0.0162   0.0030   0.0052   0.0131   0.0033   0.0092
             NH3:   0.1012   0.1016   0.1017   0.1016   0.0451   0.0068   0.0068   0.0270   0.0113   0.0925
 ---------------------------------------------------------------------------------------------------------------
        Veh. Type:   GasBUS    URBAN    SCHOOL
                   ------   ------   ------
         VMT Mix:   0.0003   0.0009   0.0015
 ---------------------------------------------------------------------------------------------------------------
  Composite Emission Factors (g/mi):
           Lead:   0.0000   ------   ------
          GASPM:   0.0345   ------   ------
        ECARBON:   ------   0.1046   0.0623
        OCARBON:   ------   0.0822   0.0490
            SO4:   0.0019   0.0015   0.0011
  Total Exhaust PM:   0.0364   0.1882   0.1124
           Brake:   0.0125   0.0125   0.0125
            Tire:   0.0120   0.0120   0.0120
        Total PM:   0.0610   0.2128   0.1369
             SO2:   0.0251   0.0218   0.0153
             NH3:   0.0451   0.0270   0.0270
 ---------------------------------------------------------------------------------------------------------------
```

Source: KBE and Massport.

Table I-9 MOBILE6.2.03 Input File for 2030

```
* Calendar Year 2030 Generic MOBILE6 input file for Mesoscale Build/No-Build Analyses
* Filename MA30_ALL.INP created by Craig Woleader, MADEP 617-348-4046, craig.woleader@state.ma.us and Marc Bennett, MADEP 617-292-5597,
marc.bennett@state.ma.us
* revised 12/2/05 to include actual diesel rebuild effects
* revised 12/17/08 to include new IM program  for 2030
* revised 11/1/09 to update diesel fractions
* revised 8/28/12 by Wayne Arner, KBE, for specific speeds
*
**********     Header Section     **********
MOBILE6 INPUT FILE
*
PARTICULATES      :
POLLUTANTS        : HC CO NOX CO2
DATABASE OUTPUT   :
WITH FIELDNAMES   :
AGGREGATED OUTPUT :
EMISSIONS TABLE   : MA30_MES.tb1 REPLACE
REPORT FILE       : MA30_MES.txt REPLACE
*
RUN DATA
**********     Run Section #1    **********
> *** Summer 2030 ***

* Pollutant output format
EXPRESS HC AS VOC  :
EXPAND BUS EFS     :

* Mass. specific user inputs -- require external data file
REG DIST          : 2005_REG.D
I/M DESC FILE     : 09NEWIM.D

* Set Diesel Rebuild effects to 10% as per EPA
REBUILD EFFECTS   : 0.10

STAGE II REFUELING :
91 3 84. 84.

* Inputs for LEV II
94+ LDG IMP       : MA_LEV2.D
T2 EXH PHASE-IN   : LEV2EXH.D
T2 EVAP PHASE-IN  : LEV2EVAP.D
T2 CERT           : LEV2CERT.D

* Meteorological inputs
MIN/MAX TEMP      : 70.4 93.7

* Fuel inputs
FUEL RVP          : 6.8
FUEL PROGRAM      : 2 N

DIESEL FRACTIONS  :
0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000
0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000
0.000   0.000   0.000   0.000   0.000
0.001   0.001   0.001   0.001   0.001   0.001   0.001   0.001   0.001   0.001
0.001   0.001   0.001   0.001   0.001   0.001   0.001   0.001   0.001   0.001
0.001   0.001   0.001   0.001   0.001
0.001   0.001   0.001   0.001   0.001   0.001   0.001   0.001   0.001   0.001
0.001   0.001   0.001   0.001   0.001   0.001   0.001   0.001   0.001   0.001
0.001   0.001   0.001   0.001   0.001
0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
0.005   0.005   0.005   0.005   0.005
0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005   0.005
0.005   0.005   0.005   0.005   0.005
```

Table I-9 MOBILE6.2.03 Input File for 2030

```
0.176  0.176  0.176  0.176  0.176  0.176  0.176  0.176  0.176  0.176
0.176  0.176  0.176  0.176  0.176  0.176  0.176  0.176  0.176  0.176
0.176  0.176  0.176  0.176  0.176
0.385  0.385  0.385  0.385  0.385  0.385  0.385  0.385  0.385  0.385
0.385  0.385  0.385  0.385  0.385  0.385  0.385  0.385  0.385  0.385
0.385  0.385  0.385  0.385  0.385
0.674  0.674  0.674  0.674  0.674  0.674  0.674  0.674  0.674  0.674
0.674  0.674  0.674  0.674  0.674  0.674  0.674  0.674  0.674  0.674
0.674  0.674  0.674  0.674  0.674
0.830  0.830  0.830  0.830  0.830  0.830  0.830  0.830  0.830  0.830
0.830  0.830  0.830  0.830  0.830  0.830  0.830  0.830  0.830  0.830
0.830  0.830  0.830  0.830  0.830
0.884  0.884  0.884  0.884  0.884  0.884  0.884  0.884  0.884  0.884
0.884  0.884  0.884  0.884  0.884  0.884  0.884  0.884  0.884  0.884
0.884  0.884  0.884  0.884  0.884
0.977  0.977  0.977  0.977  0.977  0.977  0.977  0.977  0.977  0.977
0.977  0.977  0.977  0.977  0.977  0.977  0.977  0.977  0.977  0.977
0.977  0.977  0.977  0.977  0.977
0.972  0.972  0.972  0.972  0.972  0.972  0.972  0.972  0.972  0.972
0.972  0.972  0.972  0.972  0.972  0.972  0.972  0.972  0.972  0.972
0.972  0.972  0.972  0.972  0.972
1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000
1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000
1.000  1.000  1.000  1.000  1.000
0.786  0.786  0.786  0.786  0.786  0.786  0.786  0.786  0.786  0.786
0.786  0.786  0.786  0.786  0.786  0.786  0.786  0.786  0.786  0.786
0.786  0.786  0.786  0.786  0.786


**********  Scenario Section  **********

SCENARIO RECORD   : 2030 Idle Scenario - Summer (multiply g/mi by 2.5 mph to get g/hr)
CALENDAR YEAR     : 2030
EVALUATION MONTH  : 7
PARTICULATE EF    : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE     : 10
DIESEL SULFUR     : 15
AVERAGE SPEED     : 2.5 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD   : 2030 5 mph - Summer
CALENDAR YEAR     : 2030
EVALUATION MONTH  : 7
PARTICULATE EF    : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE     : 10
DIESEL SULFUR     : 15
AVERAGE SPEED     : 5 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD   : 2030 10 mph - Summer
CALENDAR YEAR     : 2030
EVALUATION MONTH  : 7
PARTICULATE EF    : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE     : 10
DIESEL SULFUR     : 15
AVERAGE SPEED     : 10 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD   : 2030 15 mph - Summer
CALENDAR YEAR     : 2030
EVALUATION MONTH  : 7
PARTICULATE EF    : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE     : 10
DIESEL SULFUR     : 15
AVERAGE SPEED     : 15 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD   : 2030 20 mph - Summer
CALENDAR YEAR     : 2030
EVALUATION MONTH  : 7
```

Table I-9 MOBILE6.2.03 Input File for 2030

```
PARTICULATE EF    : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE     : 10
DIESEL SULFUR     : 15
AVERAGE SPEED     : 20 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD   : 2030 25 mph - Summer
CALENDAR YEAR     : 2030
EVALUATION MONTH  : 7
PARTICULATE EF    : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE     : 10
DIESEL SULFUR     : 15
AVERAGE SPEED     : 25 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD   : 2030 30 mph - Summer
CALENDAR YEAR     : 2030
EVALUATION MONTH  : 7
PARTICULATE EF    : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE     : 10
DIESEL SULFUR     : 15
AVERAGE SPEED     : 30 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD   : 2030 35 mph - Summer
CALENDAR YEAR     : 2030
EVALUATION MONTH  : 7
PARTICULATE EF    : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE     : 10
DIESEL SULFUR     : 15
AVERAGE SPEED     : 35 Arterial 0.0 100.0 0.0 0.0

SCENARIO RECORD   : 2030 50 mph - Summer
CALENDAR YEAR     : 2030
EVALUATION MONTH  : 7
PARTICULATE EF    : PMGZML.CSV  PMGDR1.CSV  PMGDR2.CSV  PMDZML.CSV  PMDDR1.CSV  PMDDR2.CSV
PARTICLE SIZE     : 10
DIESEL SULFUR     : 15
AVERAGE SPEED     : 50 Arterial 0.0 100.0 0.0 0.0

**********    End of This Run    **********
END OF RUN
```

Source: KBE and Massport.

Table I-10 MOBILE6.2.03 Output Files for 2030

```
**************************************************************************
* MOBILE6.2.03 (24-Sep-2003)                                             *
* Input file: MA30_ALL.INP (file 1, run 1). *
**************************************************************************
* *** Summer 2030 ***

* Reading Registration Distributions from the following external
* data file: 2005_REG.D
 M 49 Warning:
          1.00    MYR sum not = 1. (will normalize)
 M 49 Warning:
         0.998    MYR sum not = 1. (will normalize)
 M 49 Warning:
         0.998    MYR sum not = 1. (will normalize)
 M 49 Warning:
         0.998    MYR sum not = 1. (will normalize)
 M 49 Warning:
          1.00    MYR sum not = 1. (will normalize)
 M 49 Warning:
          1.00    MYR sum not = 1. (will normalize)
 M 49 Warning:
         0.999    MYR sum not = 1. (will normalize)
 M 49 Warning:
         0.998    MYR sum not = 1. (will normalize)
 M 49 Warning:
          1.00    MYR sum not = 1. (will normalize)
 M 49 Warning:
         0.999    MYR sum not = 1. (will normalize)
 M 49 Warning:
          1.00    MYR sum not = 1. (will normalize)
 M 49 Warning:
          1.00    MYR sum not = 1. (will normalize)
 M 49 Warning:
          1.00    MYR sum not = 1. (will normalize)
 M 49 Warning:
          1.00    MYR sum not = 1. (will normalize)

* Reading I/M program description records from the following external
* data file: 09NEWIM.D
* 15 Year Exemption Age
* New Annual OBD Exhaust I/M program for Light Duty MY 1996 through 2007 vehicles <=8,500 lb GVWR
* New Annual OBD Exhaust I/M program for Light Duty and Medium duty MY 2008 and later <=14,000 lb GVWR
* New Annual OBD Evap I/M program for Light Duty MY 1996 through 2007 vehicles <=8,500 lb GVWR
* New Annual OBD Evap I/M program for for Light Duty and Medium duty MY 2008 and later <=14,000 lb GVWR
 M601 Comment:
          User has enabled STAGE II REFUELING.


* Reading 94+ LEV IMPLEMENTATION SCHEDULE from the following external
* data file: MA_LEV2.D

 Reading User Supplied Tier2 Exhaust bin phase-in fractions

   Data read from file: LEV2EXH.D


 Reading User Supplied Tier2 EVAP phase-in fractions

   Data read from file: LEV2EVAP.D


 Reading User Supplied Tier2 50K certification standards

   Data read from file: LEV2CERT.D

 M616 Comment:
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
            User has supplied post-1999 sulfur levels.
  M614 Comment:
            User supplied diesel sale fractions.

* ##########################
* 2030 Idle Scenario - Summer (multiply g/mi by 2.5 mph to get g/hr)
* File 1, Run 1, Scenario 1.
* ##########################

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
  M583 Warning:
           The user supplied arterial average speed of  2.5
           will be used for all hours of the day. 100% of VMT
           has been assigned to the arterial/collector roadway
           type for all hours of the day and all vehicle types.
*** I/M credits for Tech1&2 vehicles were read from the following external
    data file: TECH12.D
  M 48 Warning:
            there are no sales for vehicle class HDGV8b
  M 48 Warning:
            there are no sales for vehicle class LDDV
 HDDV DEFEAT DEVICE EFFECTS ARE PRESENT. THE REBUILD FRACTION IS 0.10.

* Reading Ammonia (NH3) Basic Emission Rates
* from the external data file PMNH3BER.D

* Reading Ammonia (NH3) Sulfur Deterioration Rates
* from the external data file PMNH3SDR.D

 LEV phase-in data read from file MA_LEV2.D
                  Calendar Year:  2030
                        Month:  July
                     Altitude:  Low
              Minimum Temperature:  70.4 (F)
              Maximum Temperature:  93.7 (F)
                Absolute Humidity:   75. grains/lb
              Fuel Sulfur Content:   30. ppm

              Exhaust I/M Program:  Yes
                Evap I/M Program:  Yes
                   ATP Program:  No
                Reformulated Gas:  Yes

      Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
            GVWR:           <6000    >6000    (All)
                   ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
   VMT Distribution:   0.2607   0.4379   0.1723           0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
 Fuel Economy (mpg):     24.1     18.5     14.2     17.0      9.9      0.0     18.4      7.3     50.0     16.0
 ---------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
    Composite VOC :     1.567    1.352    1.389    1.363    1.581    0.000    0.159    0.732    11.46    1.405
    Composite CO  :    10.06     9.23     9.54     9.32    25.09    0.000    0.997    1.040   120.29    9.777
    Composite NOX :     0.292    0.254    0.332    0.276    0.122    0.000    0.066    0.898    1.12     0.331
    Composite CO2 :   368.0    479.4    624.6    520.4    894.5     0.0    552.2   1398.5     177.4    569.40
 ------------------------------------------------------------------------------------------------------------------
        Veh. Type:   GasBUS    URBAN    SCHOOL
                    ------   ------   ------
         VMT Mix:   0.0004   0.0009   0.0014
 Fuel Economy (mpg):     6.4      4.4      6.2
 ------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :    1.830    0.733    0.878
    Composite CO  :   51.03     1.650    0.975
    Composite NOX :    0.206    1.571    0.942
    Composite CO2 : 1375.0   2334.1   1646.7
 ------------------------------------------------------------------------------------------------------------------

 *##########################
 * 2030 5 mph - Summer
 * File 1, Run 1, Scenario 2.
 *##########################

 * Reading PM Gas Carbon ZML Levels
 * from the external data file PMGZML.CSV

 * Reading PM Gas Carbon DR1 Levels
 * from the external data file PMGDR1.CSV

 * Reading PM Gas Carbon DR2 Levels
 * from the external data file PMGDR2.CSV

 * Reading PM Diesel Zero Mile Levels
 * from the external data file PMDZML.CSV

 * Reading the First PM Deterioration Rates
 * from the external data file PMDDR1.CSV

 * Reading the Second PM Deterioration Rates
 * from the external data file PMDDR2.CSV
  M583 Warning:
         The user supplied arterial average speed of  5.0
         will be used for all hours of the day. 100% of VMT
         has been assigned to the arterial/collector roadway
         type for all hours of the day and all vehicle types.
  M 48 Warning:
          there are no sales for vehicle class HDGV8b
  M 48 Warning:
          there are no sales for vehicle class LDDV

 LEV phase-in data read from file MA_LEV2.D
               Calendar Year:  2030
                     Month:  July
                  Altitude:  Low
           Minimum Temperature:  70.4 (F)
           Maximum Temperature:  93.7 (F)
            Absolute Humidity:  75. grains/lb
           Fuel Sulfur Content:  30. ppm

           Exhaust I/M Program:  Yes
             Evap I/M Program:  Yes
                ATP Program:  No
             Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
          GVWR:              <6000    >6000    (All)
                    ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
  VMT Distribution:    0.2607    0.4379    0.1723          0.0375    0.0000    0.0015    0.0864    0.0036    1.0000
 Fuel Economy (mpg):     24.1      18.5      14.2      17.0      9.9       0.0       18.4      7.3       50.0      16.0
 ---------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :      0.553     0.527     0.572     0.540     0.699     0.000     0.142     0.644     7.73      0.584
    Composite CO  :      6.03      5.93      6.13      5.99      20.05     0.000     0.829     0.849     71.17     6.310
    Composite NOX :      0.241     0.221     0.287     0.239     0.125     0.000     0.059     0.807     1.05      0.287
    Composite CO2 :    368.0     479.4     624.6     520.4     894.5       0.0     552.2    1398.5     177.4     569.40
 ---------------------------------------------------------------------------------------------------------------------
        Veh. Type:    GasBUS    URBAN    SCHOOL
                      ------    ------    ------
         VMT Mix:    0.0004    0.0009    0.0014
 Fuel Economy (mpg):      6.4       4.4       6.2
---------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :      0.906     0.644     0.772
    Composite CO  :     40.77      1.347     0.796
    Composite NOX :      0.211     1.412     0.847
    Composite CO2 :   1375.0    2334.1    1646.7
---------------------------------------------------------------------------------------------------------------------

*############################
* 2030 10 mph - Summer
* File 1, Run 1, Scenario 3.
*############################

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
  M583 Warning:
          The user supplied arterial average speed of 10.0
          will be used for all hours of the day. 100% of VMT
          has been assigned to the arterial/collector roadway
          type for all hours of the day and all vehicle types.
  M 48 Warning:
           there are no sales for vehicle class HDGV8b
  M 48 Warning:
           there are no sales for vehicle class LDDV

 LEV phase-in data read from file MA_LEV2.D
                 Calendar Year:  2030
                       Month:  July
                    Altitude:  Low
              Minimum Temperature:  70.4 (F)
              Maximum Temperature:  93.7 (F)
                Absolute Humidity:   75. grains/lb
              Fuel Sulfur Content:   30. ppm

              Exhaust I/M Program:  Yes
                Evap I/M Program:  Yes
                    ATP Program:  No
                Reformulated Gas:  Yes
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
          GVWR:           <6000    >6000    (All)
                      ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.2607   0.4379   0.1723            0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
Fuel Economy (mpg):     24.1     18.5     14.2     17.0      9.9      0.0     18.4      7.3     50.0     16.0
 ---------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
   Composite VOC :     0.299    0.300    0.335    0.310    0.411    0.000    0.114    0.505    4.91     0.344
   Composite CO  :      4.15     4.32     4.46     4.36    13.34    0.000    0.598    0.585   36.49     4.429
   Composite NOX :     0.180    0.176    0.228    0.191    0.131    0.000    0.049    0.669    1.00     0.230
   Composite CO2 :     368.0    479.4    624.6    520.4    894.5      0.0    552.2   1398.5    177.4    569.40
 ---------------------------------------------------------------------------------------------------------------
       Veh. Type:    GasBUS     URBAN    SCHOOL
                     ------   ------   ------
         VMT Mix:    0.0004   0.0009   0.0014
Fuel Economy (mpg):      6.4      4.4      6.2
---------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
   Composite VOC :     0.580    0.505    0.606
   Composite CO  :     27.13    0.929    0.549
   Composite NOX :     0.222    1.171    0.703
   Composite CO2 :    1375.0   2334.1   1646.7
---------------------------------------------------------------------------------------------------------------

*############################
* 2030 15 mph - Summer
* File 1, Run 1, Scenario 4.
*############################

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
 M583 Warning:
        The user supplied arterial average speed of 15.0
        will be used for all hours of the day. 100% of VMT
        has been assigned to the arterial/collector roadway
        type for all hours of the day and all vehicle types.
 M 48 Warning:
         there are no sales for vehicle class HDGV8b
 M 48 Warning:
         there are no sales for vehicle class LDDV

LEV phase-in data read from file MA_LEV2.D
              Calendar Year:  2030
                    Month:  July
                 Altitude:  Low
          Minimum Temperature:  70.4 (F)
          Maximum Temperature:  93.7 (F)
           Absolute Humidity:   75. grains/lb
          Fuel Sulfur Content:   30. ppm
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
          Exhaust I/M Program:  Yes
            Evap I/M Program:  Yes
               ATP Program:  No
            Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
          GVWR:           <6000    >6000    (All)
                 ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.2607   0.4379   0.1723           0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
 Fuel Economy (mpg):     24.1     18.5     14.2     17.0      9.9      0.0     18.4      7.3     50.0     16.0
 ---------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :     0.238    0.238    0.267    0.246    0.309    0.000    0.095    0.406    3.94     0.273
    Composite CO  :     3.59     3.77     3.90     3.81     9.37     0.000    0.455    0.422    25.25    3.739
    Composite NOX :     0.145    0.148    0.191    0.160    0.138    0.000    0.043    0.576    1.01     0.194
    Composite CO2 :   368.0    479.4    624.6    520.4    894.5      0.0    552.2   1398.5    177.4    569.40
 ---------------------------------------------------------------------------------------------------------------
       Veh. Type:   GasBUS    URBAN    SCHOOL
                 ------   ------   ------
        VMT Mix:   0.0004   0.0009   0.0014
 Fuel Economy (mpg):      6.4      4.4      6.2
---------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :     0.458    0.406    0.486
    Composite CO  :    19.07     0.670    0.396
    Composite NOX :     0.233    1.007    0.604
    Composite CO2 :  1375.0    2334.1   1646.7
---------------------------------------------------------------------------------------------------------------

*############################
* 2030 20 mph - Summer
* File 1, Run 1, Scenario 5.
*############################

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
  M583 Warning:
          The user supplied arterial average speed of 20.0
          will be used for all hours of the day. 100% of VMT
          has been assigned to the arterial/collector roadway
          type for all hours of the day and all vehicle types.
  M 48 Warning:
           there are no sales for vehicle class HDGV8b
  M 48 Warning:
           there are no sales for vehicle class LDDV

 LEV phase-in data read from file MA_LEV2.D
                 Calendar Year:  2030
                       Month:  July
                    Altitude:  Low
             Minimum Temperature:  70.4 (F)
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
          Maximum Temperature:  93.7 (F)
           Absolute Humidity:   75. grains/lb
          Fuel Sulfur Content:   30. ppm

          Exhaust I/M Program:  Yes
            Evap I/M Program:  Yes
               ATP Program:  No
            Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
          GVWR:           <6000    >6000    (All)
                  ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.2607   0.4379   0.1723           0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
Fuel Economy (mpg):     24.1     18.5     14.2     17.0      9.9      0.0     18.4      7.3     50.0     16.0
 ---------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
   Composite VOC :     0.203    0.200    0.226    0.208    0.246    0.000    0.080    0.333     3.50    0.230
   Composite CO  :      3.24     3.44     3.56     3.47     6.96    0.000    0.364    0.319    20.08    3.325
   Composite NOX :     0.127    0.134    0.173    0.145    0.144    0.000    0.038    0.513     1.06    0.175
   Composite CO2 :    368.0    479.4    624.6    520.4    894.5      0.0    552.2   1398.5    177.4   569.40
 ---------------------------------------------------------------------------------------------------------------
       Veh. Type:   GasBUS    URBAN    SCHOOL
                  ------   ------   ------
        VMT Mix:   0.0004   0.0009   0.0014
Fuel Economy (mpg):      6.4      4.4      6.2
---------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
   Composite VOC :     0.382    0.333    0.399
   Composite CO  :     14.16    0.506    0.299
   Composite NOX :     0.244    0.897    0.538
   Composite CO2 :    1375.0   2334.1   1646.7
---------------------------------------------------------------------------------------------------------------

*############################
* 2030 25 mph - Summer
* File 1, Run 1, Scenario 6.
*############################

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
 M583 Warning:
        The user supplied arterial average speed of 25.0
        will be used for all hours of the day. 100% of VMT
        has been assigned to the arterial/collector roadway
        type for all hours of the day and all vehicle types.
 M 48 Warning:
          there are no sales for vehicle class HDGV8b
 M 48 Warning:
          there are no sales for vehicle class LDDV

 LEV phase-in data read from file MA_LEV2.D
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
                Calendar Year:  2030
                    Month:  July
                  Altitude:  Low
          Minimum Temperature:  70.4 (F)
          Maximum Temperature:  93.7 (F)
           Absolute Humidity:  75. grains/lb
          Fuel Sulfur Content:  30. ppm

          Exhaust I/M Program:  Yes
            Evap I/M Program:  Yes
               ATP Program:  No
            Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
          GVWR:            <6000    >6000    (All)
                 ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.2607   0.4379   0.1723           0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
Fuel Economy (mpg):     24.1     18.5     14.2     17.0      9.9      0.0     18.4      7.3     50.0     16.0
 ---------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
   Composite VOC :     0.184    0.183    0.207    0.190    0.210    0.000    0.070    0.279     3.22    0.208
   Composite CO  :      3.08     3.28     3.40     3.31     5.46    0.000    0.306    0.252    16.91    3.114
   Composite NOX :     0.116    0.125    0.161    0.135    0.150    0.000    0.035    0.473     1.12    0.163
   Composite CO2 :     368.0    479.4    624.6    520.4    894.5      0.0    552.2   1398.5    177.4   569.40
 ---------------------------------------------------------------------------------------------------------------
       Veh. Type:   GasBUS    URBAN    SCHOOL
                  ------   ------   ------
         VMT Mix:   0.0004   0.0009   0.0014
Fuel Economy (mpg):      6.4      4.4      6.2
---------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
   Composite VOC :     0.337    0.279    0.334
   Composite CO  :     11.11    0.400    0.236
   Composite NOX :     0.254    0.828    0.497
   Composite CO2 :   1375.0   2334.1   1646.7
---------------------------------------------------------------------------------------------------------------

*##########################
* 2030 30 mph - Summer
* File 1, Run 1, Scenario 7.
*##########################

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
 M583 Warning:
        The user supplied arterial average speed of 30.0
        will be used for all hours of the day. 100% of VMT
        has been assigned to the arterial/collector roadway
        type for all hours of the day and all vehicle types.
 M 48 Warning:
          there are no sales for vehicle class HDGV8b
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
 M 48 Warning:
         there are no sales for vehicle class LDDV

LEV phase-in data read from file MA_LEV2.D
                Calendar Year:  2030
                      Month:  July
                   Altitude:  Low
             Minimum Temperature:  70.4 (F)
             Maximum Temperature:  93.7 (F)
              Absolute Humidity:   75. grains/lb
             Fuel Sulfur Content:   30. ppm

             Exhaust I/M Program:  Yes
               Evap I/M Program:  Yes
                  ATP Program:  No
               Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
          GVWR:           <6000    >6000    (All)
                    ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.2607   0.4379   0.1723            0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
 Fuel Economy (mpg):     24.1     18.5     14.2     17.0      9.9      0.0     18.4      7.3     50.0     16.0
 ---------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :     0.172    0.172    0.194    0.178    0.185    0.000    0.062    0.239    3.02     0.192
    Composite CO  :     3.03     3.23     3.35     3.27     4.53     0.000    0.267    0.209    14.61    3.026
    Composite NOX :     0.108    0.119    0.154    0.129    0.157    0.000    0.034    0.452    1.17     0.156
    Composite CO2 :   368.0    479.4    624.6    520.4    894.5      0.0    552.2   1398.5     177.4    569.40
 ---------------------------------------------------------------------------------------------------------------
        Veh. Type:   GasBUS    URBAN    SCHOOL
                    ------   ------   ------
         VMT Mix:   0.0004   0.0009   0.0014
 Fuel Economy (mpg):      6.4      4.4      6.2
---------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :     0.306    0.239    0.287
    Composite CO  :     9.21     0.331    0.195
    Composite NOX :     0.265    0.791    0.475
    Composite CO2 :  1375.0    2334.1   1646.7
---------------------------------------------------------------------------------------------------------------

* ############################
* 2030 35 mph - Summer
* File 1, Run 1, Scenario 8.
* ############################

* Reading PM Gas Carbon ZML Levels
* from the external data file PMGZML.CSV

* Reading PM Gas Carbon DR1 Levels
* from the external data file PMGDR1.CSV

* Reading PM Gas Carbon DR2 Levels
* from the external data file PMGDR2.CSV

* Reading PM Diesel Zero Mile Levels
* from the external data file PMDZML.CSV

* Reading the First PM Deterioration Rates
* from the external data file PMDDR1.CSV

* Reading the Second PM Deterioration Rates
* from the external data file PMDDR2.CSV
  M583 Warning:
         The user supplied arterial average speed of 35.0
         will be used for all hours of the day. 100% of VMT
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
          has been assigned to the arterial/collector roadway
          type for all hours of the day and all vehicle types.
 M 48 Warning:
           there are no sales for vehicle class HDGV8b
 M 48 Warning:
           there are no sales for vehicle class LDDV

 LEV phase-in data read from file MA_LEV2.D
                 Calendar Year:  2030
                       Month:  July
                    Altitude:  Low
             Minimum Temperature:  70.4 (F)
             Maximum Temperature:  93.7 (F)
              Absolute Humidity:  75. grains/lb
             Fuel Sulfur Content:  30. ppm

             Exhaust I/M Program:  Yes
               Evap I/M Program:  Yes
                  ATP Program:  No
               Reformulated Gas:  Yes

      Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV       MC   All Veh
           GVWR:           <6000    >6000    (All)
                    ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
   VMT Distribution:   0.2607   0.4379   0.1723           0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
 Fuel Economy (mpg):     24.1     18.5     14.2     17.0      9.9      0.0     18.4      7.3     50.0     16.0
 ---------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :     0.162    0.164    0.186    0.170    0.167    0.000    0.056    0.210     2.86    0.181
    Composite CO  :      3.05     3.26     3.38     3.30     3.97    0.000    0.243    0.181    12.91    3.018
    Composite NOX :     0.103    0.116    0.150    0.125    0.163    0.000    0.033    0.448     1.22    0.153
    Composite CO2 :    368.0    479.4    624.6    520.4    894.5      0.0    552.2   1398.5    177.4   569.40
 ---------------------------------------------------------------------------------------------------------------
        Veh. Type:    GasBUS     URBAN    SCHOOL
                     ------   ------   ------
          VMT Mix:    0.0004   0.0009   0.0014
 Fuel Economy (mpg):      6.4      4.4      6.2
 ---------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :     0.285    0.210    0.251
    Composite CO  :      8.07    0.286    0.169
    Composite NOX :     0.276    0.784    0.470
    Composite CO2 :    1375.0   2334.1   1646.7
 ---------------------------------------------------------------------------------------------------------------

 *##########################
 * 2030 50 mph - Summer
 * File 1, Run 1, Scenario 9.
 *##########################

 * Reading PM Gas Carbon ZML Levels
 * from the external data file PMGZML.CSV

 * Reading PM Gas Carbon DR1 Levels
 * from the external data file PMGDR1.CSV

 * Reading PM Gas Carbon DR2 Levels
 * from the external data file PMGDR2.CSV

 * Reading PM Diesel Zero Mile Levels
 * from the external data file PMDZML.CSV

 * Reading the First PM Deterioration Rates
 * from the external data file PMDDR1.CSV

 * Reading the Second PM Deterioration Rates
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
* from the external data file PMDDR2.CSV
 M583 Warning:
        The user supplied arterial average speed of 50.0
        will be used for all hours of the day. 100% of VMT
        has been assigned to the arterial/collector roadway
        type for all hours of the day and all vehicle types.
 M 48 Warning:
         there are no sales for vehicle class HDGV8b
 M 48 Warning:
         there are no sales for vehicle class LDDV

LEV phase-in data read from file MA_LEV2.D
               Calendar Year:  2030
                     Month:  July
                  Altitude:  Low
          Minimum Temperature:  70.4 (F)
          Maximum Temperature:  93.7 (F)
           Absolute Humidity:  75. grains/lb
          Fuel Sulfur Content:  30. ppm

          Exhaust I/M Program:  Yes
            Evap I/M Program:  Yes
               ATP Program:  No
            Reformulated Gas:  Yes

    Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
         GVWR:           <6000    >6000    (All)
                ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
 VMT Distribution:   0.2607   0.4379   0.1723          0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
Fuel Economy (mpg):     24.1     18.5     14.2     17.0      9.9      0.0     18.4      7.3     50.0     16.0
 ---------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
   Composite VOC :     0.144    0.152    0.175    0.158    0.135    0.000    0.046    0.161     2.66    0.163
   Composite CO  :      3.57     3.82     3.96     3.86     3.71    0.000    0.219    0.154    10.68    3.478
   Composite NOX :     0.106    0.124    0.159    0.134    0.182    0.000    0.040    0.539     1.34    0.168
   Composite CO2 :   368.0    479.4    624.6    520.4    894.5      0.0    552.2   1398.5     177.4   569.40
 ---------------------------------------------------------------------------------------------------------------
       Veh. Type:   GasBUS    URBAN    SCHOOL
                ------   ------   ------
        VMT Mix:   0.0004   0.0009   0.0014
Fuel Economy (mpg):      6.4      4.4      6.2
---------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
   Composite VOC :     0.248    0.161    0.193
   Composite CO  :      7.54    0.244    0.144
   Composite NOX :     0.308    0.944    0.566
   Composite CO2 :  1375.0   2334.1   1646.7
---------------------------------------------------------------------------------------------------------------
*******************************************************************************
* MOBILE6.2.03 (24-Sep-2003)                                                  *
* Input file: MA30_ALL.INP (file 1, run 1). *
*******************************************************************************

*##########################
* 2030 Idle Scenario - Summer (multiply g/mi by 2.5 mph to get g/hr)
* File 1, Run 1, Scenario 1.
*##########################

                    Calendar Year:  2030
                          Month:  July
          Gasoline Fuel Sulfur Content:  30. ppm
           Diesel Fuel Sulfur Content:  15. ppm
              Particle Size Cutoff: 10.00 Microns
                 Reformulated Gas:  Yes

    Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
          GVWR:           <6000    >6000    (All)
                ------  ------  ------  ------  ------  ------  ------  ------  ------  ------
 VMT Distribution:   0.2607   0.4379   0.1723          0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
-------------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
          Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
         GASPM:   0.0037   0.0036   0.0036   0.0036   0.0088   ------   ------   ------   0.0205   0.0036
       ECARBON:   ------   ------   ------   ------   ------   0.0000   0.0037   0.0090   ------   0.0008
       OCARBON:   ------   ------   ------   ------   ------   0.0000   0.0053   0.0046   ------   0.0004
          SO4:   0.0005   0.0006   0.0006   0.0006   0.0013   0.0000   0.0003   0.0009   0.0002   0.0006
 Total Exhaust PM:   0.0042   0.0042   0.0042   0.0042   0.0102   0.0000   0.0093   0.0146   0.0207   0.0054
          Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0000   0.0125   0.0125   0.0125   0.0125
          Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0000   0.0080   0.0248   0.0040   0.0095
       Total PM:   0.0247   0.0247   0.0247   0.0247   0.0312   0.0000   0.0299   0.0520   0.0372   0.0274
          SO2:   0.0064   0.0087   0.0115   0.0095   0.0163   0.0000   0.0052   0.0130   0.0033   0.0092
          NH3:   0.0994   0.1012   0.1017   0.1013   0.0451   0.0000   0.0068   0.0270   0.0113   0.0918
-------------------------------------------------------------------------------------------------------------------------
      Veh. Type:   GasBUS    URBAN    SCHOOL
                ------  ------  ------
       VMT Mix:   0.0004   0.0009   0.0014
-------------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
          Lead:   0.0000   ------   ------
         GASPM:   0.0147   ------   ------
       ECARBON:   ------   0.0137   0.0128
       OCARBON:   ------   0.0108   0.0100
          SO4:   0.0014   0.0015   0.0011
 Total Exhaust PM:   0.0161   0.0260   0.0239
          Brake:   0.0125   0.0125   0.0125
          Tire:   0.0120   0.0120   0.0120
       Total PM:   0.0406   0.0505   0.0484
          SO2:   0.0253   0.0217   0.0153
          NH3:   0.0451   0.0270   0.0270
-------------------------------------------------------------------------------------------------------------------------

*############################
* 2030 5 mph - Summer
* File 1, Run 1, Scenario 2.
*############################

                    Calendar Year:  2030
                            Month:  July
          Gasoline Fuel Sulfur Content:   30. ppm
           Diesel Fuel Sulfur Content:   15. ppm
               Particle Size Cutoff: 10.00 Microns
                  Reformulated Gas:  Yes

    Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
          GVWR:           <6000    >6000    (All)
                ------  ------  ------  ------  ------  ------  ------  ------  ------  ------
 VMT Distribution:   0.2607   0.4379   0.1723          0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
-------------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
          Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
         GASPM:   0.0037   0.0036   0.0036   0.0036   0.0088   ------   ------   ------   0.0205   0.0036
       ECARBON:   ------   ------   ------   ------   ------   0.0000   0.0037   0.0090   ------   0.0008
       OCARBON:   ------   ------   ------   ------   ------   0.0000   0.0053   0.0046   ------   0.0004
          SO4:   0.0005   0.0006   0.0006   0.0006   0.0013   0.0000   0.0003   0.0009   0.0002   0.0006
 Total Exhaust PM:   0.0042   0.0042   0.0042   0.0042   0.0102   0.0000   0.0093   0.0146   0.0207   0.0054
          Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0000   0.0125   0.0125   0.0125   0.0125
          Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0000   0.0080   0.0248   0.0040   0.0095
       Total PM:   0.0247   0.0247   0.0247   0.0247   0.0312   0.0000   0.0299   0.0520   0.0372   0.0274
          SO2:   0.0064   0.0087   0.0115   0.0095   0.0163   0.0000   0.0052   0.0130   0.0033   0.0092
          NH3:   0.0994   0.1012   0.1017   0.1013   0.0451   0.0000   0.0068   0.0270   0.0113   0.0918
-------------------------------------------------------------------------------------------------------------------------
      Veh. Type:   GasBUS    URBAN    SCHOOL
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
                  ------  ------  ------
        VMT Mix:   0.0004   0.0009   0.0014
---------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
           Lead:   0.0000  ------  ------
         GASPM:   0.0147  ------  ------
       ECARBON:  ------   0.0137   0.0128
       OCARBON:  ------   0.0108   0.0100
           SO4:   0.0014   0.0015   0.0011
  Total Exhaust PM:   0.0161   0.0260   0.0239
         Brake:   0.0125   0.0125   0.0125
          Tire:   0.0120   0.0120   0.0120
       Total PM:   0.0406   0.0505   0.0484
           SO2:   0.0253   0.0217   0.0153
           NH3:   0.0451   0.0270   0.0270
---------------------------------------------------------------------------------------------------------------------------

*############################
* 2030 10 mph - Summer
* File 1, Run 1, Scenario 3.
*############################

                    Calendar Year:  2030
                            Month:  July
          Gasoline Fuel Sulfur Content:   30. ppm
           Diesel Fuel Sulfur Content:   15. ppm
               Particle Size Cutoff: 10.00 Microns
                 Reformulated Gas:  Yes

    Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
          GVWR:            <6000    >6000    (All)
                  ------  ------  ------  ------  ------  ------  ------  ------  ------  ------
  VMT Distribution:   0.2607   0.4379   0.1723          0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
---------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
           Lead:   0.0000   0.0000   0.0000   0.0000   0.0000  ------  ------  ------   0.0000   0.0000
         GASPM:   0.0037   0.0036   0.0036   0.0036   0.0088  ------  ------  ------   0.0205   0.0036
       ECARBON:  ------  ------  ------  ------  ------   0.0000   0.0037   0.0090  ------   0.0008
       OCARBON:  ------  ------  ------  ------  ------   0.0000   0.0053   0.0046  ------   0.0004
           SO4:   0.0005   0.0006   0.0006   0.0006   0.0013   0.0000   0.0003   0.0009   0.0002   0.0006
  Total Exhaust PM:   0.0042   0.0042   0.0042   0.0042   0.0102   0.0000   0.0093   0.0146   0.0207   0.0054
         Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0000   0.0125   0.0125   0.0125   0.0125
          Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0000   0.0080   0.0248   0.0040   0.0095
       Total PM:   0.0247   0.0247   0.0247   0.0247   0.0312   0.0000   0.0299   0.0520   0.0372   0.0274
           SO2:   0.0064   0.0087   0.0115   0.0095   0.0163   0.0000   0.0052   0.0130   0.0033   0.0092
           NH3:   0.0994   0.1012   0.1017   0.1013   0.0451   0.0000   0.0068   0.0270   0.0113   0.0918
---------------------------------------------------------------------------------------------------------------------------
      Veh. Type:   GasBUS    URBAN    SCHOOL
                  ------  ------  ------
        VMT Mix:   0.0004   0.0009   0.0014
---------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
           Lead:   0.0000  ------  ------
         GASPM:   0.0147  ------  ------
       ECARBON:  ------   0.0137   0.0128
       OCARBON:  ------   0.0108   0.0100
           SO4:   0.0014   0.0015   0.0011
  Total Exhaust PM:   0.0161   0.0260   0.0239
         Brake:   0.0125   0.0125   0.0125
          Tire:   0.0120   0.0120   0.0120
       Total PM:   0.0406   0.0505   0.0484
           SO2:   0.0253   0.0217   0.0153
           NH3:   0.0451   0.0270   0.0270
---------------------------------------------------------------------------------------------------------------------------

*############################
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
* 2030 15 mph - Summer
* File 1, Run 1, Scenario 4.
*##########################

                    Calendar Year:  2030
                         Month:  July
          Gasoline Fuel Sulfur Content:   30. ppm
           Diesel Fuel Sulfur Content:   15. ppm
               Particle Size Cutoff: 10.00 Microns
                  Reformulated Gas:  Yes

    Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
         GVWR:           <6000    >6000    (All)
                ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
 VMT Distribution:   0.2607   0.4379   0.1723          0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
-------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
         Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
        GASPM:   0.0037   0.0036   0.0036   0.0036   0.0088   ------   ------   ------   0.0205   0.0036
      ECARBON:   ------   ------   ------   ------   ------   0.0000   0.0037   0.0090   ------   0.0008
      OCARBON:   ------   ------   ------   ------   ------   0.0000   0.0053   0.0046   ------   0.0004
          SO4:   0.0005   0.0006   0.0006   0.0006   0.0013   0.0000   0.0003   0.0009   0.0002   0.0006
 Total Exhaust PM:   0.0042   0.0042   0.0042   0.0042   0.0102   0.0000   0.0093   0.0146   0.0207   0.0054
        Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0000   0.0125   0.0125   0.0125   0.0125
         Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0000   0.0080   0.0248   0.0040   0.0095
      Total PM:   0.0247   0.0247   0.0247   0.0247   0.0312   0.0000   0.0299   0.0520   0.0372   0.0274
          SO2:   0.0064   0.0087   0.0115   0.0095   0.0163   0.0000   0.0052   0.0130   0.0033   0.0092
          NH3:   0.0994   0.1012   0.1017   0.1013   0.0451   0.0000   0.0068   0.0270   0.0113   0.0918
-------------------------------------------------------------------------------------------------------------------
      Veh. Type:   GasBUS    URBAN    SCHOOL
                ------   ------   ------
       VMT Mix:   0.0004   0.0009   0.0014
-------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
         Lead:   0.0000   ------   ------
        GASPM:   0.0147   ------   ------
      ECARBON:   ------   0.0137   0.0128
      OCARBON:   ------   0.0108   0.0100
          SO4:   0.0014   0.0015   0.0011
 Total Exhaust PM:   0.0161   0.0260   0.0239
        Brake:   0.0125   0.0125   0.0125
         Tire:   0.0120   0.0120   0.0120
      Total PM:   0.0406   0.0505   0.0484
          SO2:   0.0253   0.0217   0.0153
          NH3:   0.0451   0.0270   0.0270
-------------------------------------------------------------------------------------------------------------------

*##########################
* 2030 20 mph - Summer
* File 1, Run 1, Scenario 5.
*##########################

                    Calendar Year:  2030
                         Month:  July
          Gasoline Fuel Sulfur Content:   30. ppm
           Diesel Fuel Sulfur Content:   15. ppm
               Particle Size Cutoff: 10.00 Microns
                  Reformulated Gas:  Yes

    Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
         GVWR:           <6000    >6000    (All)
                ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
 VMT Distribution:   0.2607   0.4379   0.1723          0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
-------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
         Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
          GASPM:   0.0037   0.0036   0.0036   0.0036   0.0088   ------   ------   ------   0.0205   0.0036
        ECARBON:   ------   ------   ------   ------   ------   0.0000   0.0037   0.0090   ------   0.0008
        OCARBON:   ------   ------   ------   ------   ------   0.0000   0.0053   0.0046   ------   0.0004
            SO4:   0.0005   0.0006   0.0006   0.0006   0.0014   0.0000   0.0003   0.0009   0.0002   0.0006
  Total Exhaust PM:   0.0042   0.0042   0.0042   0.0042   0.0102   0.0000   0.0093   0.0146   0.0207   0.0054
          Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0000   0.0125   0.0125   0.0125   0.0125
           Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0000   0.0080   0.0248   0.0040   0.0095
       Total PM:   0.0247   0.0247   0.0247   0.0247   0.0312   0.0000   0.0299   0.0520   0.0372   0.0274
            SO2:   0.0064   0.0087   0.0115   0.0095   0.0163   0.0000   0.0052   0.0130   0.0033   0.0092
            NH3:   0.0994   0.1012   0.1017   0.1013   0.0451   0.0000   0.0068   0.0270   0.0113   0.0918
-------------------------------------------------------------------------------------------------------------------------------
      Veh. Type:   GasBUS    URBAN    SCHOOL
                   ------   ------   ------
       VMT Mix:   0.0004   0.0009   0.0014
-------------------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
          Lead:   0.0000   ------   ------
          GASPM:   0.0146   ------   ------
        ECARBON:   ------   0.0137   0.0128
        OCARBON:   ------   0.0108   0.0100
            SO4:   0.0014   0.0015   0.0011
  Total Exhaust PM:   0.0161   0.0260   0.0239
          Brake:   0.0125   0.0125   0.0125
           Tire:   0.0120   0.0120   0.0120
       Total PM:   0.0406   0.0505   0.0484
            SO2:   0.0253   0.0217   0.0153
            NH3:   0.0451   0.0270   0.0270
-------------------------------------------------------------------------------------------------------------------------------
*##########################
* 2030 25 mph - Summer
* File 1, Run 1, Scenario 6.
*##########################

                    Calendar Year:  2030
                            Month:  July
          Gasoline Fuel Sulfur Content:   30. ppm
           Diesel Fuel Sulfur Content:   15. ppm
              Particle Size Cutoff: 10.00 Microns
                Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
          GVWR:          <6000    >6000    (All)
                 ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.2607   0.4379   0.1723          0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
-------------------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
          Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
          GASPM:   0.0038   0.0037   0.0037   0.0037   0.0086   ------   ------   ------   0.0205   0.0036
        ECARBON:   ------   ------   ------   ------   ------   0.0000   0.0037   0.0090   ------   0.0008
        OCARBON:   ------   ------   ------   ------   ------   0.0000   0.0053   0.0046   ------   0.0004
            SO4:   0.0004   0.0005   0.0005   0.0005   0.0016   0.0000   0.0003   0.0009   0.0001   0.0006
  Total Exhaust PM:   0.0042   0.0042   0.0042   0.0042   0.0102   0.0000   0.0093   0.0146   0.0206   0.0054
          Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0000   0.0125   0.0125   0.0125   0.0125
           Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0000   0.0080   0.0248   0.0040   0.0095
       Total PM:   0.0247   0.0247   0.0247   0.0247   0.0313   0.0000   0.0299   0.0520   0.0372   0.0274
            SO2:   0.0065   0.0087   0.0115   0.0095   0.0162   0.0000   0.0052   0.0130   0.0033   0.0092
            NH3:   0.0994   0.1012   0.1017   0.1013   0.0451   0.0000   0.0068   0.0270   0.0113   0.0918
-------------------------------------------------------------------------------------------------------------------------------
      Veh. Type:   GasBUS    URBAN    SCHOOL
                   ------   ------   ------
       VMT Mix:   0.0004   0.0009   0.0014
-------------------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
          Lead:   0.0000   ------   ------
          GASPM:   0.0144   ------   ------
        ECARBON:   ------   0.0137   0.0128
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
        OCARBON:   ------   0.0108   0.0100
           SO4:    0.0016   0.0015   0.0011
  Total Exhaust PM:   0.0161   0.0260   0.0239
         Brake:    0.0125   0.0125   0.0125
          Tire:    0.0120   0.0120   0.0120
       Total PM:   0.0406   0.0505   0.0484
           SO2:    0.0252   0.0217   0.0153
           NH3:    0.0451   0.0270   0.0270
-------------------------------------------------------------------------------------------------------------------

*##########################
* 2030 30 mph - Summer
* File 1, Run 1, Scenario 7.
*##########################

                    Calendar Year:  2030
                         Month:  July
          Gasoline Fuel Sulfur Content:   30. ppm
           Diesel Fuel Sulfur Content:   15. ppm
              Particle Size Cutoff: 10.00 Microns
                Reformulated Gas:  Yes

    Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
         GVWR:            <6000    >6000    (All)
                ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
 VMT Distribution:   0.2607   0.4379   0.1723           0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
-------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
         Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
        GASPM:   0.0039   0.0037   0.0037   0.0037   0.0083   ------   ------   ------   0.0205   0.0037
      ECARBON:   ------   ------   ------   ------   ------   0.0000   0.0037   0.0090   ------   0.0008
      OCARBON:   ------   ------   ------   ------   ------   0.0000   0.0053   0.0046   ------   0.0004
         SO4:    0.0003   0.0005   0.0005   0.0005   0.0019   0.0000   0.0003   0.0009   0.0001   0.0005
  Total Exhaust PM:   0.0042   0.0042   0.0042   0.0042   0.0102   0.0000   0.0093   0.0146   0.0206   0.0054
        Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0000   0.0125   0.0125   0.0125   0.0125
         Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0000   0.0080   0.0248   0.0040   0.0095
      Total PM:   0.0247   0.0247   0.0247   0.0247   0.0313   0.0000   0.0299   0.0520   0.0371   0.0274
         SO2:    0.0065   0.0087   0.0115   0.0095   0.0162   0.0000   0.0052   0.0130   0.0033   0.0092
         NH3:    0.0994   0.1012   0.1017   0.1013   0.0451   0.0000   0.0068   0.0270   0.0113   0.0918
-------------------------------------------------------------------------------------------------------------------
      Veh. Type:   GasBUS    URBAN    SCHOOL
                ------   ------   ------
       VMT Mix:   0.0004   0.0009   0.0014
-------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
         Lead:   0.0000   ------   ------
        GASPM:   0.0142   ------   ------
      ECARBON:   ------   0.0137   0.0128
      OCARBON:   ------   0.0108   0.0100
         SO4:    0.0019   0.0015   0.0011
  Total Exhaust PM:   0.0161   0.0260   0.0239
        Brake:   0.0125   0.0125   0.0125
         Tire:   0.0120   0.0120   0.0120
      Total PM:   0.0406   0.0505   0.0484
         SO2:    0.0251   0.0217   0.0153
         NH3:    0.0451   0.0270   0.0270
-------------------------------------------------------------------------------------------------------------------

*##########################
* 2030 35 mph - Summer
* File 1, Run 1, Scenario 8.
*##########################

                    Calendar Year:  2030
                         Month:  July
          Gasoline Fuel Sulfur Content:   30. ppm
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
            Diesel Fuel Sulfur Content:   15. ppm
                Particle Size Cutoff: 10.00 Microns
                  Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
          GVWR:           <6000    >6000    (All)
                 ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.2607   0.4379   0.1723          0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
-------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
          Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
         GASPM:   0.0040   0.0038   0.0038   0.0038   0.0081   ------   ------   ------   0.0205   0.0037
        ECARBON:   ------   ------   ------   ------   ------   0.0000   0.0037   0.0090   ------   0.0008
        OCARBON:   ------   ------   ------   ------   ------   0.0000   0.0053   0.0046   ------   0.0004
           SO4:   0.0002   0.0004   0.0004   0.0004   0.0021   0.0000   0.0003   0.0009   0.0001   0.0005
  Total Exhaust PM:   0.0042   0.0042   0.0042   0.0042   0.0102   0.0000   0.0093   0.0146   0.0206   0.0054
         Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0000   0.0125   0.0125   0.0125   0.0125
          Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0000   0.0080   0.0248   0.0040   0.0095
        Total PM:   0.0247   0.0247   0.0247   0.0247   0.0313   0.0000   0.0299   0.0520   0.0371   0.0274
           SO2:   0.0065   0.0087   0.0115   0.0095   0.0161   0.0000   0.0052   0.0130   0.0033   0.0093
           NH3:   0.0994   0.1012   0.1017   0.1013   0.0451   0.0000   0.0068   0.0270   0.0113   0.0918
-------------------------------------------------------------------------------------------------------------------
       Veh. Type:   GasBUS    URBAN    SCHOOL
                 ------   ------   ------
        VMT Mix:   0.0004   0.0009   0.0014
-------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
          Lead:   0.0000   ------   ------
         GASPM:   0.0139   ------   ------
        ECARBON:   ------   0.0137   0.0128
        OCARBON:   ------   0.0108   0.0100
           SO4:   0.0021   0.0015   0.0011
  Total Exhaust PM:   0.0161   0.0260   0.0239
         Brake:   0.0125   0.0125   0.0125
          Tire:   0.0120   0.0120   0.0120
        Total PM:   0.0406   0.0505   0.0484
           SO2:   0.0251   0.0217   0.0153
           NH3:   0.0451   0.0270   0.0270
-------------------------------------------------------------------------------------------------------------------
*##########################
* 2030 50 mph - Summer
* File 1, Run 1, Scenario 9.
*##########################

                    Calendar Year:  2030
                        Month:  July
            Gasoline Fuel Sulfur Content:   30. ppm
            Diesel Fuel Sulfur Content:   15. ppm
                Particle Size Cutoff: 10.00 Microns
                  Reformulated Gas:  Yes

     Vehicle Type:     LDGV   LDGT12   LDGT34     LDGT     HDGV     LDDV     LDDT     HDDV      MC   All Veh
          GVWR:           <6000    >6000    (All)
                 ------   ------   ------   ------   ------   ------   ------   ------   ------   ------
  VMT Distribution:   0.2607   0.4379   0.1723          0.0375   0.0000   0.0015   0.0864   0.0036   1.0000
-------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
          Lead:   0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
         GASPM:   0.0040   0.0038   0.0038   0.0038   0.0081   ------   ------   ------   0.0205   0.0037
        ECARBON:   ------   ------   ------   ------   ------   0.0000   0.0037   0.0090   ------   0.0008
        OCARBON:   ------   ------   ------   ------   ------   0.0000   0.0053   0.0046   ------   0.0004
           SO4:   0.0002   0.0004   0.0004   0.0004   0.0021   0.0000   0.0003   0.0009   0.0001   0.0005
  Total Exhaust PM:   0.0042   0.0042   0.0042   0.0042   0.0102   0.0000   0.0093   0.0146   0.0206   0.0054
         Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0000   0.0125   0.0125   0.0125   0.0125
          Tire:   0.0080   0.0080   0.0080   0.0080   0.0085   0.0000   0.0080   0.0248   0.0040   0.0095
        Total PM:   0.0247   0.0247   0.0247   0.0247   0.0313   0.0000   0.0299   0.0520   0.0371   0.0274
```

Table I-10 MOBILE6.2.03 Output Files for 2030

```
            SO2:   0.0065   0.0087   0.0115   0.0095   0.0161   0.0000   0.0052   0.0130   0.0033   0.0093
            NH3:   0.0994   0.1012   0.1017   0.1013   0.0451   0.0000   0.0068   0.0270   0.0113   0.0918
-------------------------------------------------------------------------------------------------------------------------------
        Veh. Type:   GasBUS    URBAN    SCHOOL
                     ------   ------   ------
         VMT Mix:   0.0004   0.0009   0.0014
-------------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
           Lead:   0.0000   ------   ------
          GASPM:   0.0139   ------   ------
        ECARBON:   ------   0.0137   0.0128
        OCARBON:   ------   0.0108   0.0100
            SO4:   0.0021   0.0015   0.0011
  Total Exhaust PM:   0.0161   0.0260   0.0239
          Brake:   0.0125   0.0125   0.0125
           Tire:   0.0120   0.0120   0.0120
       Total PM:   0.0406   0.0505   0.0484
            SO2:   0.0251   0.0217   0.0153
            NH3:   0.0451   0.0270   0.0270
-------------------------------------------------------------------------------------------------------------------------------
```

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[2] 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-11 presents Logan Airport's fuel throughput by category.

Stationary Sources

Stationary sources include the Central Heating and Cooling Plant, emergency generators, snow melters, and boilers. Emission factors from EPA's AP-42 or NO_x Reasonably Available Control Technology (RACT) compliance testing were combined with the actual 2011 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-12 presents Logan Airport's stationary source fuel throughput by fuel category.

2 Compilation of Air Pollutant Emission Factors, AP-42, Office of Air Quality Planning and Standards, EPA, Fifth Edition,1995.

Table I-11 Fuel Throughput by Fuel Category (gallons)

Fuel Category	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
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	345,631,788	327,358,619	335,693,997	**340,421,373**
Fire Training Fuel[1]	NA	NA	NA	NA	13,719	12,227	8,105	5,000	8,631	5,971	3,510	800	**3,810**
Aviation Gas	99,726	90,922	60,691	35,111	32,515	34,717	52,487	35,098	29,067	25,037	18,238	15,268	**14,064**
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	5,693,178	5,736,724	5,696,505	**5,487,952**
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	1,071,707	1,121,241	1,168,761	**1,099,720**
Heating Oil No.2	480,733	494,500	582,283	340,492	370,903	381,852	367,899	259,768	423,181	303,143	409,049	319,727	**18,727**
Heating Oil No.6	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	16,385	368,690	9,010	**0**

Source: Massport, 2012.
1 Fire Training Fuel used in 1999-2002 was Jet A Fuel while in 2003 through 2011 it was Tek-Flame®. 2011 includes 310 gallons of avgas.
NA Not available.

Table I-12 Stationary Source Fuel Throughput by Fuel Category (gallons)

Fuel Category	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
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	458,680,000	430,810,000	449,640,000	479,830,000
Heating Oil No. 2	480,733	494,500	582,283	340,492	370,903	381,852	367,899	259,768	423,181	303,143	409,050	319,727	384,906
Heating Oil No. 6	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	16,385	368,690	9,010	11,285
Diesel Fuel[1]	57,441	NA	NA	NA	NA	67,198	77,848	77,848	258,606	146,718	145,778	116,511	218,081
Fire Training Fuel[2]	23,000	NA	NA	NA	13,719	12,227	8,105	5,000	8,631	5,971	3,510	800	3,810

Source: Massport, 2012.
NA Not available.
1 Diesel fuel was from the stationary snow melter usage. Starting in 2007, portable snow melter usage was also included.
2 Fire Training Fuel used in 1999-2002 was Jet A Fuel while in 2003 through 2011 it was Tek-Flame®. 2011 includes 310 gallons of avgas.

1993 Through 1999 Emissions Inventories

Tables I-13 through I-15 contain the 1993 through 1999 Emissions Inventory summary tables for Logan Airport.

Table I-13 Estimated Volatile Organic Compounds (VOC) Emissions (in kg/day) at Logan Airport[1]

	1993	1994	1995	1996	1997	1998	1999[2]
Aircraft/GSE Model	**Logan Dispersion Modeling System (LDMS)**					**EDMS v3.22**	**EDMS v4.21**
Motor Vehicle Model	**MOBILE5a**					**MOB5a_h**	**MOB6.2.03**
Aircraft Sources							
Air carriers	1,958	1,554	1,407	1,390	1,227	736	653
Commuter aircraft	943	543	531	622	498	154	196
Cargo aircraft	89	244	236	214	207	43	318
General aviation	51	48	36	24	27	13	141
Total aircraft sources	3,041	2,389	2,210	2,250	1,959	946	1,308
Ground Service Equipment[3]	636	533	521	497	530	145	243
Motor Vehicles							
Ted Williams Tunnel through-traffic	NA	NA	NA	NA	NA	NA	15
Parking/curbside	173	148	127	102	102	118	101
On-airport vehicles[4]	238	215	179	223	205	258	256
Total motor vehicle sources	411	363	306	325	307	376	372
Other Sources							
Fuel storage/handling	408	434	318	356	381	372	352
Miscellaneous sources[5]	5	5	5	6	6	2	16
Total other sources	413	439	323	362	387	374	368
Total Airport Sources	4,501	3,724	3,360	3,434	3,183	1,841	2,291

Source: KBE.

Notes:

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 the 2005 EDR. 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-14 Estimated Nitrogen Oxides (NO_X) Emissions (in kg/day) at Logan Airport[1]

	1993	1994	1995	1996	1997	1998	1999[2]
Aircraft/GSE Model	**Logan Dispersion Modeling System (LDMS)**					**EDMS v3.22**	**EDMS v4.21**
Motor Vehicle Model	**MOBILE5a**					**MOB5a_h**	**MOB6.2.03**
Aircraft Sources							
Air carriers	4,271	4,317	3,861	3,781	4,150	4,471	4,183
Commuter aircraft	202	158	192	137	159	203	166
Cargo aircraft	213	257	332	363	262	254	286
General aviation	13	13	17	18	21	5	12
Total aircraft sources	4,699	4,745	4,402	4,299	4,592	4,933	4,647
Ground Service Equipment[3]	722	617	607	588	622	317	444
Motor Vehicles							
Ted Williams Tunnel through-traffic	NA	NA	NA	NA	NA	NA	28
Parking/curbside	25	24	24	24	24	37	39
On-airport vehicles[4]	240	239	229	257	244	372	449
Total motor vehicle sources	265	263	253	281	268	409	516
Other Sources							
Fuel storage/handling[5]	0	0	0	0	0	0	0
Miscellaneous sources[6]	278	330	320	275	244	284	165
Total other sources	278	330	320	275	244	284	165
Total Airport Sources	5,964	5,955	5,582	5,443	5,726	5,943	5,772

Source: KBE.

Notes:

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 the 2005 EDR. 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-15 Estimated Carbon Monoxide (CO) Emissions (in kg/day) at Logan Airport[1]

	1993	1994	1995	1996	1997	1998	1999[2]
Aircraft/GSE Model	**Logan Dispersion Modeling System (LDMS)**					**EDMS v3.22**	**EDMS v4.21**
Motor Vehicle Model	**MOBILE5a**					**MOB5a_h**	**MOB6.2.03**
Aircraft Sources							
Air carriers	5,663	4,660	4,691	4,812	4,698	3,079	3,754
Commuter aircraft	1,309	927	934	859	770	482	1,404
Cargo aircraft	344	572	598	580	514	218	503
General aviation	353	356	339	549	654	269	940
Total aircraft sources	7,669	6,515	6,562	6,800	6,636	4,048	6,601
Ground Service Equipment[3]	7,482	6,187	6,029	5,740	6,098	5,113	4,532
Motor Vehicles							
Ted Williams Tunnel through-traffic	NA	NA	NA	NA	NA	NA	151
Parking/curbside	952	820	650	644	586	772	437
On-airport vehicles[4]	1,575	1,451	1,087	1,514	1,283	1,883	2,547
Total motor vehicle sources	2,527	2,271	1,737	2,158	1,869	2,655	3,135
Other Sources							
Fuel storage/handling[5]	0	0	0	0	0	0	0
Miscellaneous sources[6]	26	30	29	39	37	37	168
Total other sources	26	30	29	39	37	37	168
Total Airport Sources	17,704	15,003	14,357	14,737	14,640	11,853	14,436

Source: KBE.

Notes:

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 the 2005 EDR. 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.

Greenhouse Gas Emissions Inventory for 2011

The Massachusetts Executive Office of Energy and Environmental Affairs (EOEEA) has published the *MEPA Greenhouse Gas Emissions Policy and Protocol*.[3] 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.[4] Even though the *2011 ESPR* 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.[5] The 2011 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,[6] 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 Version 5.1.3. Table I-16 summarizes these data and information used in the 2011 GHG inventory.

Massport will update the GHG Emissions Inventory for Logan Airport annually.

3 Revised *MEPA Greenhouse Gas Emissions Policy and Protocol*, Massachusetts Executive Office of Energy and Environmental Affairs, effective May 10, 2010.

4 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.

5 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.

6 Criteria pollutants are pollutants for which there are National Ambient Air Quality Standards (i.e., carbon monoxide, sulfur dioxide, nitrogen dioxide, etc.).

Table I-16 Logan Airport Greenhouse Gas (GHG) Inventory Input Data and Information[1] for 2011

Activity	Fuel Type	Usage	Units	Source
Aircraft				
Aircraft Taxi	Jet A[2]	19,550,164	gallons	EDMS v5.1.3
	AvGas[3]	808	gallons	EDMS v5.1.3
Engine Startup	Jet A	228,822	gallons	EDMS v5.1.3
Aircraft Ground up to 3,000 feet	Jet A[2]	17,527,225	gallons	EDMS v5.1.3
	AvGas[3]	724	gallons	EDMS v5.1.3
Aircraft Support Equipment				
GSE	Diesel	650,257	gallons	Massport
	Gasoline	284,550	gallons	Massport
	Propane	1,682	gallons	EDMS v5.1.3
	CNG	413,281	ft^3	EDMS v5.1.3
APU	Jet A	792,147	gallons	EDMS v5.1.3
Motor Vehicles				
On-airport Vehicles	Composite[5]	61,190,976	VMT	Massport
On-airport Parking/Curbsides	Composite[5]	1,214,831	Idle hours	Massport
Massport Shuttle Bus	CNG	358,714	GEG	Massport
	Diesel	2,864	gallons	Massport
Massport Express Bus	Diesel	202,817	gallons	Massport
Masspoort Fire Rescue	Diesel	12,000	gallons	Massport
Aquircultural Equipment	Diesel	110,128	gallons	Massport
Massport Fleet Vehicles (Honda Civic)	CNG	78,579	GEG	Massport
Massport Fleet Vehicles (Fueled Onsite)	Gasoline	109,300	gallons	Massport
Massport Fleet Vehicles (Fueled Offsite)	Gasoline	82,197	gallons	Massport
Massport Fleet Vehicles (Fueled Onsite)	Diesel	248,691	gallons	Massport
Off-airport Vehicles (Public)	Composite[5]	149,813,495	VMT	Massport
Off-airport Vehicles (Airport Employees)	Composite[5]	3,581,673	VMT	Massport
Off-airport Vehicles (Tenant Employees)	Composite[5]	48,376,557	VMT	Massport
Stationary and Portable Sources				
Boilers and Space Heaters	No 2 Oil	384,906	gallons	Massport
	No 6 Oil	11,285	gallons	Massport
	Natural Gas	472.350	million ft^3	Massport
Generators	Diesel	75,863	gallons	Massport
Snow melters	ULSD	218,081	gallons	Massport
	CNG	7.48	million ft^3	Massport
Fire Training Facility	Tekflame	3,500	gallons	Massport
	AvGas	310	gallons	Massport
Electrical Consumption – Massport	-	25,428,190	kWh	Massport
Electrical Consumption – Common Area	-	101,291,489	kWh	Massport
Electrical Consumption – Tenant	-	56,542,521	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 Based on 2011 activity levels and conditions.
2 Jet A density of 6.84 pounds per gallon.
3 AvGas density of 6.0 pounds per gallon.
4 The LTO (landing and take-off operation) includes landing, taxi-in, taxi-out, take-off, and up to an altitude of 3,000 feet.
5 Composite means gasoline and diesel-fueled motor vehicle feel mix based on MOBILE62.

Emission factors were obtained from the U.S. Energy Information Administration, the International Panel on Climate Change (IPCC), and the EPA.[7,8,9] Table I-17 presents these emission factors for CO_2, nitrous oxide (N_2O), and methane (CH_4).

Table I-17 Greenhouse Gas (GHG) Emission Factors

Sources	Fuel	CO_2	N_2O	CH_4	Units
Aircraft[1]	Jet A	21.095	0.000188	0.00052	lb/gallon
	AvGas	18.355	0.000188	0.00052	lb/gallon
Ground Support Equipment/	Diesel	22.384	0.0002	0.00053	lb/gallon
Auxiliary Power Units[1]	Gasoline	19.564	0.0002	0.00055	lb/gallon
	CNG	120.593	0.0002	0.00020	lb/1000 ft^3
	Propane	12.669	2.30E-07	0.000003	lb/gallon
	Jet A	21.095	0.000188	0.00052	lb/gallon
Motor Vehicles[2]	Composite	368	0.005	0.017	g/mile
	Composite	921	0.0125	0.190	g/hour
	CNG	120.593	0.0002	0.00020	lb/1000 ft^3
	Diesel	22.384	0.0002	0.000534	lb/gallon
	Gasoline	19.564	0.0002	0.00055	lb/gallon
Stationary and Portable[1]	No. 2 Oil	22.384	0.000193	0.000534	lb/gallon
	No. 6 Oil	26.033	0.000208	0.000225	lb/gallon
	Natural Gas	120.593	0.0002	0.0002	lb/1000 ft^3
	ULSD	22.384	0.000193	0.000534	lb/gallon
Fire Training Facility[1]	Tekflame[3]	12.669	2.30E-07	0.000003	lb/gallon
	AvGas	18.355	0.000188	0.00052	lb/gallon
Electrical Consumption[4]	-	0.98	0.0000136	0.0000584	lb/kW-hr

Sources: Massport and KBE.

Notes: CH_4 – methane; CNG – compressed natural gas; CO_2 – carbon dioxide; g- grams; kWhr – kilowatt hour; lb – pound; N_20 – nitrous oxides.

1 Energy Information Administration, www.eia.doe.gov/oiaf/1605/coefficients.html.

2 Environmental Protection Agency, MOBILE6.2 Emissions Model and Volume 2 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories

3 As propane

4 Energy Information Administration, *Updated State-and Regional-level Greenhouse Gas Emission Factors for Electricity* (March 2002), http://www.eia.gov/pub/oiaf/1605/cdrom/pdf/e-supdoc.pdf

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 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, 2006, www.ipcc-nggip.iges.or.jp/public/2006gl/index.html

9 U.S. Environmental Protection Agency, MOBILE6.2 Emissions Model, www.epa.gov/otaq/m6.htm

Results

Table I-18 presents the results of the 2011 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).

Table I-18 Greenhouse Gas (GHG) Emissions (MMT CO_2 Eq)[1] for 2011

Activity	CO_2	N_2O	CH_4	Total
Aircraft Sources				
Aircraft Taxi	0.19	<0.01	<0.01	0.19
Engine Startup	<0.01	<0.01	<0.01	<0.01
Aircraft AGL to 3,000 feet	0.17	<0.01	<0.01	0.17
Aircraft Support Equipment				
GSE	0.01	<0.01	<0.01	0.01
APU	0.01	<0.01	<0.01	0.01
Motor Vehicles				
On-airport Vehicles	0.02	<0.01	<0.01	0.02
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)	0.04	<0.01	<0.01	0.04
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	0.08	<0.01	<0.01	0.08

Sources: Massport and KBE.
1 Units expressed as million metric tons of CO_2 equivalent (MMT CO_2 Eq): 1 metric ton = 1.1 short tons.

Table I-19 compares the total GHG emission from Logan Airport to the totals GHG emissions for Massachusetts.

Table I-19 Logan Airport Greenhouse Gas (GHG) Emissions Compared to Massachusetts Totals[1]

	CO_2	N_2O	CH_4	Totals
Logan Airport Emissions[2]	0.58	<0.01	<0.01	0.58
Massachusetts[3]	82.1	1.3	1.2	84.6
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, 2010)
4 Percentages represent the relative amount Logan-related emissions compared to the state totals.

Table I-20 provides a comparison between Airport-related GHG emissions from 2007 through 2011. GHG emissions in 2011 were slightly higher (4.8 percent) than 2010 levels. In order to equally compare to previous years, the 2011 emissions are summarized in a manner similar to previous years.

Table I-20 Comparison of Estimated Total Greenhouse Gas (GHG) Emissions (MMT of CO_2eq) at Logan Airport – 2007 through 2011

Source	2007	2008	2009	2010	2011
Direct Emissions[2]					
Aircraft[3]	0.22	0.21	0.19	0.18	0.19
GSE/APUs	0.08	0.08	0.02	0.02	0.02
Motor vehicles[4]	0.03	0.03	0.03	0.03	0.04
Other sources[5]	0.04	0.03	0.03	0.03	0.03
Total Direct Emissions	0.37	0.35	0.27	0.27	0.28
Indirect Emissions[6]					
Aircraft[7]	0.18	0.17	0.17	0.17	0.17
Motor vehicles[8]	0.05	0.05	0.05	0.05	0.06
Electrical consumption[9]	0.09	0.08	0.07	0.07	0.08
Total Indirect Emissions	0.32	0.30	0.29	0.29	0.30
Total Emissions[10]	0.69	0.65	0.56	0.56	0.58
Percent of State Totals[11]	<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 60.5 miles (2010 Passenger Ground Access Survey).

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).

Greenhouse Gas Emissions Inventory for 2030

Methodology

Airport GHG emissions for 2030 are calculated in the same manner as for 2011, 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). Activity levels and material throughput rates were estimated based on scaling the 2011 data (or recent five-year average) to 2030 as a function of the forecasted changes in aircraft operations, traffic volumes, passenger counts, terminal square footage, or similar matrices over this timeframe. Generally, these estimates represent a conservative calculation of the activity and material rates during 2030 and thus, a conservative estimate of the GHG emissions. Table I-21 summarizes these data and information used in the 2030 GHG emissions inventory.

Table I-21 Logan Airport Greenhouse Gas (GHG) Inventory Input Data and Information[1] for 2030

Activity	Fuel Type	Usage	Units	Source
Aircraft				
Aircraft Taxi	Jet A[2]	21,198,863	gallons	EDMS v5.1.3
	AvGas[3]	876	gallons	EDMS v5.1.3
Engine Startup	Jet A	302,531	gallons	EDMS v5.1.3
Aircraft Ground up to 3,000 feet	Jet A[2]	23,537,689	gallons	EDMS v5.1.3
	AvGas[3]	972	gallons	EDMS v5.1.3
Aircraft Support Equipment				
GSE	Diesel	836,612	gallons	Massport
	Gasoline	366,098	gallons	Massport
	Propane	2,407	gallons	EDMS v5.1.3
	CNG	575,465	ft^3	EDMS v5.1.3
APU	Jet A	1,075,075	gallons	EDMS v5.1.3
Motor Vehicles				
On-airport Vehicles	Composite[5]	71,334,417	VMT	Massport
On-airport Parking/Curbsides	Composite[5]	1,685,021	Idle hours	Massport
Massport Shuttle Bus	CNG	494,262	GEG	Massport
	Diesel	3,946	gallons	Massport
Massport Express Bus	Diesel	279,456	gallons	Massport
Masspoort Fire Rescue	Diesel	15,439	gallons	Massport
Aquircultural Equipment	Diesel	141,689	gallons	Massport
Massport Fleet Vehicles (Honda Civic)	CNG	101,099	GEG	Massport
Massport Fleet Vehicles (Fueled Onsite)	Gasoline	140,624	gallons	Massport
Massport Fleet Vehicles (Fueled Offsite)	Gasoline	105,754	gallons	Massport
Massport Fleet Vehicles (Fueled Onsite)	Diesel	319,963	gallons	Massport
Off-airport Vehicles (Public)	Composite[5]	157,050,804	VMT	Massport
Off-airport Vehicles (Airport Employees)	Composite[5]	3,814,077	VMT	Massport
Off-airport Vehicles (Tenant Employees)	Composite[5]	51,515,572	VMT	Massport
Stationary and Portable Sources				
Boilers and Space Heaters	No 2 Oil	363,959	gallons	Massport
	No 6 Oil	252,061	gallons	Massport
	Natural Gas	443,646	million ft^3	Massport
Generators	Diesel	38,192	gallons	Massport
Snow melters	ULSD	158,838	gallons	Massport
	Natural Gas	3.01	million ft^3	Massport
Fire Training Facility	Tekflame	4,482	gallons	Massport
	AvGas	379	gallons	Massport
Electrical Consumption – Massport	-	26,226,705	kWh	Massport
Electrical Consumption – Common Area	-	104,472,319	kWh	Massport
Electrical Consumption – Tenant	-	58,318,110	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 Based on 2011 activity levels and conditions.
2 Jet A density of 6.84 pounds per gallon.
3 AvGas density of 6.0 pounds per gallon.
4 The LTO (landing and take-off operation) includes landing, taxi-in, taxi-out, take-off, and up to an altitude of 3,000 feet.
5 Composite means gasoline and diesel-fueled motor vehicle feel mix based on MOBILE62.

Results

Table I-22 presents the results of the 2030 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).

Table I-22 Greenhouse Gas (GHG) Emissions (MMT CO_2 Eq)[1] for 2030

Activity	CO_2	N_2O	CH_4	Total
Aircraft Sources				
Aircraft Taxi	0.20	<0.01	<0.01	0.20
Engine Startup	<0.01	<0.01	<0.01	<0.01
Aircraft AGL to 3,000 feet	0.23	<0.01	<0.01	0.23
Aircraft Support Equipment				
GSE	0.01	<0.01	<0.01	0.01
APU	0.01	<0.01	<0.01	0.01
Motor Vehicles				
On-airport Vehicles	0.02	<0.01	<0.01	0.02
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)	0.03	<0.01	<0.01	0.03
Off-airport Vehicles (Airport Employees)	<0.01	<0.01	<0.01	<0.01
Off-airport Vehicles (Tenant Employees)	0.01	<0.01	<0.01	0.01
Stationary Sources				
Boilers	0.03	<0.01	<0.01	0.04
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	0.08	<0.01	<0.01	0.08

Sources: Massport and KBE.
1 Units expressed as million metric tons of CO2 equivalent (MMT CO2 Eq): 1 metric ton = 1.1 short tons.

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J

Water Quality/ Environmental Compliance and Management

This appendix provides detailed information in support of *Chapter 8, Water Quality/Environmental Compliance and Management:*

- Table J-1 National Pollutant Discharge Elimination System (NPDES) Permit Stormwater Outfall Monitoring Requirements (2007)
- Table J-2 Logan Airport 2011 Monthly Monitoring Results for First Quarter — North, West, and Maverick Street Stormwater Outfalls
- Table J-3 Logan Airport 2011 Monthly Monitoring Results for First Quarter — Porter Street Stormwater Outfall
- Table J-4 Logan Airport 2011 Monthly Monitoring Results for Second Quarter — North, West, and Maverick Street Stormwater Outfalls
- Table J-5 Logan Airport 2011 Monthly Monitoring Results for Second Quarter — Porter Street Stormwater Outfall
- Table J-6 Logan Airport 2011 Monthly Monitoring Results for Third Quarter — North, West, and Maverick Street Stormwater Outfalls
- Table J-7 Logan Airport 2011 Monthly Monitoring Results for Third Quarter — Porter Street Stormwater Outfall
- Table J-8 Logan Airport 2011 Monthly Monitoring Results for Fourth Quarter — North, West, and Maverick Street Stormwater Outfalls
- Table J-9 Logan Airport 2011 Monthly Monitoring Results for Fourth Quarter — Porter Street Stormwater Outfall
- Table J-10 Logan Airport 2011 Quarterly Wet Weather Monitoring Results — North, West, Maverick Street, and Porter Street Stormwater Outfalls

- Table J-11 Logan Airport 2011 Quarterly Wet Weather Monitoring Results – Northwest and Runway/Perimeter Stormwater Outfalls
- Table J-12 Logan Airport 2011 Wet Weather Deicing Monitoring Results – North, West, and Porter Street Stormwater Outfalls
- Table J-13 Logan Airport 2011 Wet Weather Deicing Monitoring Results – Runway/Perimeter Stormwater Outfalls
- Table J-14 Logan Airport Stormwater Outfall NPDES Water Quality Monitoring Results – 1993 to 2011
- Table J-15 Logan Airport Oil and Hazardous Material Spills and Jet Fuel Handling – 1990 to 2011
- Table J-16 Type and Quantity of Oil and Hazardous Material Spills at Logan Airport – 1999 to 2011
- Letter to Environmental Protection Agency Regarding Discharge Monitoring Reports for Logan Airport Outfalls for January 2011, dated February 15, 2011.
- Letter to Environmental Protection Agency Regarding Discharge Monitoring Reports for Logan Airport Outfalls for March 2011, dated April 15, 2011.
- Letter to Environmental Protection Agency Regarding Discharge Monitoring Reports for Logan Airport Outfalls for April 2011, dated May 16, 2011.
- Letter to Environmental Protection Agency Regarding Discharge Monitoring Reports for Logan Airport Outfalls for July 2011, dated August 15, 2011.
- Letter to Environmental Protection Agency Regarding Discharge Monitoring Reports for Logan Airport Outfalls for November 2011, dated December 15, 2011.
- EnviroNews Vol. 36, Issue 4 – December 2010/January 2011
  Vol. 37, Issue 1 – May 2011
  Vol. 37, Issue 3 – December 2011/January 2012

Table J-1 NPDES Permit Stormwater Outfall Monitoring Requirements (2007)

	North Outfall 001		West Outfall 002		Maverick Outfall 003	
Monitoring Event	**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 Tolytriazole	Not Required	Ethylene Glycol Propylene Glycol BOD5[4] COD[5] Total Ammonia Nitrogen Nonylphenol Tolytriazole	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 NPDES Permit 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 Logan Airport 2011 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)
001A – North Outfall[1]	1/18/2011	Wet Weather	2.24	0.54	6.42	<4.4	22	<1.0	0.15	170	<10
002A – West Outfall[1]	1/18/2011	Wet Weather	9.87	1.52	6.36	**28**	**230**	4.5	0.24	440	220
004A – Maverick Street Outfall[2,3]	1/25/2011	Wet Weather	0.83	0.09	6.35	<4.0	38	NA	0.42	30	70
001C – North Outfall	1/24/2011	Dry Weather				<4.0	25	<1.0	0.14	90	30
002C – West Outfall	1/24/2011	Dry Weather				<4.4	26	<1.0	0.06	500	240
004C – Maverick Street Outfall	1/24/2011	Dry Weather				<4.4	26	<1.0	0.05	10	10
001A – North Outfall	2/25/2011	Wet Weather	3.95	0.50	7.23	5.3	40	<1.0	0.07	50	1,300
002A – West Outfall	2/25/2011	Wet Weather	14.05	1.73	6.89	4.5	56	<1.0	0.07	750	350
004A – Maverick Street Outfall	2/25/2011	Wet Weather	0.97	0.11	7.04	4.2	31	<1.0	0.06	40	150
001C – North Outfall	2/11/2011	Dry Weather				<4.0	27	<1.0	0.06	490	50
002C – West Outfall	2/11/2011	Dry Weather				<4.0	19	<1.0	0.06	3,000	390
004C – Maverick Street Outfall[4]	2/18/2011	Dry Weather				<4.4	30	<1.0	0.17	490	700
001A – North Outfall	3/11/2011	Wet Weather	1.25	0.26	7.47	<4.0	26	<1.0	0.09	160	530
002A – West Outfall	3/11/2011	Wet Weather	4.50	1.10	6.74	8.4	66	<1.0	0.11	3,600	380
004A – Maverick Street Outfall	3/11/2011	Wet Weather	0.37	0.06	7.77	12	**110**	<1.0	0.15	2,000	3,300
001C – North Outfall	3/15/2011	Dry Weather				<4.0	22	<1.0	0.07	90	10
002C – West Outfall	3/15/2011	Dry Weather				<4.0	18	<1.0	0.06	720	280
004C – Maverick Street Outfall	3/15/2011	Dry Weather				<4.4	14	<1.0	<0.05	<10	<10
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 Daily			Report	Report	6.0 to 8.5	–	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.
Bold values exceed maximum daily discharge limitation.
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 Due to hazardous driving conditions preventing transport to the laboratory, the fecal coliform and Enterococcus samples for all external outfalls were collected on January 25, 2011.

2 The Maverick Street Outfall was inaccessible on January 18, 2011 and therefore was sampled on January 25, 2011.

3 Benzene was not analyzed (denoted with NA) at the Maverick Street Outfall since sampling vials were misplaced by the laboratory while in their custody.

4 The Maverick Street Outfall was dry on February 11, 2011 and therefore a sample was collected on February 18, 2011.

TSS Total Suspended Solids

NS Not Sampled

Table J-3 Logan Airport 2011 Stormwater Outfalls 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]	1/18/2011	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	1/18/2011	Wet Weather	-	-	8.36	10	30	<1.0	0.11	<10	<10
003 - Porter Street Outfall 3[1]	1/18/2011	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall Average		Wet Weather	1.79	0.27	8.36	0.0	30	0.0	0.11	1.0	1.0
003 - Porter Street Outfall 1[1]	1/24/2011	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	1/24/2011	Dry Weather				<4.4	15	<1.0	0.09	<10	10
003 - Porter Street Outfall 3[1]	1/24/2011	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall Average		Dry Weather				0.0	15	0.0	0.09	1.0	10
003 - Porter Street Outfall 1[2]	2/25/2011	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	2/25/2011	Wet Weather	-	-	7.04	<4.4	18	<1.0	<0.05	<10	<10
003 - Porter Street Outfall 3[3]	2/25/2011	Wet Weather	-	-	7.13	<4.0	17	<1.0	<0.05	<10	60
003 - Porter Street Outfall Average		Wet Weather	2.59	0.28	7.09	0.0	17.5	0.0	0.0	1.0	7.7
003 - Porter Street Outfall 1[2]	2/11/2011	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	2/11/2011	Dry Weather				<4.0	10	<1.0	0.08	10	<10
003 - Porter Street Outfall 3[3]	2/18/2011	Dry Weather				5.0	22	<1.0	0.19	<10	80
003 - Porter Street Outfall Average		Dry Weather				2.5	16	0.0	0.14	3.2	8.9
003 - Porter Street Outfall 1[2]	3/11/2011	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	3/11/2011	Wet Weather	-	-	7.37	<4.0	20	<1.0	<0.05	<10	<10
003 - Porter Street Outfall 3[3]	3/11/2011	Wet Weather	-	-	6.71	<4.0	19	<1.0	0.08	60	30
003 - Porter Street Outfall Average		Wet Weather	0.94	0.15	7.04	0.0	19.5	0.0	0.04	7.7	5.5
003 - Porter Street Outfall 1[2]	3/15/2011	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	3/15/2011	Dry Weather				<4.0	<5.0	<1.0	0.06	<10	<10
003 - Porter Street Outfall 3[3]	3/15/2011	Dry Weather				<4.4	<5.0	<1.0	0.09	<10	<10
003 - Porter Street Outfall Average		Dry Weather				0.0	0.0	0.0	0.08	1.0	1.0
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 Daily			Report	Report	6.0 to 8.5	—	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 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 The Porter Street Outfall 1 and Porter Street Outfall 3 were not accessible due to construction; therefore samples were not collected from either location.

2 The Porter Street Outfall 1 was not accessible due to construction; therefore samples were not collected from either location.

3 A new sampling location was established for Porter Street Outfall 3 due to ongoing construction. It was sampled for the first time on February 18, 2011.

TSS Total Suspended Solids

Table J-4 Logan Airport 2011 Stormwater Outfalls 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)
001A – North Outfall	4/13/2011	Wet Weather	4.90	0.59	7.33	<4.4	5.5	<1.0	0.06	470	2,800
002A – West Outfall	4/13/2011	Wet Weather	15.52	2.36	7.41	**24**	**560**	<1.0	0.07	570	630
004A – Maverick Street Outfall	4/13/2011	Wet Weather	1.20	0.14	7.20	<4.0	8.6	<1.0	0.27	810	670
001C – North Outfall	4/8/2011	Dry Weather				<4.4	22	<1.0	0.12	70	20
002C – West Outfall	4/8/2011	Dry Weather				<4.0	15	<1.0	0.11	670	190
004C – Maverick Street Outfall	4/8/2011	Dry Weather				<4.4	10	<1.0	0.87	220	130
001A – North Outfall	5/23/2011	Wet Weather	1.62	0.25	7.76	<4.0	9.3	<1.0	0.22	600	390
002A – West Outfall	5/23/2011	Wet Weather	5.56	1.03	7.42	<4.0	15	<1.0	0.10	1,600	680
004A – Maverick Street Outfall	5/23/2011	Wet Weather	0.44	0.06	7.54	<4.0	17	<1.0	<0.05	210	470
001C – North Outfall	5/12/2011	Dry Weather				<4.0	20	<1.0	0.57	430	360
002C – West Outfall	5/12/2011	Dry Weather				<4.0	12	<1.0	0.14	4,800	410
004C – Maverick Street Outfall	5/12/2011	Dry Weather				<4.0	7.0	<1.0	0.05	20	20
001A – North Outfall	6/29/2011	Wet Weather	5.40	0.52	8.20	<4.0	11	<1.0	0.35	720	540
002A – West Outfall	6/29/2011	Wet Weather	14.08	1.96	7.11	<4.4	20	<1.0	0.17	6,000	13,000
004A – Maverick Street Outfall	6/29/2011	Wet Weather	1.43	0.13	6.75	<4.0	11	<1.0	<0.05	200	100
001C – North Outfall	6/8/2011	Dry Weather				<4.0	13	<1.0	0.11	320	260
002C – West Outfall	6/8/2011	Dry Weather				<4.0	16	<1.0	0.06	4,900	1,300
004C – Maverick Street Outfall	6/8/2011	Dry Weather				<4.0	11	<1.0	<0.05	20	40
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 Daily			Report	Report	6.0 to 8.5	–	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.
Bold values exceed maximum daily discharge limitation.
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

Table J-5 Logan Airport 2011 Stormwater Outfalls 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[1]	4/13/2011	Wet Weather	---	---	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	4/13/2011	Wet Weather	---	---	7.30	<4.4	<5.0	<1.0	<0.05	<10	30
003 - Porter Street Outfall 3[2]	4/13/2011	Wet Weather	---	---	7.28	<4.0	<5.0	<1.0	0.07	<10	40
003 - Porter Street Outfall Average		Wet Weather	2.82	0.37	7.29	0.0	0.0	0.0	0.04	1.0	34.6
003 - Porter Street Outfall 1[1]	4/8/2011	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	4/8/2011	Dry Weather				<4.0	<5.0	<1.0	0.06	<10	<10
003 - Porter Street Outfall 3[2]	4/8/2011	Dry Weather				<4.4	24	<1.0	0.15	<10	<10
003 - Porter Street Outfall Average		Dry Weather				0.0	12	0.0	0.11	1.0	1.0
003 - Porter Street Outfall 1[1]	5/23/2011	Wet Weather	---	---	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	5/23/2011	Wet Weather	---	---	8.01	<4.0	<5.0	<1.0	<0.05	80	1,000
003 - Porter Street Outfall 3[2]	5/23/2011	Wet Weather	---	---	7.82	<4.0	<5.0	<1.0	<0.05	20	530
003 - Porter Street Outfall Average		Wet Weather	1.22	0.15	7.92	0.0	0.0	0.0	0.0	40	728
003 - Porter Street Outfall 1[1]	5/12/2011	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	5/12/2011	Dry Weather				<4.0	<5.0	<1.0	0.13	55	40
003 - Porter Street Outfall 3[2]	5/12/2011	Dry Weather				<4.4	43	<1.0	0.09	10	30
003 - Porter Street Outfall Average		Dry Weather				0.0	22	0.0	0.11	23.5	34.6
003 - Porter Street Outfall 1[1]	6/29/2011	Wet Weather	---	---	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	6/29/2011	Wet Weather	---	---	8.06	13	<5.0	<1.0	0.13	20	6,600
003 - Porter Street Outfall 3[2]	6/29/2011	Wet Weather	---	---	7.98	13	<5.0	<1.0	0.34	130	1,400
003 - Porter Street Outfall Average		Wet Weather	3.12	0.35	8.02	6.5	0.0	0.0	0.24	51	3,040
003 - Porter Street Outfall 1[1]	6/8/2011	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	6/8/2011	Dry Weather				<4.0	40	<1.0	0.14	<10	<10
003 - Porter Street Outfall 3[2]	6/8/2011	Dry Weather				<4.0	<5.0	<1.0	0.19	<10	<10
003 - Porter Street Outfall Average		Dry Weather				0.0	20	0.0	0.17	1.0	1.0
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 Daily			Report	Report	6.0 to 8.5	–	Report	Report	Report	Report	Report

Source: Massport

Notes: Porter Street Outfall location 3 (PSO-MH75) exhibited low flow during the wet sampling event and was dry during the dry sampling event, therefore PSO-MH78 was sampled in its place for both samples.
Bold values exceed maximum daily discharge limitation.
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 The Porter Street Outfall 1 was not accessible due to construction; therefore samples were not collected from this location.

2 A new sampling location was established for Porter Street Outfall 3 due to ongoing construction. It was sampled for the first time on February 18, 2011.

TSS Total Suspended Solids

NS Not Sampled

Table J-6 Logan Airport 2011 Stormwater Outfalls Monthly Monitoring Results for Third Quarter — North, West, and Maverick Street Stormwater Outfalls

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)	*Klebsiella*[1] (cfu/100mL)
001A – North Outfall	7/8/2011	Wet Weather	2.56	0.19	8.41	<4.0	6.4	<1.0	0.52	31,000	1,000	2,400
002A – West Outfall	7/8/2011	Wet Weather	11.09	0.71	7.86	<4.0	16	<1.0	0.40	11,000	6,600	
004A – Maverick Street Outfall	7/8/2011	Wet Weather	0.59	0.03	7.55	<4.0	17	<1.0	0.28	5,900	3,600	
001C – North Outfall	7/25/2011	Dry Weather				<4.0	9.0	<1.0	0.40	63,000	1,300	>8,000
002C – West Outfall	7/25/2011	Dry Weather				<4.0	15	<1.0	029	52,00	6,500	
004C – Maverick Street Outfall	7/25/2011	Dry Weather				<4.0	**370**	<1.0	012	<10	700	
001A – North Outfall	8/15/2011	Wet Weather	4.25	0.75	7.79	<4.0	<5.0	<1.0	0.18	2,400	3,600	<10
002A – West Outfall	8/15/2011	Wet Weather	18.11	2.72	6.82	<4.0	17	<1.0	0.22	16,000	5,600	
004A – Maverick Street Outfall[2]	8/15/2011	Wet Weather	1.10	0.18	NS	NS	NS	NS	NS	NS	NS	
001C – North Outfall	8/25/2011	Dry Weather				4.1	20	<1.0	0.08	35,000	520	<10
002C – West Outfall	8/25/2011	Dry Weather				<4.0	8.2	<1.0	0.07	30,000	10,000	
004C – Maverick Street Outfall	8/25/2011	Dry Weather				<4.0	42	<1.0	0.05	400	180	
001A – North Outfall	9/6/2011	Wet Weather	4.04	0.42	7.48	<4.0	<5.0	<1.0	0.12	3,300	1,100	NA
002A – West Outfall	9/6/2011	Wet Weather	15.42	1.54	7.89	<4.0	8.0	<1.0	0.13	5,400	3,500	
004A – Maverick Street Outfall	9/6/2011	Wet Weather	0.92	0.10	7.17	<4.0	92	<1.0	0.10	2,100	1,500	
001C – North Outfall	9/15/2011	Dry Weather				<4.0	19	<1.0	0.19	16,000	610	11,000
002C – West Outfall	9/15/2011	Dry Weather				<4.0	15	<1.0	0.24	5,500	3,600	
004C – Maverick Street Outfall	9/15/2011	Dry Weather				<4.0	16	<1.0	0.05	120	410	
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 Daily			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.
Bold values exceed maximum daily discharge limitation.
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.

2 The Maverick Street Outfall was not accessible due to construction; therefore, a sample was not collected

TSS Total Suspended Solids

NA Not Analyzed

NS Not Sampled

Table J-7 Logan Airport 2011 Stormwater Outfalls 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[1]	7/8/2011	Wet Weather	---	---	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	7/8/2011	Wet Weather	---	---	8.48	<4.4	<5.0	<1.0	0.14	90	5,200
003 - Porter Street Outfall 3[2]	7/8/2011	Wet Weather	---	---	8.50	<4.0	<5.0	<1.0	0.58	240	640
003 - Porter Street Outfall Average		Wet Weather	2.20	0.11	8.49	0.0	0.0	0.0	0.36	147	1,824
003 - Porter Street Outfall 1[1]	7/25/2011	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	7/25/2011	Dry Weather				<4.0	10	<1.0	0.12	30	140
003 - Porter Street Outfall 3[2]	7/25/2011	Dry Weather				<4.0	81	<1.0	0.67	100	20
003 - Porter Street Outfall Average		Dry Weather				0.0	46	0.0	0.40	55	53
003 - Porter Street Outfall 1[1]	8/15/2011	Wet Weather	---	---	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	8/15/2011	Wet Weather	---	---	8.04	<4.0	<5.0	<1.0	0.07	18,000	130
003 - Porter Street Outfall 3[2]	8/15/2011	Wet Weather	---	---	7.81	<4.4	<5.0	<1.0	0.09	560	740
003 - Porter Street Outfall Average		Wet Weather	4.78	0.56	7.93	0.0	0.0	0.0	0.08	3,175	310
003 - Porter Street Outfall 1[1]	8/25/2011	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	8/25/2011	Dry Weather				<4.0	<5.0	<1.0	0.05	<10	20
003 - Porter Street Outfall 3[2]	8/25/2011	Dry Weather				<4.0	<5.0	<1.0	0.26	50	155
003 - Porter Street Outfall Average		Dry Weather				0.0	0.0	0.0	0.16	7.1	56
003 - Porter Street Outfall 1[1]	9/6/2011	Wet Weather	---	---	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	9/6/2011	Wet Weather	---	---	8.21	<4.0	<5.0	<1.0	<0.05	<10	60
003 - Porter Street Outfall 3[2]	9/6/2011	Wet Weather	---	---	7.73	<4.0	<5.0	<1.0	0.16	360	360
003 - Porter Street Outfall Average		Wet Weather	3.13	0.31	7.97	0.0	0.0	0.0	0.08	19	147
003 - Porter Street Outfall 1[1]	9/15/2011	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	9/15/2011	Dry Weather				<4.0	<5.0	<1.0	0.13	50	50
003 - Porter Street Outfall 3[2]	9/15/2011	Dry Weather				<4.0	5.6	<1.0	0.23	150	230
003 - Porter Street Outfall Average		Dry Weather				0.0	2.8	0.0	0.18	86.6	107
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 Daily			Report	Report	6.0 to 8.5	–	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 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 The Porter Street Outfall 1 was not accessible due to construction; therefore samples were not collected from this location.

2 A new sampling location was established for Porter Street Outfall 3 due to ongoing construction. It was sampled for the first time on February 18, 2011.

TSS Total Suspended Solids

NA Not Analyzed

NS Not Sampled

Table J-8 Logan Airport 2011 Stormwater Outfalls 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	10/13/2011	Wet Weather	3.94	0.73	7.99	<4.0	6.1	<1.0	0.07	14,000	7,000	6,000
002A – West Outfall	10/13/2011	Wet Weather	13.48	2.65	6.92	<4.0	11	<1.0	0.19	3,300	1,200	
004A – Maverick Street Outfall	10/13/2011	Wet Weather	0.96	0.18	7.37	<4.0	34	<1.0	0.14	3,300	1,500	
001C – North Outfall	10/7/2011	Dry Weather				<4.0	11	<1.0	0.14	19,000	250	24,000
002C – West Outfall	10/7/2011	Dry Weather				<4.0	15	<1.0	0.10	4,400	4,500	
004C – Maverick Street Outfall	10/7/2011	Dry Weather				<4.0	18	<1.0	0.06	40	90	
001A – North Outfall	11/10/2011	Wet Weather	5.40	0.50	7.47	<4.0	40	<1.0	0.28	>80,000	660	19,000
002A – West Outfall	11/10/2011	Wet Weather	19.06	1.92	7.81	<4.0	24	<1.0	0.11	2,800	1,600	
004A – Maverick Street Outfall	11/10/2011	Wet Weather	1.24	0.12	6.78	<4.0	57	<1.0	0.13	13,000	4,300	
001C – North Outfall	11/3/2011	Dry Weather				<4.0	<5.0	<1.0	0.06	25,000	80	10,000
002C – West Outfall	11/3/2011	Dry Weather				<4.0	15	<1.0	0.05	2,700	910	
004C – Maverick Street Outfall	11/3/2011	Dry Weather				<4.0	**150**	<1.0	<0.05	4,600	200	
001A – North Outfall	12/15/2011	Wet Weather	5.16	0.564	7.44	<4.0	14	<1.0	0.08	8,000	90	<10
002A – West Outfall	12/15/2011	Wet Weather	19.6	2.24	7.46	<4.0	33	<1.0	0.09	6,300	1,400	
004A – Maverick Street Outfall	12/15/2011	Wet Weather	1.29	0.148	7.57	<4.0	<5.0	<1.0	<0.05	240	150	
001C – North Outfall	12/13/2011	Dry Weather				<4.0	11	<1.0	0.12	3,500	280	NA
002C – West Outfall	12/13/2011	Dry Weather				<4.0	10	<1.0	<0.05	50	320	
004C – Maverick Street Outfall	12/13/2011	Dry Weather				<4.0	17	<1.0	<0.05	440	260	
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 Daily			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.
Bold values exceed maximum daily discharge limitation.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and *Enterococcus*) a value of 1 was employed for those results measured below the laboratory detection limit.

1 *Klebsiella* is an indication of non-fecal coliform bacteria and is tested for at the North Outfall when fecal coliform concentration exceeds 5,000 cfu/100ml.

TSS Total Suspended Solids

NA Not Analyzed

Table J-9 Logan Airport 2011 Stormwater Outfalls 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[1]	10/13/2011	Wet Weather	---	---	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	10/13/2011	Wet Weather	---	---	6.70	<4.0	22	<1.0	<0.05	<10	30
003 - Porter Street Outfall 3[2]	10/13/2011	Wet Weather	---	---	6.58	<4.0	8.9	<1.0	<0.05	100	1,500
003 - Porter Street Outfall Average		Wet Weather	2.31	0.51	6.64	0.0	15	0.0	0.0	10	212
003 - Porter Street Outfall 1[1]	10/7/2011	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	10/7/2011	Dry Weather				<4.0	<5.0	<1.0	0.05	<10	60
003 - Porter Street Outfall 3[2]	10/7/2011	Dry Weather				<4.0	<5.0	<1.0	0.17	20	250
003 - Porter Street Outfall Average		Dry Weather				0.0	0.0	0.0	0.11	4.5	122
003 - Porter Street Outfall 1[1]	11/10/2011	Wet Weather	---	---	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	11/10/2011	Wet Weather	---	---	8.06	<4.0	<5.0	<1.0	0.13	<10	80
003 - Porter Street Outfall 3[2]	11/10/2011	Wet Weather	---	---	7.51	<4.0	<5.0	<1.0	0.10	480	220
003 - Porter Street Outfall Average		Wet Weather	3.43	0.34	7.79	0.0	0.0	0.0	0.12	22	133
003 - Porter Street Outfall 1[1]	11/3/2011	Dry Weather				NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	11/3/2011	Dry Weather				<4.0	18	<1.0	<0.05	<10	80
003 - Porter Street Outfall 3[2]	11/3/2011	Dry Weather				<4.0	<5.0	<1.0	0.10	<10	10
003 - Porter Street Outfall Average		Dry Weather				0.0	9.0	0.0	0.05	1.0	28
003 - Porter Street Outfall 1	12/15/2011	Wet Weather	---	---	8.05	<4.0	40	<1.0	<0.05	<10	<10
003 - Porter Street Outfall 2	12/15/2011	Wet Weather	---	---	7.77	<4.0	<5.0	<1.0	<0.05	<10	10
003 - Porter Street Outfall 3[2]	12/15/2011	Wet Weather	---	---	7.86	<4.0	22	<1.0	0.11	10	260
003 - Porter Street Outfall Average		Wet Weather	5.38	0.379	7.89	0.0	21	0.0	0.04	2.2	14
003 - Porter Street Outfall 1	12/13/2011	Dry Weather				<4.0	<5.0	<1.0	<0.05	<10	<10
003 - Porter Street Outfall 2	12/13/2011	Dry Weather				<4.0	<5.0	<1.0	<0.05	30	20
003 - Porter Street Outfall 3[2]	12/13/2011	Dry Weather				<4.0	<5.0	<1.0	0.09	<10	10
003 - Porter Street Outfall Average		Dry Weather				0.0	0.0	0.0	0.03	3.1	5.8
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 Daily			Report	Report	6.0 to 8.5	–	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 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 The Porter Street Outfall 1 was not accessible due to construction; therefore samples were not collected from this location.

2 A new sampling location was established for Porter Street Outfall 3 due to ongoing construction. It was sampled for the first time on February 18, 2011.

TSS Total Suspended Solids

NS Not Sampled

Table J-10 Logan Airport 2011 Quarterly Wet Weather Monitoring Results – North, West, Maverick Street, and Porter Street Stormwater Outfalls

		Wet Weather									
	Date	pH (S.U.)	Benzo(a)-anthracene (µg/L)	Benzo(a)-pyrene (µg/L)	Benzo(b)-fluoranthene (µg/L)	Benzo(k)-fluoranthene (µg/L)	Chrysene (µg/L)	Dibenzo(a,h,)-anthracene (µg/L)	Indeno(1,2,3-cd)-pyrene (µg/L)	Naphthalene (µg/L)	Total PAHs (µg/L)
001 - North Outfall	2/25/2011	7.23	<50	<50	<50	<50	<50	<50	<70	<50	ND
002 - West Outfall	2/25/2011	6.89	<50	<50	<50	<50	<50	<50	<70	<50	ND
004 - Maverick Street Outfall	2/25/2011	7.04	<50	<50	<50	<50	<50	<50	<70	<50	ND
003 - Porter Street Outfall 1[1]	2/25/2011	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	2/25/2011	7.04	<10	<10	<10	<10	<10	<10	<14	<10	ND
003 - Porter Street Outfall 3[1]	2/25/2011	7.13	<10	<10	<10	<10	<10	<10	<14	<10	ND
003 - Porter Street Outfall Average		7.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
001 - North Outfall	7/8/2011	8.41	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
002 - West Outfall	7/8/2011	7.86	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
004 - Maverick Street Outfall	7/8/2011	7.55	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
003 - Porter Street Outfall 1[1]	7/8/2011	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	7/8/2011	8.48	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
003 - Porter Street Outfall 3[1]	7/8/2011	8.50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
003 - Porter Street Outfall Average		8.49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
001 - North Outfall	9/20/2011	8.00	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
002 - West Outfall	9/20/2011	7.00	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
004 - Maverick Street Outfall	9/20/2011	6.24	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
003 - Porter Street Outfall 1[1]	9/20/2011	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	9/20/2011	8.09	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
003 - Porter Street Outfall 3[1]	9/20/2011	7.85	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
003 - Porter Street Outfall Average		7.97	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
001 - North Outfall	12/15/2011	7.44	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
002 - West Outfall	12/15/2011	7.46	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
004 - Maverick Street Outfall	12/15/2011	7.57	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
003 - Porter Street Outfall 1	12/15/2011	8.05	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
003 - Porter Street Outfall 2	12/15/2011	7.77	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
003 - Porter Street Outfall 3	12/15/2011	7.86	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<7.0	<5.0	ND
003 - Porter Street Outfall Average		7.89	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily		6.0 to 8.5	Report	Report	Report	Report	Report	Report	Report	Report	Total

Source: Massport

Notes: **Bold** values exceed maximum daily discharge limitation.
ND Not Detected; NS Not Sampled; PAH Polynuclear Aromatic Hydrocarbons
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit.

1 The Porter Street Outfall 1 and Outfall 3 were not accessible due to construction, therefore samples were not collected from either location. A new sampling location for Outfall 3 was established.

Table J-11 Logan Airport 2011 Quarterly Wet Weather Monitoring Results – Northwest and Runway/Perimeter Stormwater Outfalls

	Date	Maximum Daily Flow (MGD)	Average Quarterly Flow (MGD)	pH (SU)	Oil and Grease (mg/L)	Total Suspended Solids (mg/L)	Benzene (µg/L)
005 - Northwest Outfall	2/25/2011	0.51	0.05	6.64	11	170	<1.0
006- Runway/ Perimeter Outfall (A9)	2/25/2011	0.33	0.04	6.87	<4.4	16	<1.0
006- Runway/ Perimeter Outfall (A17)	2/25/2011	0.11	0.01	6.96	<4.4	5.5	<1.0
006- Runway/ Perimeter Outfall (A19)	2/25/2011	0.04	0.01	6.93	<4.0	6.8	<1.0
006- Runway/ Perimeter Outfall (A21)	2/25/2011	2.46	0.29	6.90	<4.4	40	<1.0
006- Runway/ Perimeter Outfall (A23)	2/25/2011	0.27	0.03	7.00	<4.4	44	<1.0
006- Runway/ Perimeter Outfall (A33)	2/25/2011	0.18	0.03	6.91	<4.4	14	<1.0
006- Runway/ Perimeter Outfall (A38)	2/25/2011	0.33	0.03	7.04	<4.4	66	<1.0
006- Runway/Perimeter Outfall Average		0.53	0.06	6.94	0.0	27	0.0
005 - Northwest Outfall	7/8/2011	0.33	0.02	8.00	<4.4	30	<1.0
006- Runway/ Perimeter Outfall (A9)	7/8/2011	0.16	0.01	8.02	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A15)	7/8/2011	0.07	0.00	8.34	<4.4	9.6	<1.0
006- Runway/ Perimeter Outfall (A19)	7/8/2011	0.03	0.00	8.24	<4.0	200	<1.0
006- Runway/ Perimeter Outfall (A21)	7/8/2011	1.50	0.10	7.47	<4.0	9.6	<1.0
006- Runway/ Perimeter Outfall (A23)	7/8/2011	0.13	0.01	7.82	<4.0	5.1	<1.0
006- Runway/ Perimeter Outfall (A33)	7/8/2011	0.08	0.01	8.10	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A38)	7/8/2011	0.19	0.01	7.63	<4.0	9.7	<1.0
006- Runway/Perimeter Outfall Average		0.31	0.02	7.95	0.0	33	0.0
005 - Northwest Outfall	9/20/2011	0.53	0.05	6.62	<4.0	42	<1.0
006- Runway/ Perimeter Outfall (A9)	9/20/2011	0.26	0.03	8.44	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A15)	9/20/2011	0.11	0.01	8.04	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A17)	9/20/2011	0.11	0.01	7.95	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A21)	9/20/2011	2.12	0.19	6.97	<4.0	12	<1.0
006- Runway/ Perimeter Outfall (A23)	9/20/2011	0.20	0.02	7.12	<4.0	32	<1.0
006- Runway/ Perimeter Outfall (A33)	9/20/2011	0.13	0.02	8.45	<4.0	9.0	<1.0
006- Runway/ Perimeter Outfall (A38)	9/20/2011	0.28	0.02	7.89	<4.0	7.0	<1.0
006- Runway/Perimeter Outfall Average		0.46	0.04	7.84	0.0	8.6	0.0
005 - Northwest Outfall	12/15/2011	0.69	0.063	7.17	<4.4	<5.0	<1.0
006- Runway/ Perimeter Outfall (A9)	12/15/2011	0.341	0.052	7.69	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A18)	12/15/2011	0.052	0.008	7.66	<4.0	14	<1.0
006- Runway/ Perimeter Outfall (A19)	12/15/2011	0.053	0.007	7.30	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A21)	12/15/2011	2.79	0.38	7.46	<4.0	87	<1.0
006- Runway/ Perimeter Outfall (A23)	12/15/2011	0.268	0.040	7.36	<4.4	12	<1.0
006- Runway/ Perimeter Outfall (A33)	12/15/2011	0.235	0.036	7.64	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A38)	12/15/2011	0.351	0.032	7.50	<4.0	17	<1.0
006- Runway/Perimeter Outfall Average		0.585	0.080	7.52	0.0	19	0.0
Discharge Limitations		Report	Report	Report	Report	Report	Report

Source: Massport

Note: Requirements are from NPDES Permit MA 0000787, issued July 31, 2007

Table J-12 Logan Airport 2011 Wet Weather Deicing Monitoring Results – North, West and Porter Street Stormwater Outfalls

	Date	Ethylene Glycol, Total (mg/L)	Propylene Glycol, Total (mg/L)	BOD_5 (mg/L)	COD (mg/L)	Total Ammonia Nitrogen (mg/L of N)	Nonylphenol (µg/L)	4-Methyl-1-H-benzotriazole (µg/L)	5-Methyl-1-H-benzotriazole (µg/L)	Tolytriazole (µg/L)	Whole Effluent Toxicity[1]
001 - North Outfall	1/18/2011	560	890	980	2,400	2.06	<0.30	82.650	91.804	174.454	NS
002 - West Outfall	1/18/2011	690	8,400	7,200	17,000	1.60	<3.2	584.815	803.677	1,388.492	NS
003B - Porter Street 1[2]	1/18/2011	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
003B - Porter Street 2	1/18/2011	34	23	93	190	0.195	<0.3	15.674 J	21.708 J	37.382	NS
003B - Porter Street 3[2]	1/18/2011	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
003B - Porter Street Outfall Average		34	23	93	190	0.195	0.0	15.674	21.708	37.382	NA
001 - North Outfall	2/1/2011	22	280	320	930	2.65	<0.03	25.930	26.251	52.181	NS
002 - West Outfall	2/1/2011	90	110	340	1,400	1.19	<0.03	21.910	19.666	41.576	NS
003B - Porter Street 1[2]	2/1/2011	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
003B - Porter Street 2	2/1/2011	16	75	97	220	0.563	<0.03	6.395	8.158	14.553	NS
003B - Porter Street 3[2]	2/1/2011	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
003B - Porter Street Outfall Average		16	75	97	220	0.563	0.0	6.395	8.158	14.553	NA
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily		Report	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.

1 Whole Effluent Toxicity sample conducted on April 1, 2011.

2 During both deicing events, Porter Street Outfalls 1 and 3 were not sampled due to construction.

BOD_5 Five-day Biochemical Oxygen Demand

COD Chemical Oxygen Demand

NA Not Applicable

ND Not Detected

NS Not Sampled

Table J-13 Logan Airport 2011 Wet Weather Deicing Monitoring Results – Runway/ Perimeter Stormwater Outfalls

	Date	Ethylene Glycol, Total (mg/L)	Propylene Glycol, Total (mg/L)	BOD_5 (mg/L)	COD (mg/L)	Total Ammonia Nitrogen (mg/L of N)	Nonylphenol (µg/L)	4-Methyl-1-H-benzotriazole (µg/L)	5-Methyl-1-H-benzotriazole (µg/L)	Tolytriazole (µg/L)[2]	Whole Effluent Toxicity[1]
006- Runway/ Perimeter (A9)	1/18/2011	<10	<10	<5.0	400	0.659	<0.03	<0.500	<0.500	ND	NS
006- Runway/ Perimeter (A13)	1/18/2011	<10	<10	7.9	650	0.301	0.06	<0.500	<0.500	ND	NS
006- Runway/ Perimeter (A20)	1/18/2011	<10	<10	<10	830	0.510	0.09	<0.500	<0.500	ND	NS
006- Runway/ Perimeter (A21)	1/18/2011	<10	<10	14	710	1.10	<0.03	<0.500	<0.500	ND	NS
006- Runway/ Perimeter (A23)	1/18/2011	<10	<10	<5.0	530	1.05	<0.03	<0.500	<0.500	ND	NS
006- Runway/ Perimeter (A33)	1/18/2011	<10	<10	110	170	4.94	<0.03	71.807	8.015 J	79.822	NS
006- Runway/ Perimeter (A38)	1/18/2011	<10	<10	5.0	390	0.329	2.01	<0.500	<0.500	ND	NS
006- Runway/Perimeter Outfall Average		0.0	0.0	19.6	526	1.270	0.31	10.258	1.145	11.403	NA
006- Runway/ Perimeter (A9)	2/1/2011	<10	22	2.9	80	1.09	<0.03	5.141	0.420 J	5.561	NS
006- Runway/ Perimeter (A13)	2/1/2011	<10	<10	4.0	670	0.460	<0.03	1.225 J	0.316 J	1.541	NS
006- Runway/ Perimeter (A19)	2/1/2011	<10	<10	5.6	650	1.16	<0.03	5.258	<0.100	5.258	NS
006- Runway/ Perimeter (A21)	2/1/2011	<10	<10	5.3	460	1.16	<0.03	2.865 J	0.642 J	3.507	NS
006- Runway/ Perimeter (A23)	2/1/2011	<10	<10	14	470	2.83	<0.03	8.379	1.942 J	10.321	NS
006- Runway/ Perimeter (A33)	2/1/2011	<10	<10	39	230	3.71	<0.0	12.626	4.228 J	16.854	NS
006- Runway/ Perimeter (A38)	2/1/2011	<10	<10	<2.0	570	0.339	<0.03	<0.100	<0.100	ND	NS
006- Runway/Perimeter Outfall Average		0.0	3.1	8.9	447	1.54	0.0	5.071	1.078	6.149	NA
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations Maximum Daily		Report	Report	Report	Report	Report	Report	Report	Report	Report	NA

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.

1 Whole Effluent Toxicity sample conducted on April 1, 2011.

BOD_5 Five-day Biochemical Oxygen Demand

COD Chemical Oxygen Demand

NA Not Applicable

ND Not Detected

NS Not Sampled

Table J-14 Logan Airport Stormwater Outfall NPDES Water Quality Monitoring Results – 1993 to 2011

	1993	1994	1995	1996	1997	1998	1999	2000	2001[1]	2002	2003[1]	2004	2005	2006	2007	2008	2009	2010[1,2]	2011[2]
#/#= Number of samples at or below NPDES limits / Total number of samples taken																			
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
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
Porter Street Outfall[2]	30/30	35/36	34/34	36/36	35/35	34/36	30/30	35/36	28/28	34/36	32/32	33/34	34/35	33/33	22/22	50/50	72/72	50/50	49/49
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
Settleable Solids[3] (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
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
TSS (mg/L)																			
North Outfall	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6/6	24/24	24/24	22/23	24/24
West Outfall	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5/6	24/24	24/24	23/23	22/24
Maverick Street Outfall	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4/6	22/24	20/21	18/19	20/23
pH																			
North Outfall	34/35	33/36	35/35	35/35	35/35	36/36	30/30	36/36	29/29	36/36	32/32	34/34	35/35	34/34	26/26	12/12	16/16	11/11	12/12
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
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
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

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 In 2001, 2003, and 2010, exceptional weather, tidal conditions, or insufficient discharge precluded the collection of some samples, leading to a fewer number of samples collected than in other years.

2 In 2010 and 2011, Porter Street Outfall 1 and Porter Street Outfall 3 were not accessible due to construction, leading to a fewer number of samples collected than in other years. A new sampling location was established for Porter Street Outfall 3 and it was sampled for the first time on February 18, 2011. Porter Street Outfall 1 was accessible again in December 2011.

3 Settleable solids analyses were replaced with TSS in 2008.

Table J-15 Logan Airport Oil and Hazardous Material Spills[1] and Jet Fuel Handling - 1990 to 2011

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**

Source: Massport Fire-Rescue Department.
NA Not available.
1 Materials include: jet fuel, hydraulic oil, diesel fuel, gasoline, and other materials such as glycol and paint.
2 One tenant spill, which occurred on October 15, 1995, totaled 18,000 gallons (84 percent of the annual spill total). The spill did not enter the Airport's storm drain system.
3 On October 23, 1997, a fuel line on an aircraft failed, resulting in the release of approximately 2,500 gallons, all but 60 gallons of which were recovered in drums before reaching the ground. Only the 60 gallons is included in the 1997 total.
4 Includes a 7,200-gallon spill that was discovered on September 2, 1998, and a 1,300-gallon spill that occurred on June 3, 1998. Neither spill entered the Airport's storm drain system.
5 Includes a 5,000-gallon spill, none of which entered the Airport's storm drainage system.
6 In 2003, one fuel spill comprised 9,460 gallons or 94 percent of the total volume of the MassDEP/MCP reportable spills that year. The fuel spill was contained and did not enter the drainage system.

Table J-16 Type and Quantity of Oil and Hazardous Material Spills at Logan Airport - 1999 to 2011

	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**

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).

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Massachusetts Port Authority
One Harborside Drive, Suite 200S
East Boston, MA 02128-2090
Telephone (617) 568-5950
www.massport.com

February 15, 2011

Water Technical Unit (SEW)
U.S. Environmental Protection Agency
P.O. Box 8127
Boston, MA 02114

Re: Discharge Monitoring Report
Logan International Airport
NPDES Permit No. MA0000787

To Whom It May Concern:

Enclosed are the Discharge Monitoring Reports (DMRs) for Logan Airport Outfalls for the month of ~~April 2010.~~ January 2011.

As indicated on the attached report, stormwater samples collected from the West Outfall (Outfall 002) were found to have a Total Suspended Solids (TSS) concentration of 230 milligrams per liter (mg/l) and an Oil and Grease (O&G) concentration of 28 mg/l. The permit limit for TSS is 100 mg/l and the limit for O&G is 15 mg/l. The samples were obtained during a wet weather stormwater sampling event on January 18, 2011. Massport was informed of the exceedances on January 24, 2011, by our environmental consultant, Camp Dresser & McKee, Inc. (CDM), following confirmation of the analytical data by the laboratory.

Massport believes the exceedances may be attributable to the amount of precipitation that occurred on the sampling date, including approximately 0.8 inch of rain and 1.9 inches of snow. Prior to the January 18th sampling date, there had been a significant snow event on January 12th (14.6 inches) followed by five days of dry weather. So it is likely that the excessive runoff generated on the sampling date, which included the stormwater and snow melt, carried a higher than normal pollutant loading due to accumulated sediment and other stormwater contaminants such as oil and grease associated with roadways and paved areas.

Massport continues to implement the Best Management Practices included in the Logan Airport Stormwater Pollution Prevention Plan including daily pavement sweeping and maintenance of the pollution control equipment located at the West Outfall and North Outfall.

If you have any questions regarding the current DMRs, please contact me at (617) 568-3552. Thank you.

Sincerely,
Massachusetts Port Authority

James W. Stolecki

James W. Stolecki, P.E.
Senior Environmental Project Manager

Enclosure: Discharge Monitoring Reports

cc: Edward Pawlowski, MADEP NERO
M. Ashan, MADEP NERO
MADEP Division of Watershed Management
Bryan Glascock, City of Boston Environment Department
Leon Bethune, Boston Public Health Commission

Massachusetts Port Authority
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Telephone (617) 568-5950
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April 15, 2011

Water Technical Unit (SEW)
U.S. Environmental Protection Agency
P.O. Box 8127
Boston, MA 02114

Re: Discharge Monitoring Report
Logan International Airport
NPDES Permit No. MA0000787

To Whom It May Concern:

Enclosed are the Discharge Monitoring Reports (DMRs) for Logan Airport Outfalls for the month of March 2011.

As indicated on the attached report, a stormwater sample collected from the Maverick Outfall (Outfall 004) was found to have a Total Suspended Solids (TSS) concentration of 110 milligrams per liter (mg/l) which exceeds the permit limit for TSS of 100 mg/l. The sample was obtained during a wet weather stormwater sampling event on March 11, 2011. Massport was informed of the exceedances on March 17, 2011, by our environmental consultant, Camp Dresser & McKee, Inc. (CDM), following confirmation of the analytical data by the laboratory.

On March 10, 2011, prior to the exceedance of the TSS discharge limit, Massport had notified its tenants who operate within the Maverick Outfall drainage area to inspect and clean catch basins as required at the end of the winter sanding Massport has confirmed that the tenants have conducted the required inspection and cleaning, and Massport's Facilities Department continues its daily sweeping of all paved areas.

If you have any questions regarding the current DMRs, please contact me at (617) 568-3552. Thank you.

Sincerely,
Massachusetts Port Authority

James W. Stolecki

James W. Stolecki, P.E.
Senior Environmental Project Manager

Enclosure: Discharge Monitoring Reports

cc: Edward Pawlowski, MADEP NERO
MADEP Division of Watershed Management
Bryan Glascock, City of Boston Environment Department
Leon Bethune, Boston Public Health Commission

Massachusetts Port Authority
One Harborside Drive, Suite 200S
East Boston, MA 02128-2090
Telephone (617) 568-5950
www.massport.com

May 16, 2011

Water Technical Unit (SEW)
U.S. Environmental Protection Agency
P.O. Box 8127
Boston, MA 02114

Re: Discharge Monitoring Report
Logan International Airport
NPDES Permit No. MA0000787

To Whom It May Concern:

Enclosed are the Discharge Monitoring Reports (DMRs) for Logan Airport Outfalls for the month of April 2011.

As indicated on the attached report, stormwater samples collected from the West Outfall (Outfall 002) were found to have a Total Suspended Solids (TSS) concentration of 560 milligrams per liter (mg/l) which exceeds the permit limit for TSS of 100 mg/l, and a Oil & Grease concentration of 24 mg/l which exceeds the permit limit for O&G of 15 mg/l. The samples were obtained during a wet weather stormwater sampling event on April 13, 2011. Massport was informed of the exceedances on April 21, 2011, by our environmental consultant, Camp Dresser & McKee, Inc. (CDM), following confirmation of the analytical data by the laboratory.

Upon being informed of the exceedances, Massport inspected activities within the 450-acre West Outfall drainage area to identify potential sources of the TSS and petroleum detected in the outfall samples. No specific sources were identified. The rainfall event that occurred during the April 13th stormwater sampling generated 1.33 inches of rain and followed a relatively dry month of March. This may account for the increased pollutant loading.

In implementing Best Management Practices in accordance with the Logan Airport Stormwater Pollution Prevention Plan, Massport's Facilities Department conducted a "Spring Cleanup" of all Massport and tenant operated areas. The cleanup, which was initiated on March 21st and extended through April, included the ramp areas adjacent to the airline terminals, areas occupied by the car rental facilities, and roadways and parking areas maintained by Massport. During the cleanup, equipment was moved to facilitate removal of sand and debris that had accumulated during the winter.

If you have any questions regarding the current DMRs, please contact me at (617) 568-3552. Thank you.

Sincerely,
Massachusetts Port Authority

James W. Stolecki

James W. Stolecki, P.E.
Senior Environmental Project Manager

Enclosure: Discharge Monitoring Reports

cc: Edward Pawlowski, MADEP NERO
MADEP Division of Watershed Management
Bryan Glascock, City of Boston Environment Department
Leon Bethune, Boston Public Health Commission

Massachusetts Port Authority
One Harborside Drive, Suite 200S
East Boston, MA 02128-2090
Telephone (617) 568-5950
www.massport.com

August 15, 2011

Water Technical Unit (SEW)
U.S. Environmental Protection Agency
P.O. Box 8127
Boston, MA 02114

Re: Discharge Monitoring Report
Logan International Airport
NPDES Permit No. MA0000787

To Whom It May Concern:

Enclosed are the Discharge Monitoring Reports (DMRs) for Logan Airport Outfalls for the month of July 2011. Also enclosed are the Quarterly DMRs for the outfalls.

As indicated on the attached report, a stormwater sample collected from the Maverick Street Outfall (Outfall 004) sampling location was found to have a Total Suspended Solids (TSS) concentration of 370 milligrams per liter (mg/l) which exceeds the permit limit for TSS of 100 mg/l. The sample was obtained during a dry weather sampling event on July 25, 2011. Massport was informed of the exceedances on August 2, 2011, by our environmental consultant, Camp Dresser & McKee, Inc. (CDM), following confirmation of the analytical data by the laboratory.

On August 5th, Massport conducted an inspection of the Maverick Street Outfall drainage area. The 34-acre drainage area is within the Southwest Service Area of Logan Airport which is undergoing construction activity associated with Massport's Consolidated Rental Car Facility (ConRAC) Project. During the inspection, significant quantities of stockpiled soil were observed at the construction site. There was no siltation observed at the outfall. Appropriate sedimentation controls were in place throughout the construction area including: straw wattles around catch basins and at the limits of the work; filter inserts within the catch basins; and ongoing pavement sweeping.

Massport's contractor for the ConRAC Project, Suffolk Construction, inspects the sedimentation controls on a weekly basis in accordance with the project's Construction General Permit issued by the EPA. Massport requested that the contractor replace the catch basin inserts and wattles, and remove any accumulated sediment from the catch basin locations. Massport conducted a follow-up inspection on August 8th and documented that the contractor had replaced the sedimentation controls and removed accumulated sediment. Massport will continue to monitor conditions at the construction site.

If you have any questions regarding the current DMRs, please contact me at (617) 568-3552. Thank you.

Sincerely,
Massachusetts Port Authority

James W. Stolecki

James W. Stolecki, P.E.
Senior Environmental Project Manager

Enclosure: Discharge Monitoring Reports

cc: Edward Pawlowski, MADEP NERO
MADEP Division of Watershed Management
Bryan Glascock, City of Boston Environment Department
Leon Bethune, Boston Public Health Commission

Massachusetts Port Authority
One Harborside Drive, Suite 200S
East Boston, MA 02128-2090
Telephone (617) 568-5950
www.massport.com

December 15, 2011

Water Technical Unit (SEW)
U.S. Environmental Protection Agency
P.O. Box 8127
Boston, MA 02114

Re: Discharge Monitoring Report
Logan International Airport
NPDES Permit No. MA0000787

To Whom It May Concern:

Enclosed are the Discharge Monitoring Reports (DMRs) for Logan Airport Outfalls for the month of November 2011.

As indicated on the attached report, a stormwater sample collected from the Maverick Street Outfall (Outfall 004) sampling location was found to have a Total Suspended Solids (TSS) concentration of 150 milligrams per liter (mg/l) which exceeds the permit limit for TSS of 100 mg/l. The sample was obtained during a dry weather sampling event on November 3, 2011. Massport was informed of the exceedance on November 14, 2011, by our environmental consultant, Camp Dresser & McKee, Inc. (CDM), following confirmation of the analytical data by the laboratory.

Current activities within the Maverick Street Outfall drainage area include the construction of Massport's Consolidated Rental Car Facility (ConRAC) Project. Massport forwarded the exceedance notification to the ConRAC field inspectors, Parsons Brinkerhoff Inc., and the project contractor, Suffolk Construction, and requested that they conduct a thorough inspection of the construction area, in addition to their routine weekly NPDES inspection, and also confirm that there was no dewatering occurring that could impact the stormwater drainage system. The inspection identified three (3) catch basin filter inserts that were filled or deteriorated. These deficiencies were subsequently corrected. There was no construction dewatering observed during the inspection that would impact the drainage system.

The ConRAC construction site contains a significant area of exposed soil and large quantities of stockpiled soil. As such, daily monitoring of the site and the Maverick Street Outfall are conducted by the field inspectors to identify and address any deficiencies in stormwater controls.

If you have any questions regarding the current DMRs, please contact me at (617) 568-3552. Thank you.

Sincerely,
Massachusetts Port Authority

James W. Stolecki

James W. Stolecki, P.E.
Senior Environmental Project Manager

Enclosure: Discharge Monitoring Reports

cc: Edward Pawlowski, MADEP NERO
MADEP Division of Watershed Management
Bryan Glascock, City of Boston Environment Department
Leon Bethune, Boston Public Health Commission

Capital Programs and Environmental Affairs

ENVIRONEWS

A Massport Tenant Newsletter

Volume 36, Issue 4

December 2010/
January 2011

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EnviroNews is a newsletter published quarterly for Massport Tenants. Your comments and suggestions are welcome—please contact Tricia Haederle (phaederle@massport.com) at 617.568.5963.

KNOW YOUR RESPONSIBILITIES: SPILL REPORTING AND RESPONSE

Massport's Environmental Management Unit reminds everyone that employees, tenants and contractors at Logan Airport are obligated to report all spills of oil, jet fuel, lavatory waste or any oil/hazardous material that they encounter, regardless if they caused the release, and regardless of quantity.

To report a spill, place a call to Massport Fire Alarm (617-567-2020). This quickly mobilizes appropriate resources including Fire Rescue, Environmental Management, Aviation Operations and Massport's spill response contractor. Tenants are encouraged to remind all employees of the importance of early notification and action, which can reduce the cost to clean up a spill, and reduce the magnitude of impact to the environment.

TAKE NOTE!

ALL OIL, HAZARDOUS MATERIAL & LAVATORY WASTE SPILLS AT LOGAN AIRPORT REGARDLESS OF QUANTITY MUST BE REPORTED IMMEDIATELY TO MASSPORT FIRE ALARM 617-567-2020

POROUS ASPHALT IMPROVES STORMWATER QUALITY AT LOGAN AIRPORT

On December 1, the newly relocated cell phone lot was opened to the public at Logan Airport. In addition offering an alternative to driving around the terminal roadways for those waiting to pick up passengers (and thus cutting vehicle emissions), another benefit of this lot goes largely unnoticed: porous pavement allows precipitation to infiltrate into the ground instead of discharging to a storm drain via overland sheet flow. Outwardly, the pavement's appearance is no different than any other asphalt, but it's internal structure provides a route for the stormwater to percolate through to the ground beneath.

"The porous pavement used in the new cell phone lot looks like regular asphalt, but was mixed without some of the particles used in traditional impermeable asphalt," said Sam Sleiman, Massport's Director of Capital Programs and Environmental Affairs. "This allows water to penetrate through the pavement."

Recharging groundwater directly in this manner has several advantages. First, water that would normally enter into the airport's storm drain system (and ultimately discharge

(Continued on page 5)

New Permit Required for All Aboveground Storage Tanks

Even though Above Ground Storage Tanks (ASTs) with a capacity of less than 10,000-gallons are no longer regulated under Massachusetts Storage Tank Regulations, they are still regulated under Massachusetts Fire Regulations governing flammable and combustible liquid storage, and require permitting. Therefore, effective immediately, Massport tenants are required to complete a Massport/Massachusetts Department of Fire Services (DFS) Application & Permit Form for **all** ASTs, used for storage of flammable and combustible liquids on Massport property, regardless of capacity. Please note that this also includes glycol tanks, and mobile tanks. Since Massport Fire Rescue has jurisdiction over ASTs on Massport property, permits must be obtained through them. Permits must be renewed annually, and renewal is the responsibility of the tank owner.

Tenants with ASTs have already been contacted by Massport's Environmental Management Unit to begin the permitting process, however, tenants can obtain a blank permit application form from Massport Fire Rescue (617-561-3500) or from Erik Bankey in the Massport Environmental Management Unit (617-568-3514). Tenant owners of ASTs greater than 10,000 gallons capacity must also obtain an annual permit from the DFS. Note that DFS will not issue its permit until the tank owner has been issued the permit by Massport Fire Rescue. Tenants should submit completed forms to Massport Environmental Management Unit; the signed permit will be returned to the tenant who must post it in a conspicuous location at the building listed on the permit.

Contact Erik Bankey at the number above or at ebankey@massport.com for more information.

ALL above ground storage tanks on Massport property now require permits, regardless of size. Tanks containing deicing fluid and mobile tanks are also included in this requirement.

Tier 2 Reports are Due March 1

The Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 establishes requirements for Federal, State and local governments and industry regarding emergency planning and "Community Right-to-Know" reporting on hazardous and toxic chemicals. This law aids communities in meeting their responsibilities in regard to potential chemical emergencies. The Right-to-Know provisions increase knowledge and access to information on the presence of hazardous chemicals in communities and releases of these chemicals into the environment.

Among the key provisions of EPCRA, Sections 311 and 312 require annual submission of chemical inventory data (known as Tier II reports) by facilities to state and local planning officials for incorporation into ongoing emergency planning. Section 313 requires facilities to quantify and submit annual releases of certain chemicals for incorporation into a national data base known as the Toxics Release Inventory (TRI). The primary purpose of the TRI reporting requirement is to assist in research and development of regulations, guidelines and standards relating to routine discharges of chemical materials.

Tier II reports are due electronically on March 1. Instructions on how to submit the inventories can be found on EPA's website at http://www.epa.gov/region1/enforcement/epcra/index.html. Note that EPA is also sponsoring a series of free EPCRA compliance assistance workshops around New England in February. A schedule for these events can be found on the above EPA web page.

Source: USEPA

Eliminating FOD is Everyone's Business

FOD PREVENTION TIPS

CLEAN AS YOU GO—KEEP YOUR WORKSPACE CLEAN

SECURE LOOSE BELONGINGS

TRACK TOOLS, LATEX GLOVES, HAIR NETS, WATER BOTTLES, NEWSPAPERS AND PLASTIC BAGS AROUND YOUR WORK SPACE

SEE FOD? PICK IT UP

DISPOSE OF FOD IN DESIGNATED AIRFIELD BINS OR IN A CLOSED CONTAINER

FOD or Foreign Object Debris, is the term given to any object on an airfield that has the potential to come loose and cause damage, potentially resulting in severe or fatal injuries to personnel and damaging equipment. Damage can include cutting aircraft tires, ingestion into engines or lodging in mechanisms affecting flight operations. Injuries can occur when jet blast propels FOD through the airport environment at high velocities.

FOD creates other problems: it gets washed into the Logan storm sewer system...nearly 70 cubic yards of debris are collected on a weekly basis—that's enough to fill about 100 five gallon buckets.

FOD comes from many sources, such as personnel, airport infrastructure (pavement, lights, and signs), the environment (wildlife, snow, ice) and equipment operating on the airfield (aircraft, airport operations vehicles, maintenance equipment, fueling trucks, other aircraft servicing equipment, and construction equipment). FOD can collect both on and below ground support equipment stored or staged on the airport apron. Jet blast can then blow FOD onto personnel or an aircraft. FOD may also be more prevalent in winter conditions, as pavement infrastructure may be influenced by weathering (freeze and thaw cycles) and begin to crack or break apart.

FOD creates other problems: it gets washed into the Logan storm sewer system. FOD that makes it through the system is collected at stormwater outfalls; nearly 70 cubic yards of debris such as cups, packing peanuts, food wrappers, are collected on a weekly basis—that's enough to fill about 100 five gallon buckets.

Sources: FAA Advisory Circular 150/5210-24, Airport Foreign Object Debris (FOD) Management & Massport

Winter Safety Reminder

RECOGNIZE SLIP & TRIP HAZARDS

- Weather Induced Conditions
- De-Icing Fluid on Surfaces or Shoes
- Spills and Melted Snow/Ice
- Poor Lighting
- Clutter and Obstacles in Walkways
- Loose Mats and Carpet

BE AWARE OF YOUR ENVIRONMENT

- Take your time and pay attention to where you are going
- Walk on designated and cleared paths
- Watch your footing and use handrails
- Don't carry too much; you can lose your balance or block your view
- Anticipate slippery conditions

Regulatory Round Up

EPA Improves Guidance for Compact Fluorescent Light Bulb Cleanup

In December 2010, the U.S. Environmental Protection Agency (EPA) updated its guidance on how to properly clean up a broken compact fluorescent lamp (CFL). Included with the guidance is a new consumer brochure with CFL recycling and cleanup tips. EPA encourages Americans to use CFLs for residential lighting to save energy and prevent greenhouse gas emissions that lead to global climate change.

CFLs contain a small amount of mercury sealed within the glass tubing. When a CFL breaks, some of the mercury is released as vapor and may pose potential health risks. The guidance and brochure will provide simple, user friendly directions to help prevent and reduce exposure to people from mercury pollution.

More information on the clean up guidance: http://www.epa.gov/cflcleanup
More information on CFLs: www.epa.gov/cfl

Source: USEPA

Commonwealth of Massachusetts Sets Statewide Greenhouse Gas Emissions Limit for 2020

In compliance with the Global Warming Solutions Act (GWSA) signed by Governor Patrick in 2008, Energy and Environmental Affairs (EEA) Secretary Ian Bowles is pleased to announce he has set the statewide greenhouse gas (GHG) emissions limit for 2020 and released the Massachusetts Clean Energy and Climate Plan for 2020 which details how the Commonwealth will comply with the limit. Secretary Bowles set the 2020 limit 25 percent below 1990 levels, the maximum authorized by the GWSA. Building on existing measures that will get Massachusetts much of the way toward the 25 percent limit, the EEA plan comprises a targeted portfolio of additional policies that promise overall cost savings and clean energy jobs, while allowing the Bay State to reach the most ambitious target for GHG reduction of any state in the country.

A complete copy of the Massachusetts Clean Energy and Climate Plan for 2020 can be downloaded from the Executive Office of Energy and Environmental Affairs home page, accessible through www.mass.gov.

Source: MassDEP Bureau of Waste Prevention

MADEP Bans Disposal of Drywall Effective July 1, 2011

The Massachusetts Department of Environmental Protection (MADEP) has banned the disposal of clean gypsum wallboard (drywall) through an amendment to 310 CMR 19.000, the Commonwealth of Massachusetts' Solid Waste Management Regulations. Clean is defined as wallboard that is not coated with paint, joint compound, adhesives, nails or other materials.

During new construction, gypsum wallboard installers generate scrap material. Approximately 15% -20% of new gypsum wallboard is disposed of as scrap. It is estimated that approximately 40,000 tons to 50,000 tons of new gypsum wallboard scrap material is generated annually in Massachusetts.

Since 2001, MassDEP has successfully worked with the construction and demolition (C&D) industry to develop a recycling and reuse infrastructure that can divert this material from disposal. In 2006, Massachusetts became the first state to ban from disposal certain components of the C&D waste stream, specifically asphalt pavement, brick, concrete, metal and wood. There is now a sustainable recycling infrastructure that has a current capacity to recycle approximately 80,000 tons of gypsum wallboard waste material into new gypsum wallboard, with the potential to increase capacity.

Contractors and haulers will have the option to either continue to send mixed C&D to solid waste facilities (i.e. construction and demolition debris processors or transfer stations) that will separate the clean gypsum wallboard material or separate the clean gypsum wallboard scrap material and send it directly to a gypsum recycling facility. Loads with a cumulative total of 20% or less asphalt pavement, brick, concrete, metal, wood and gypsum wallboard will not be considered failed loads. In addition, pieces of clean gypsum wallboard with dimensions of two square feet or less are exempt from the disposal ban.

For more information on the upcoming disposal ban, background information and locations of disposal facilities in Massachusetts, visit the MADEP website at:

http://www.mass.gov/dep/recycle/laws/regulati.htm#bans

Source: MADEP

MADEP Snow Disposal Guidance

The Massachusetts Department of Environmental Protection (MADEP) has developed guidelines is to help businesses dispose of snow appropriately. Snow that is contaminated with road salt, sand, litter, and other pollutants threatens public health and the environment. As snow melts, pollutants are transported into surface water or through the soil where they may eventually reach the groundwater, contaminating water supplies impacting aquatic life. Sand washed into water bodies can create sand bars or fill in wetlands and ponds, causing flooding. The following are highlights from the MADEP guidelines. Please see the MADEP website at http://www.mass.gov/dep/water/laws/snowdisp.htm for the complete guidance:

MADEP recommends that you avoid dumping snow into any water body, including the ocean. Avoid disposing of snow on top of storm drain catch basins or in stormwater drainage swales or ditches. Snow combined with sand and debris may block a storm drainage system, causing localized flooding. A high volume of sand, sediment and litter released from melting snow also may be quickly transported through the system into surface water. Debris should be cleared from the site prior to using the site for snow disposal, and debris should be removed from the site at the end of the season (no later than May 15).

Under extraordinary conditions, when all land-based snow disposal options are exhausted, disposal of snow may be allowed in certain water bodies under certain conditions. In these dire situations, notify your local Conservation Commission and the appropriate MassDEP Regional Service Center before disposing of snow in a waterbody:

Northeast Regional Office, Wilmington, 978-694-3200/Southeast Regional Office, Lakeville, 508-946-2714 or Central Regional Office, Worcester, 508-792-7683

Source: MADEP

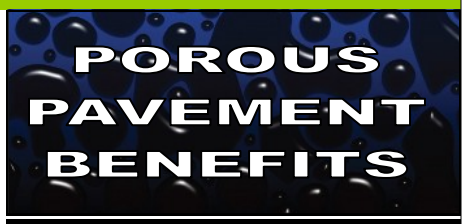
Porous Pavement (Cont'd)

(Continued from page 1)

to Boston Harbor) directly recharges the groundwater. This replenishes groundwater base flow and provides more water for the root zones of plants. Recharging stormwater close to its point of origin is advantageous as it mimics the natural drainage patterns in the absence of development.

Second, any debris or contaminants that may be entrained in the runoff, such as oil and grease, can be trapped within the pores of the pavement, or can adhere to the soil where biodegradation, adsorption or other natural processes can work to reduce their concentrations. To remove debris entrained n the pavement and to maintain its porosity, it will need to be vacuum swept—an increased maintenance need over traditional pavement.

The size of the new Cell Phone Lot is about 20,000 square feet. The cost of paving it with porous pavement was approximately 1.5 times more expensive than traditional mix due to the composition of the mix itself (more liquid asphalt and additives), and the additional base layers required.



FLOOD CONTROL

WATER QUALITY TREATMENT

GROUNDWATER RECHARGE

REDUCED SAND/SALT USE DUE TO LOW OR NO ICE DEVELOPMENT

MAINTAINS TRACTION WHEN WET

REDUCED ROADWAY NOISE

REDUCED INFRASTRUCTURE (CATCH BASINS, CURBING, ETC.)

SOURCE: UNH Stormwater Center, www.unh.edu/erg/cstev/

SEE A SPILL?
REPORT IT.

REPORTING COSTS NOTHING
INACTION CAN COST A FORTUNE

Report ALL fuel, oil, hazardous materials or lavatory waste spills within 2 hours of discovery at Logan Airport to Massport Fire Alarm 617-567-2020

Capital Programs and Environmental Affairs

ENVIRONEWS

A Massport Tenant Newsletter

Volume 37, Issue 1
May 2011

INSIDE THIS ISSUE:

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EnviroNews is a newsletter published four times a year for Massport Tenants. Your comments and suggestions are welcome—please contact Tricia Haederle (phaederle@massport.com) at 617.568.5963.

Massport Hazardous Waste Collection Nets Over 27,000 Pounds of Materials

Massport celebrated the 41st anniversary of Earth Day by sponsoring a free hazardous waste collection event at Logan Airport on April 21 and at Hanscom Field on May 10. Open to all tenants, their employees and Massport employees, the event resulted in the collection of over 27,000 pounds of hazardous and related materials.

"This collection effort will properly dispose of hazardous materials and make the airport environment safer and cleaner as well as making the homes of airport employees safer as well," said Sam Sleiman, Director of Capital Programs and Environmental Affairs. "Massport is working with a private contractor to dispose of all the material in licensed facilities."

The largest amount of reclaimed materials by weight were electronics or "e-waste". A total of approximately 14,900 pounds of televisions, computers, monitors and printers were collected at both Hanscom and Logan. This accounted for over 53% of the materials collected. See below for the importance of recycling this valuable resource.

e-cycle

Did You Know?

- Recycling one million laptops saves the energy equivalent to the electricity used by 3,657 US homes in a year.
- Almost all of the materials used to manufacture a cell phone can be recovered to make new products.
- For every million cell phones we recycle, 35,274 pounds of copper, 772 pounds of silver, 75 pounds of gold, and 33 pounds of palladium can be recovered.
- Electronics contain precious metals, copper, and plastics—all of which require energy to mine and process. Recycling avoids mining & processing new materials, conserving natural resources and avoiding air and water pollution and greenhouse gas emissions.
- Socially responsible recycling: If a cell phone is in good working condition, some collection programs donate them to a charity, provide them for sale to those who need them, or donate the proceeds of the sale to worthwhile causes.

Source: USEPA

MISSED MASSPORT'S HAZARDOUS WASTE COLLECTION EVENTS?

TRY THESE OPTIONS

Download the FREE iRecycle application for your smartphone and find another collection location near you. iRecycle provides access to more than 800,000 recycling and disposal resources for more than 240 materials. Links to the application are available at **http://Earth911.com/irecycle/**. You can also search for collection locations online by zip code or city at **http://Earth911.com**.

Electronics Recycling: Over ten locations in Massachusetts and New Hampshire accept Mitsubishi, Panasonic, Quasar, Sharp, Visio, Toshiba and Technics brand electronics at no charge (restrictions may apply), and other brands for a fee. Go to: **http://www.mrmrecycling.com/collection_ne.htm**

The Telecommunications Industry Association's **E-cycling Central** website **http://www.ecyclingcentral.com/** offers an updated **calendar of recycling and collection events in your area**, a list of Frequently Asked Questions, and links to other disposal options for items such as batteries and light bulbs.

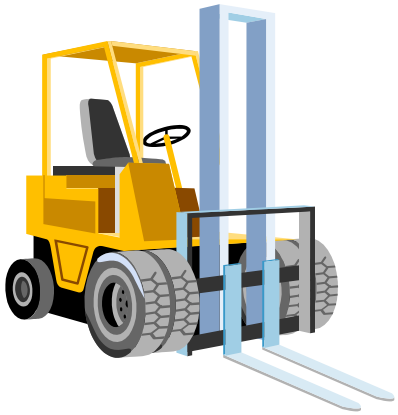
Check it Out! A 30 Second Solution for Leaks and Spills

We all know that sometimes equipment leaks just happen. Aging ground service equipment (GSE) is commonplace, often heavily used, by a multitude of operators, from one shift to another, day after day. It is for this reason that **doing an equipment check** before engine start up and driving off to the next destination is an essential and solid business practice.

It is as easy as doing a quick walk around and taking a careful look under the equipment to check for drips and puddles, **all in 30 seconds or less**. Don't have the 30 seconds to spare? Think about this – you get into your GSE, drive from the terminal to the hangar, park, get out, and realize that the GSE has just left a trail of hydraulic fluid from originating point to the final destination. You now have the responsibility of contacting Fire Alarm and mobilizing the emergency cleanup crew and may have possibly triggered state and federal environmental notification and cleanup requirements. It also happens to be during peak hours so that numerous other vehicles have driven through the leaked fluid and the release has just spread here, there and everywhere. It takes numerous and costly labor hours to clean up the spill, the magnitude of which could have been minimized by a careful 30 second inspection. Incorporating a simple inspection protocol as part of your standard operating procedure goes a long way in optimizing your time for all the important things that you do.

-Rosanne Joyce, Massport Senior Environmental Project Manager

Information Session on Hoisting Licenses



Massport will be hosting a hoisting license information session for its employees, tenants and contractors , presented by Department of Public Safety (DPS) staff, on Tuesday, June 21, 2011, in the Logan Media Room at 10 am. DPS is the state agency responsible overseeing the issuance of hoisting licenses. DPS staff will briefly review regulations and license requirements, followed by a question and answer session. This presentation will take place during the regular monthly meeting of the Airside Safety Alliance, and is open to any interested party. Offered at no charge, there is no RSVP required. If you have any questions regarding the meeting or hoisting licensure, please contact Brian Dinneen, Massport Safety Manager, at 617-568-7427 or bdinneen@massport.com.

Anyone operating hoisting equipment in Massachusetts, including at Logan Airport, must obtain a license from the Massachusetts Department of Public Safety (DPS). This includes those individuals operating excavators, forklifts, snow removal equipment and other machinery where the:

- height of the lift exceeds ten feet or
- weight of the load exceeds 500 pounds or
- capacity of the bucket exceeds 1/4 cubic yard capacity

Hoisting operators must be 18 years of age and successfully pass an examination covering all working parts of the hoisting machinery, safe operating practices, hand signals, and inspection procedures in order to obtain a license. Additional information on licensing requirements, exams and Frequently Asked Questions can be found on the DPS website, which can be accessed at **http://www.Mass.gov/dps** .

HOISTING LICENSE QUESTIONS?

DPS Information Session

Tuesday, June 21

Logan Media Room

10 am

For All Employees, Tenants & Contractors

Flammable Storage Permits

In order to store flammable and/or combustible liquids at Logan Airport, **including in approved flammable storage cabinets**, permits must be obtained from Massport Fire Rescue. Logan tenants and Massport personnel can pick up an application in the front lobby (street side) of Massport Fire Rescue located at 162 Harborside Drive. Complete and sign the permit and leave it in the Permits for Approval box in the Fire Rescue lobby. Once issued, Fire Rescue will deliver the permit to your location and review your storage. Please note that these permits do not expire and are offered without a fee. Massport Fire Rescue also offers tenants a free fire safety inspection of their lease areas. To arrange an inspection, or if you have questions, contact Captain Jay Drumm of Massport Fire Rescue at 617-561-3415.

Use an air freshener.

Taking mass transit, biking, or walking to work, school, or the store can save you money, plus help to reduce traffic congestion and pollution. So keep it up, because —

It all adds up to cleaner air

U.S. Department of Transportation
Federal Highway Administration

massport

Capital Programs and Environmental Affairs

ENVIRONEWS

A Massport Tenant Newsletter

Volume 37, Issue 3

December 2011/
January 2012

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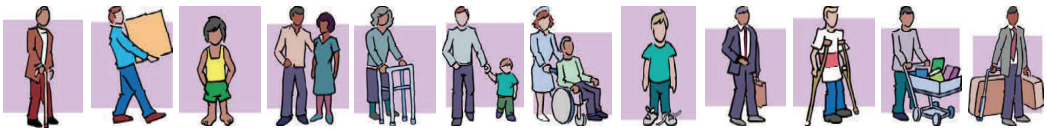
EnviroNews is a newsletter published quarterly for Massport Tenants. Your comments and suggestions are welcome—please contact Brenda Enos (benos@massport.com) at 617.568.5963.

Ride Escalators Responsibly

The first patent for an escalator type machine was granted in March of 1859 to Nathan Ames of Saugus, Massachusetts that he called Revolving Stairs. He was ahead of his time and a prototype was not built until Jesse Reno introduced a working escalator as a new ride at Coney Island, NY in 1896. Logan Airport currently has 65 escalators and 24 moving walkways available to assist tens of thousands of customers per day who navigate the airport. Although common, many customers and employees can ride escalators improperly leading to injury.

It's Easy to Be Safe

You can help avoid accidents by using an elevator under certain conditions. Put an X through the boxes below which show people who should **not** *be using an escalator.*
(answers on page 2.)



1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12.

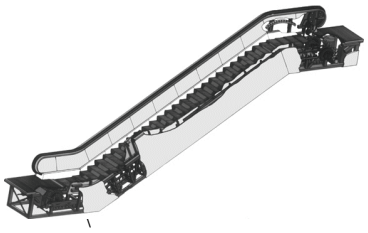
Follow these safety tips and enjoy a safe ride!

Before entering escalators:

- No canes, walkers, wheeled vehicles, carts or large bags.
- Don't ride barefoot or with loose shoelaces.
- Check the direction of the moving steps.

When entering escalators:

- Step on and off promptly. Take care if you are wearing bifocals.



- Hold children or small packages firmly with one hand.
- Grasp the handrail as you step promptly onto the moving step.
- Stand toward the middle of the step away from the sides and face forward.
- Keep loose clothing clear of steps and sides.
- Keep a firm grip on the handrail
- Reposition your hand slowly if the handrail moves ahead or behind the steps.

(Continued on page 2)

Reporting Corner

Tier 2 Reports are Due March 1

The Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 establishes requirements for Federal, State and local governments and industry regarding emergency planning and "Community Right-to-Know" reporting on hazardous and toxic chemicals. This law aids communities in meeting their responsibilities in regard to potential chemical emergencies. The Right-to-Know provisions increase knowledge and access to information on the presence of hazardous chemicals in communities and releases of these chemicals into the environment.

Among the key provisions of EPCRA, Sections 311 and 312 require annual submission of chemical inventory data (known as Tier II reports) by facilities to state and local planning officials for incorporation into ongoing emergency planning. Section 313 requires facilities to quantify and submit annual releases of certain chemicals for incorporation into a national data base known as the Toxics Release Inventory (TRI). The primary purpose of the TRI reporting requirement is to assist in research and development of regulations, guidelines and standards relating to routine discharges of chemical materials.

Tier II reports are due electronically on March 1. Instructions on how to submit the inventories can be found on EPA's website at http://www.epa.gov/region1/enforcement/epcra/workshops.html. Note that EPA is also sponsoring a series of free EPCRA compliance assistance workshops around New England in January and February. A schedule can be found on the above EPA web page.

Large Quantity Hazardous Waste Generator Biennial Reporting Due March 1

In accordance with Massachusetts Hazardous Waste regulations, large quantity generators who transport or offer for transportation any hazardous waste off the site of generation shall prepare and submit a copy of a Biennial Report. The report is due March 1st of each even-numbered year (2012) for activities during the previous year (2011). EPA form 8700-13A can be found on EPA's website.

Ride Escalator Responsibly

(Continued from page # 1)

- Don't rest your handbag or parcels on the handrail.
- Pay attention. Don't window-shop or sight see while riding.
- Don't lean against the side.

When exiting escalators

- Don't hesitate. Step off promptly.
- Immediately move clear of the escalator exit area — don't stop to talk or look around. Other passengers may be behind you.

Answer from above: Customers and employees numbered 1, 2, 3, 5, 7, 8, 10, 11 and 12 should choose the elevator.

Top 10 2011 OSHA Citations

OSHA has published data on its most frequently cited standards, for fiscal year 2011 (October 2010 through September 2011). The results show that the "Top 10" most frequently cited standards make up almost 44 percent of the citations issued with fall protection in construction and hazard communication in general industry leading the way.

Top 10 most frequently cited standards:

1. Duty to have fall protection, construction (29 CFR 1926.501)
2. Scaffolds, general requirements, construction (29 CFR 1926.451)
3. Hazard communication standard, general industry (29 CFR 1910.1200)
4. Respiratory protection, general industry (29 CFR 1910.134)
5. Control of Hazardous energy (lockout/tagout), general industry (29 CFR 1910.147)
6. Electrical, wiring methods, components and equipment, general industry (29 CFR 1910.305)
7. Ladders, construction (29 CFR 1926.l053)
8. Powered industrial trucks, general industry (29 CFR 1910.178)
9. Electrical systems design, general requirements, general industry (29 CFR 1910.303)
10. Machines, general requirements, general Industry (29 CFR 1910.212)

Road Salt Alternatives

According to the National Research Council (NRC), road-salt use in the United States ranges from 8 million to 12 million tons of NaCl per year. Road Salt is a very effective method to help keep our roadways clear of ice during winter months; however, recent studies have shown that 55% of chlorine in road salt is being washed from the roads, driveways and sidewalks through storm water runoff and into rivers where it can be toxic to fish, other aquatic life and plants as well. Try these tips for keeping your driveway and sidewalk clear and dry this winter.

- **Shovel or plow first.** Removing snow buildup means using less salt and makes it more effective.
- **Use salt, deicers and abrasives only where needed,** such as on slopes or in high traffic areas.
- **Consider using only abrasives** (sand, sawdust or cat litter) to create traction. Sweep them up in the spring to keep them from washing away and becoming a pollutant.
- **Apply deicers evenly** using a broadcast spreader instead of by the handful (see photo).
- **Choose round pellets.** They reach the icy surface faster.
- **Read labels.** Know what you are applying and the effects of exposure. Some deicing chemicals corrode metal or harm pets.

MADEP Snow Disposal Guidance — Annual Reminder

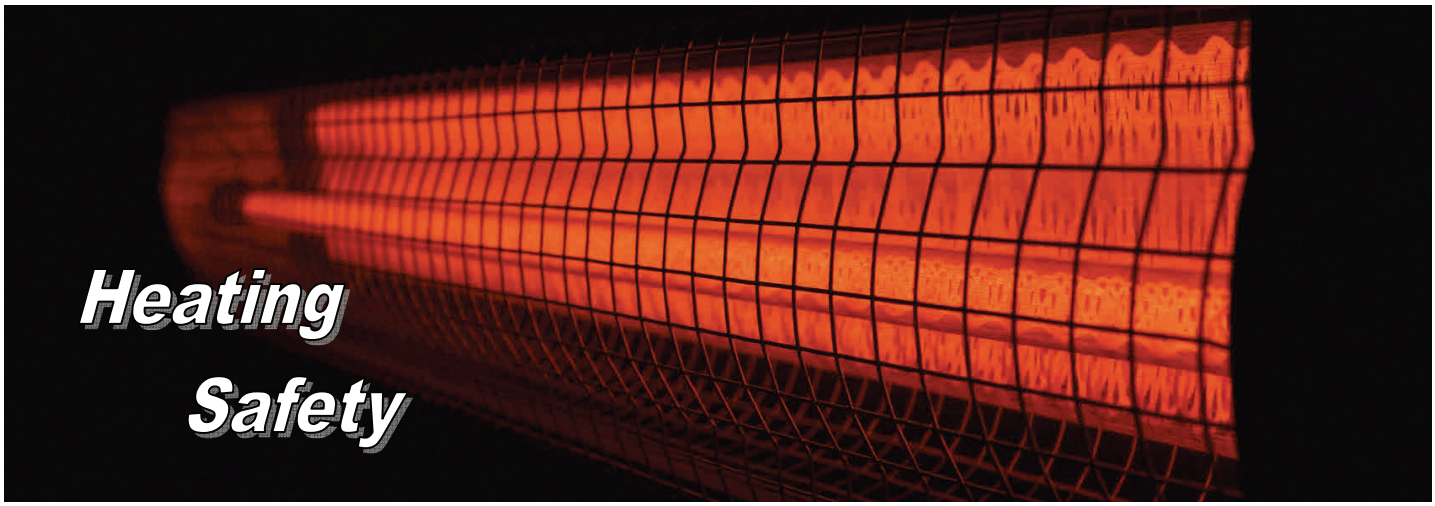
The Massachusetts Department of Environmental Protection (MADEP) has developed guidelines to help businesses dispose of snow appropriately. Snow that is contaminated with road salt, sand, litter, and other pollutants threatens public health and the environment. As snow melts, pollutants are transported into surface water or through the soil where they may eventually reach the groundwater, contaminating water supplies impacting aquatic life. Sand washed into water bodies can create sand bars or fill in wetlands and ponds, causing flooding. The MADEP website at http://www.mass.gov/dep/water/laws/snowdisp.htm has the complete guidelines:

MADEP recommends that you avoid dumping snow into any water body, including the ocean. Avoid disposing of snow on top of storm drain catch basins or in stormwater drainage swales or ditches. Debris should be cleared from the site prior to using the site for snow disposal, and debris should be removed from the site at the end of the season (no later than May 15).

Under extraordinary conditions, when all land-based snow disposal options are exhausted, disposal of snow may be allowed in certain water bodies under certain conditions. In these dire situations, notify your local Conservation Commission and the appropriate MassDEP Regional Service Center before disposing of snow in a waterbody:

Northeast Regional Office, Wilmington, 978-694-3200/Southeast Regional Office, Lakeville, 508-946-2714 or Central Regional Office, Worcester, 508-792-7683

Source: MADEP



There is something about the winter months and curling up with a good book by the fireplace. But did you know that heating equipment is a leading cause of home fire deaths? Here are a few safety tips and precautions that will help you prevent most heating fires from happening.

- Keep anything that can burn at least three-feet away from heating equipment, like the furnace, fireplace, wood stove, or portable space heater.
- Have a three-foot "kid-free zone" around open fires and space heaters.
- Never use your oven or stovetop to heat your home.
- Have a qualified professional install stationary space heating equipment, water heaters or central heating equipment according to the local codes and manufacturer's instructions.
- Have heating equipment and chimneys cleaned and inspected every year by a qualified professional.
- Remember to turn portable heaters off when leaving the room or going to bed.
- Make sure the fireplace has a sturdy screen to stop sparks from flying into the room. Ashes should be cool before putting them in a metal container. Keep the container a safe distance away from your home.
- Test smoke alarms monthly.
- Install a spark arrestor on top of your chimney to keep sparks from starting a fire on your roof or outside your home.
- Burn only well seasoned wood in a fireplace or wood stove. Use paper or kindling to start the fire-not flammable liquids. And do not use artificial logs in wood stoves.
- Place portable generators outside your home and away from windows, doors or vents. Also keep clear from trees or leaves.

FACT

Half of home heating fires are reported during the months of **December**, **January** and **February**.

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2012 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:	**009**
Monitoring Period:	**Through Sept. 2012**
Report Issue Date:	**May 2012**

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 2012. 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 September 2012.**

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:

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Table 1: Summary Overview of Peak Period Surcharge Program

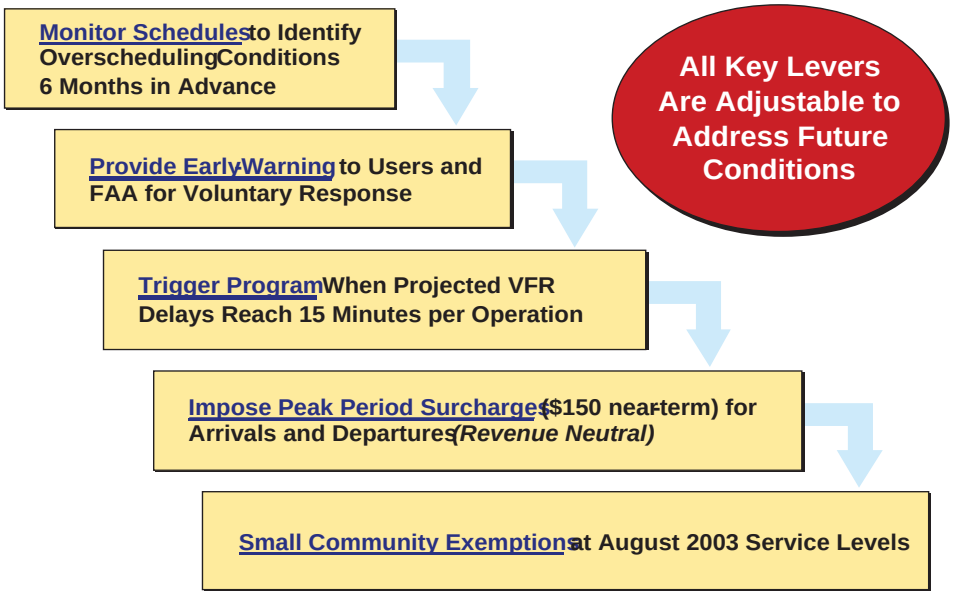
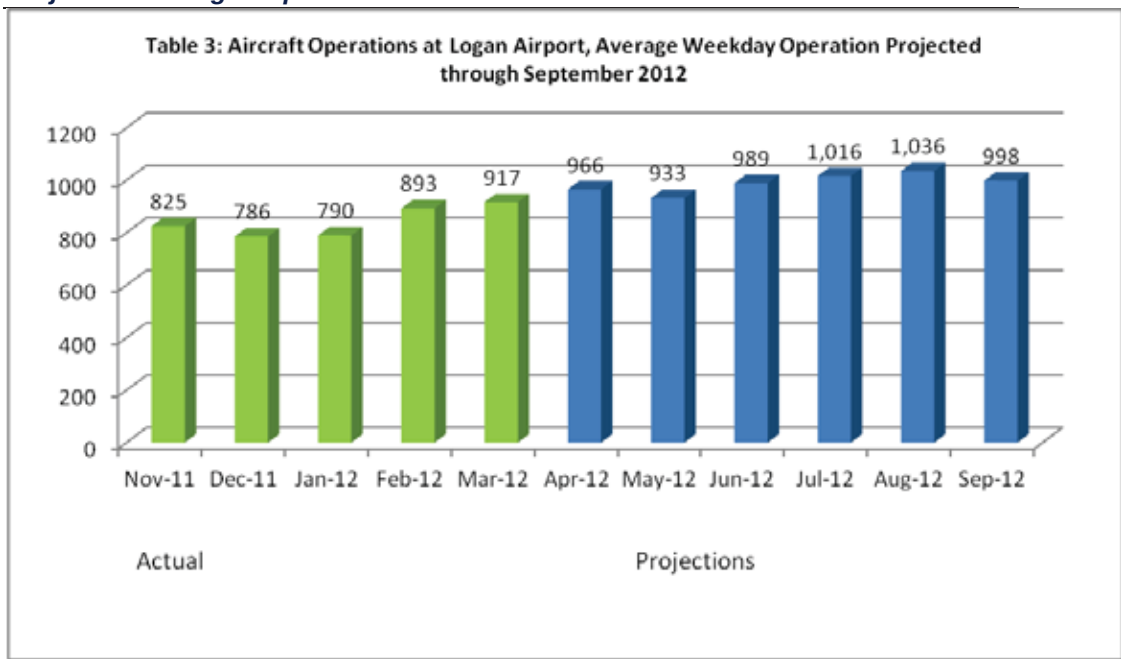


Table 2: Summary Overview of Forecast Methodology

- 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, *Average Weekday Operations Projected Through September*



Actual **Projections**

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, *Average Weekday, August*

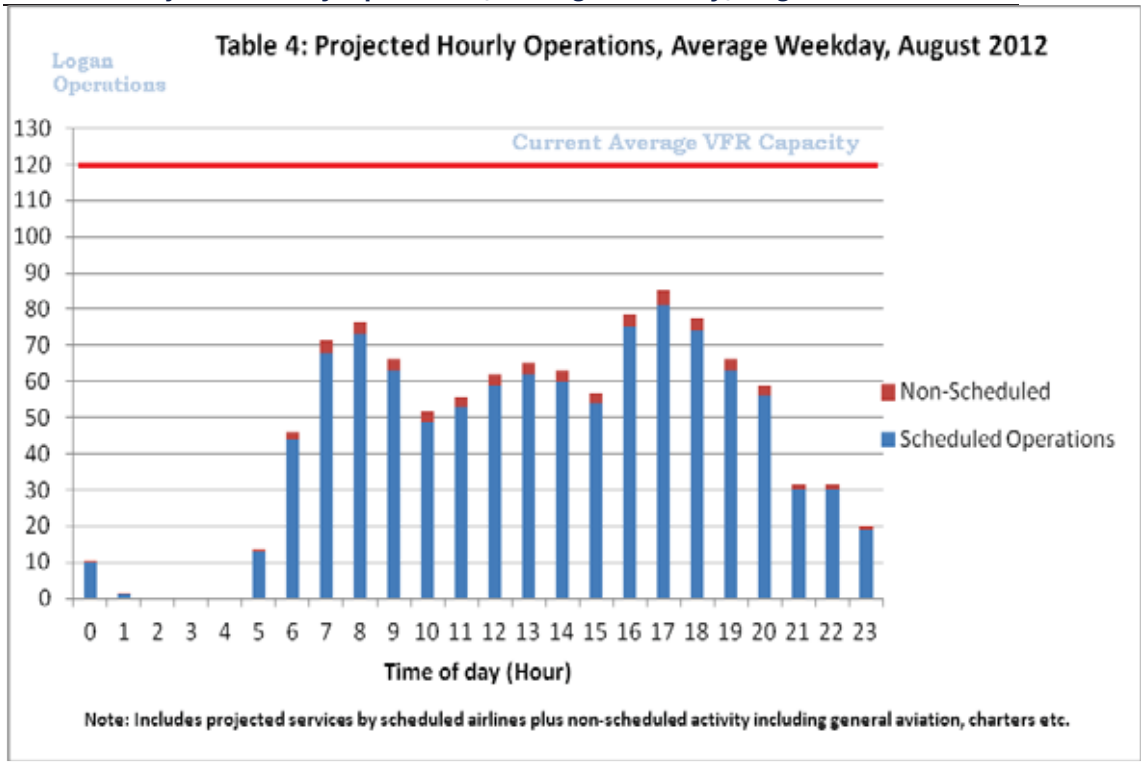


Table 5: Forecast Logan Average Weekday Operations, *Feb. – Sep.*

Forecast Daily Operations								
Hour Range	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12
0	5	5	8	7	9	9	10	0
1	1	2	1	1	1	1	1	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	12	12	15	11	14	15	13	12
6	39	43	43	41	44	43	44	69
7	57	60	58	59	62	66	68	73
8	65	68	70	66	71	71	73	90
9	59	57	59	59	63	63	63	74
10	43	45	50	48	43	50	49	46
11	42	44	47	49	54	54	53	52
12	47	46	49	49	46	52	59	53
13	54	57	59	55	66	64	62	55
14	45	50	54	52	53	56	60	64
15	52	48	49	49	50	53	54	56
16	67	63	64	65	69	73	75	61
17	72	72	78	74	83	81	81	84
18	71	73	75	69	70	73	74	70
19	55	58	60	63	61	60	63	73
20	43	47	50	50	54	57	56	40
21	29	32	30	21	26	28	30	14
22	21	21	28	30	30	31	30	11
23	12	17	18	16	18	18	19	2
Total	**893**	**917**	**965**	**933**	**989**	**1,016**	**1,035**	**998**

Note: Activity for Feb and March is actual traffic not projected.

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ESPR 2011 Boston-Logan International Airport

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Demonstration of Reduced Airport Congestion through Pushback Rate Control

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DEMONSTRATION OF REDUCED AIRPORT CONGESTION THROUGH PUSHBACK RATE CONTROL

This report is based on the paper submitted to the
Ninth USA/EUROPE Air Traffic Management R & D Seminar

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Abstract

Airport surface congestion results in significant increases in taxi times, fuel burn and emissions at major airports. This paper presents the field tests of a control strategy to airport congestion control 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 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.

1 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.

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 undesirably high congested states.

1.1 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, but as this number, denoted as 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 with the number of aircraft taxiing out and the arrival rate is illustrated for a 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 benefits from the control strategy.

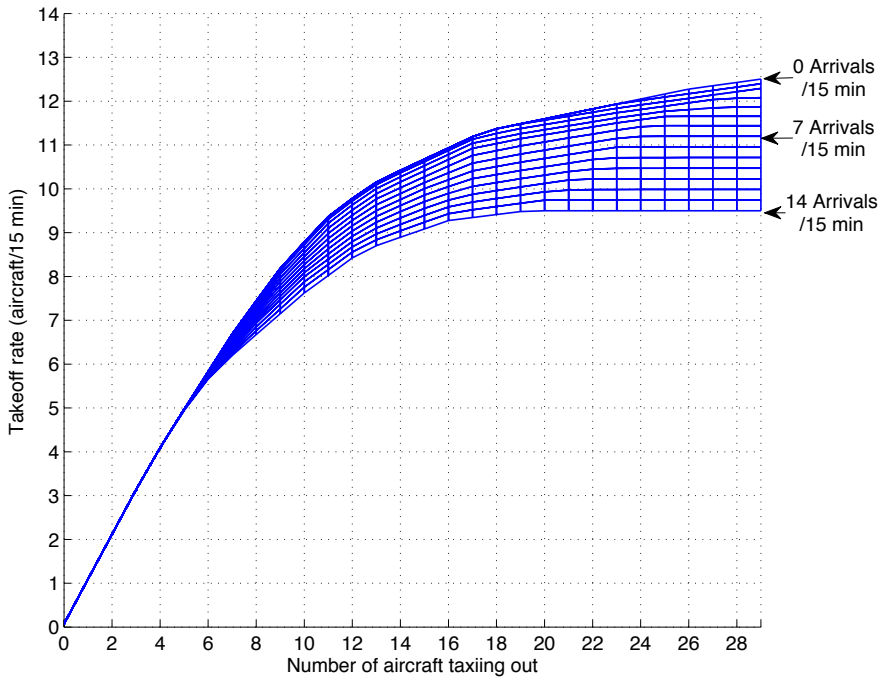

Figure 1: Regression of the departure throughput as a function of the number of aircraft taxiing out, parameterized by the arrival rate for 22L, 27 | 22L, 22R configuration, under VMC [9].

2 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 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.

2.1 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

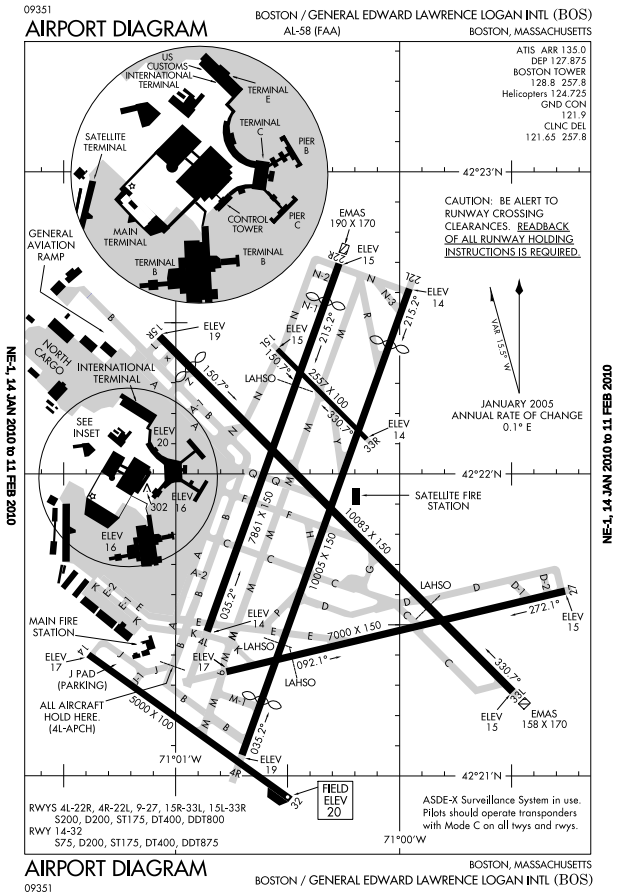

Figure 2: BOS airport diagram, showing alignment of runways.

duration of the demo, departures headed to 22R used 15L to cross runway 22R onto taxiway "Mike". This resulted in active runway crossings 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.

2.2 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

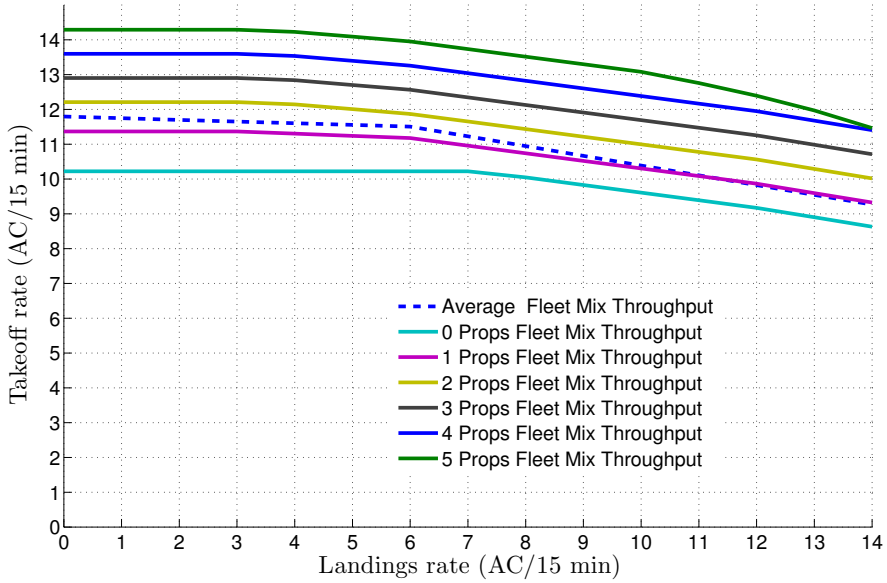

Figure 3: Regression of the takeoff rate as a function of the landing rate, parameterized by the number of props in a 15-minute interval for 22L, 27 | 22L, 22R configuration, under VMC [9].

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 interfere very much 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 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).

2.3 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 recorded), flights cancelled after pushback, etc. A comparison of

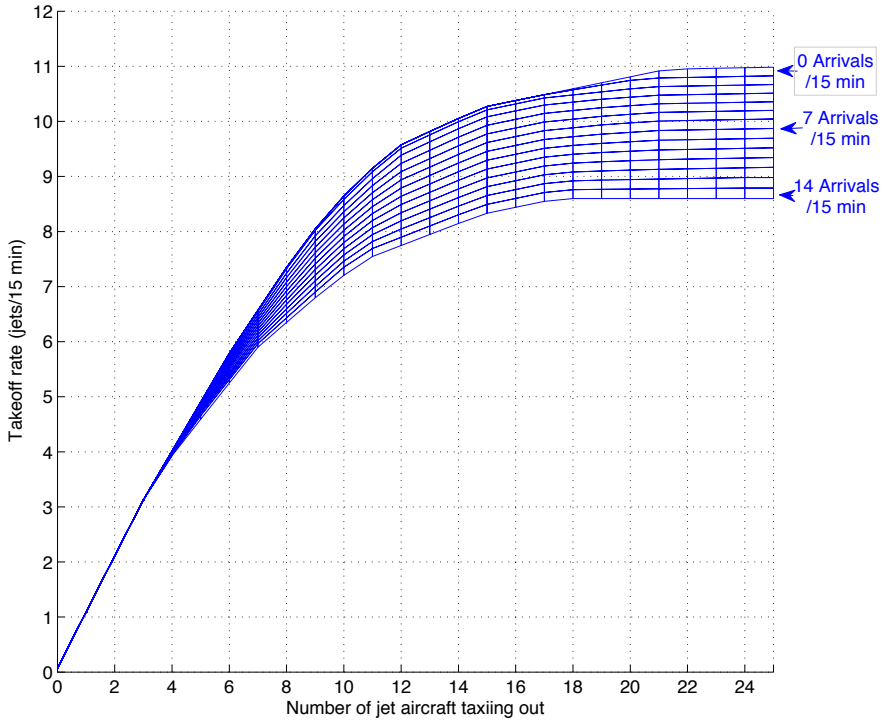

Figure 4: Regression of the jet takeoff rate as a function of the number of departing jets on the ground, parameterized by the number of arrivals for 22L, 27 | 22L, 22R configuration, under VMC [9].

both ASDE-X and ASPM records with live observations made in the tower on August 26, 2010 revealed that the average difference in the number of pushbacks per 15-minutes as recorded by ASDE-X and 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.

2.4 Estimates of N^*

Table 1 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,

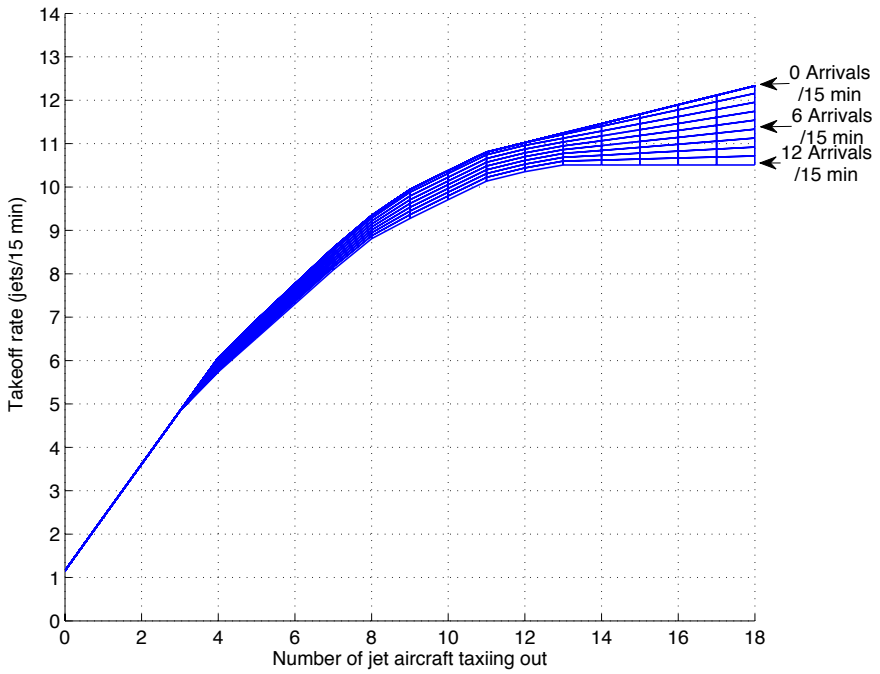

Figure 5: Regression of the takeoff rate as a function of the number of jets taxiing ~~out, parame~~terized by the number of arrivals, using ASDE-X data, for the 22L, 27 | 22L, 22R configuration.

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.

Table 1: 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

3 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.

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.

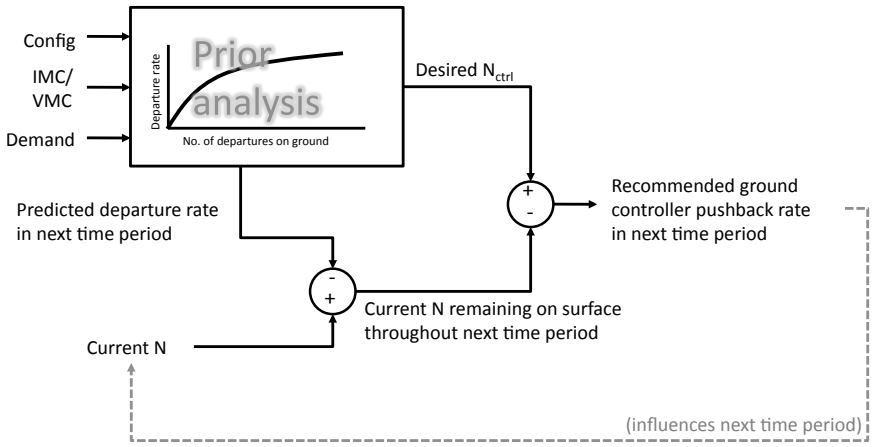

Figure 6: A schematic of the pushback rate calculation.

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.").

3.1 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 $\times$ 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).

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

Figure 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.

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 be cleared at 2335), and that they also accurately implemented the push rates suggested by the cards.

3.2 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.

3.3 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.

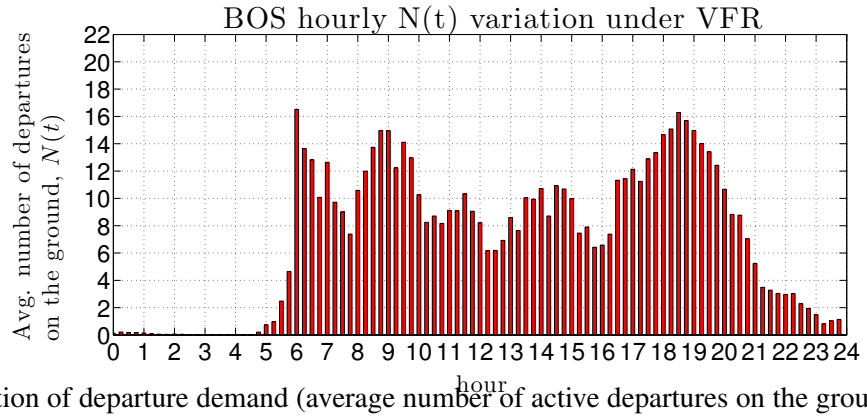

Figure 8: Variation of departure demand (average number of active departures on the ground) as a function of the time of day.

4 Results of field tests

Although the pushback rate control strategy was tested at BOS during 16 demo periods, there was very little metering 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, metering was in effect during the field tests for over 37 hours, with about 24 hours of test periods with significant gate-holds.

4.1 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, similar 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),

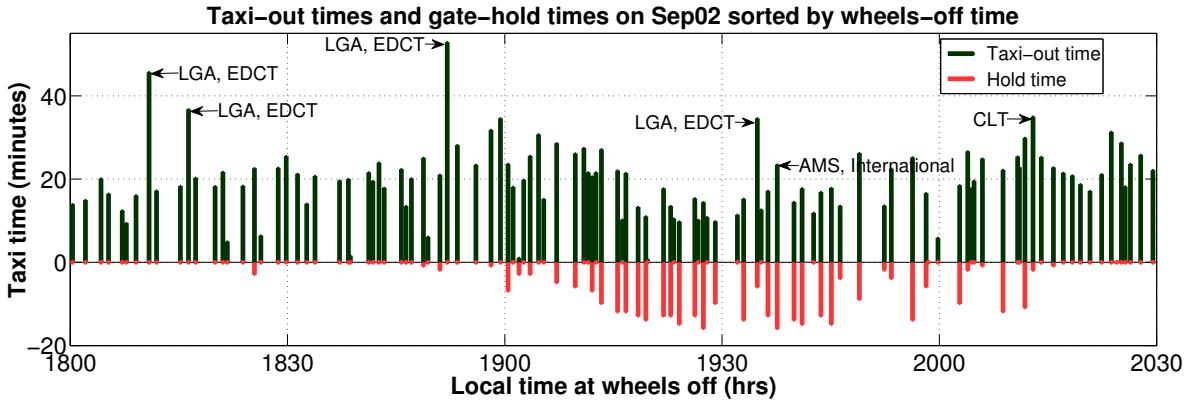

Figure 9: Taxi-out and gate-hold times from the field test on September 2, 2010.

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 metering can be further visualized by using ASDE-X data, as can be seen in the Figure 10, which shows snapshots of the airport surface at two instants of time, the first before the metering started, and the second during the metering. 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.

Figure 10: Snapshots of the airport surface, (left) before metering, and (right) during metering of pushbacks. 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 during metering. The white area on the taxiway near the top of the images indicates the closed portion of taxiway “November”.

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

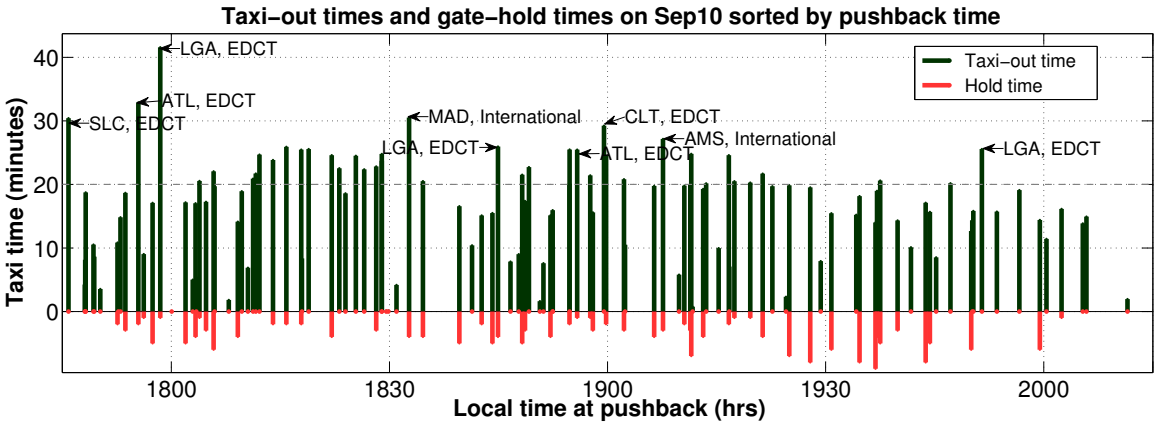

Figure 11: Taxi-out and gate-hold times from the field test on September 10, 2010.

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 metering 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 (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 1930), the average number of jets taxiing out stayed close to 20 and the average taxi-out time was about 25 minutes.

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 metering. 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 metering 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.

4.2 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 metering periods, as illustrated in Figure 14.

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, departure that is holding for takeoff clearance, etc. We

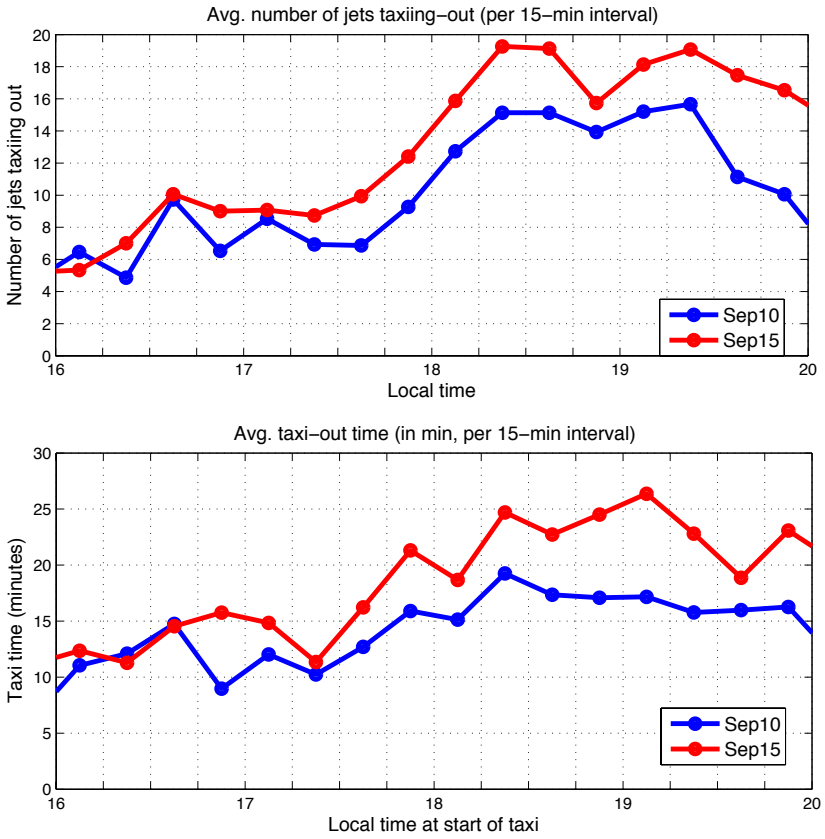

Figure 12: Surface congestion (top) and average taxi-out times (bottom) per 15-minutes, for (blue) a day with pushback rate control, and (red) a day with similar demand, same runway configuration and visual weather conditions, but without metering. Delay attributed to EDCTs has been removed from the taxi-out time averages.

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 metering periods, with the exception of a three-minute interval on the third day of metering. 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 metering pushbacks, demonstrating the ability of the approach to adapt to the uncertainties in the system.

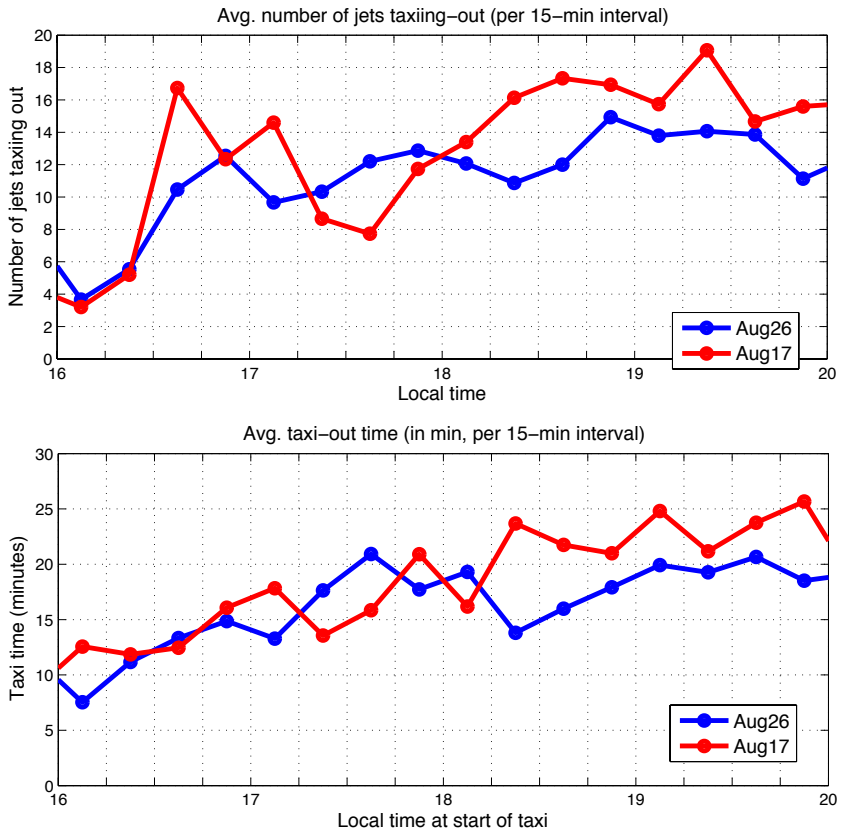

Figure 13: Ground congestion (top) and average taxi-out times (bottom) per 15-minutes, for (blue) a day with pushback rate control, and (red) a day with similar demand, same runway configuration and weather conditions, but without metering. Delay attributed to EDCTs has been removed from the taxi-out time averages.

5 Benefits analysis

Table 2 presents a summary of the gate-holds on the eight demo periods with sufficient congestion for metering pushbacks. As mentioned earlier, we had no significant congestion when the airport was operating in its most efficient configuration (4L, 4R | 4L, 4R, 9).

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 tradeoff taxi-out time for time spent at the gate with engines off, as illustrated in Figures 9 and 11.

5.1 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 metering. 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

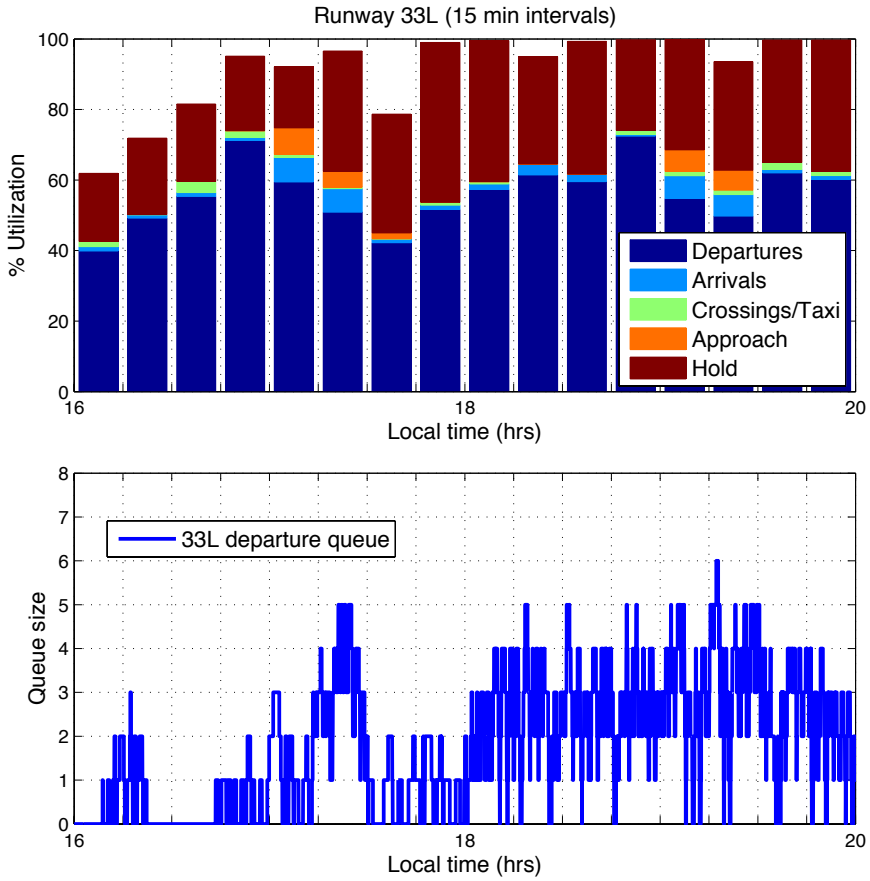

Figure 14: Runway utilization plots (top) and queue sizes (bottom) for the primary departure runway (33L) during the field test on September 10, 2010. These metrics are evaluated through the analysis of ASDE-X data.

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 and the nonlinear effects of shorter departure queues due to reduced congestion, but these effects are neglected in the preliminary analysis.

5.2 Fuel burn savings

Supported by the analysis presented in Section 5.1, 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 multiplicative 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 metering. 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

Table 2: Summary of gatehold times for the eight demo periods with significant metering and gate-holds.

	Date	Period	Configuration	No. of gate-holds	Average gatehold (min)	Total gatehold (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

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.

5.3 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 metering 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.

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.

6 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 metering 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

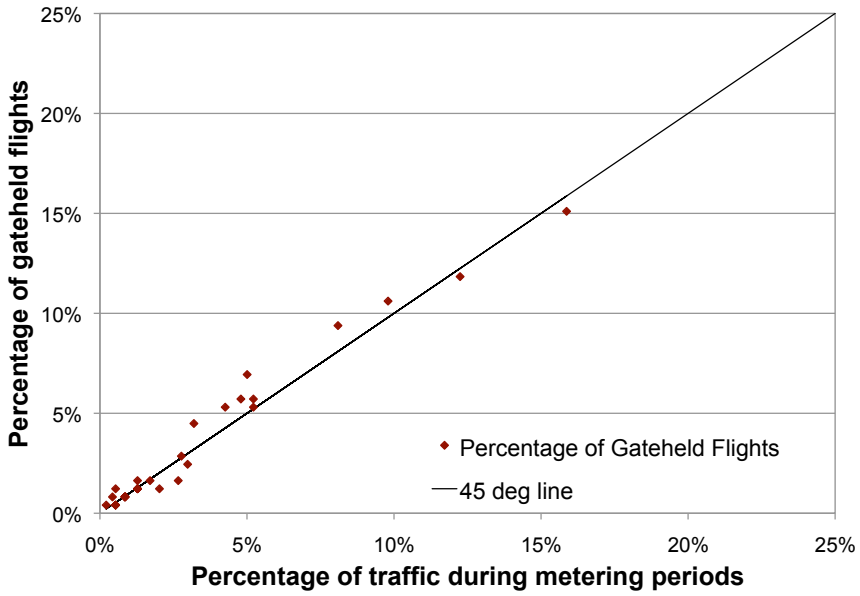

Figure 15: Comparison of gate-hold share and total departure traffic share for different airlines.

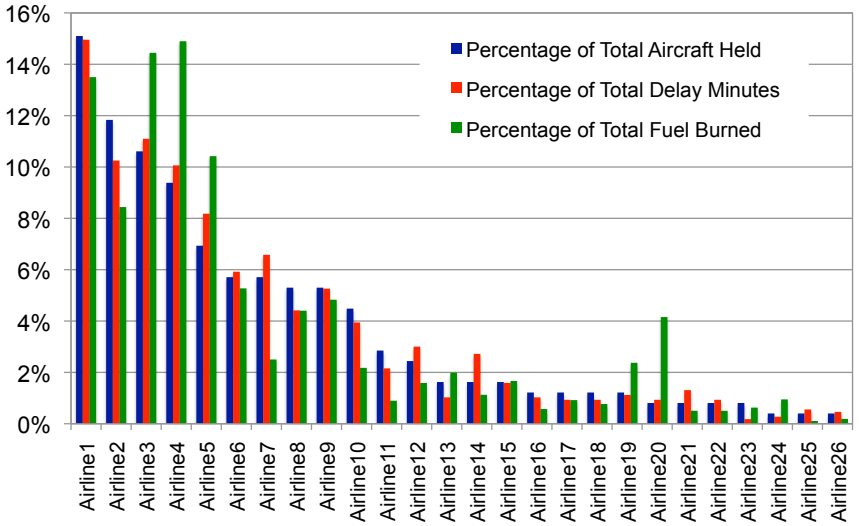

Figure 16: Percentage of gate-held flights, taxi-out time reduction and fuel burn savings incurred by each airline.

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.

7 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 active metering of pushback rates, over 1077 minutes (nearly 18 hours) of gate holds were experienced during the demonstration period across 247 flights, at an average of 4.3 minutes of gate hold per flight (which correlated well to the observed decreases in taxi-out time). Preliminary fuel burn savings from gate-holds with engines off were estimated to be between 12,000-15,000 kg (depending on whether APUs were on or off at the gate).

Acknowledgments

We would like to acknowledge the cooperation and support of the following individuals who made the demo at BOS possible: Deborah James, Pat Hennessy, John Ingaharro, John Melecio, Michael Nelson and Chris Quigley at the BOS Facility; Vincent Cardillo, Flavio Leo and Robert Lynch at Massport; and George Ingram and other airline representatives at the ATA. Alex Nakahara provided assistance in computing the preliminary fuel burn savings from the gate-hold data, and Regina Clewlow, Alex Donaldson and Diana Michalek Pfeil helped with tower observations before and during the trials. We are also grateful to Lourdes Maurice (FAA) and Ian Waitz (MIT) for insightful feedback on the research, and James Kuchar, Jim Eggert and Daniel Herring of MIT Lincoln Laboratory for their support and help with the ASDE-X data.

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Reduced/Single Engine Taxiing at Logan Airport Memorandum

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 at Boston Logan, Dated January 4, 2011
- Clewlow, Regina, Hamsa Balakrishnan, and Tom Reynolds. "A Survey of Airline Pilots Regarding Fuel Conservation Procedures for Taxi Operations." *International Airport Review.* Issue 3, 2010.

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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 Airline Committee (BAC)

From: Edward C. Freni
Director of Aviation

Date: January 4, 2011

RE: Single/Reduced Engine Taxiing at Boston Logan

As an important user of Boston-Logan International Airport ("Boston Logan"), your involvement in making Boston Logan the safest, most dependable and environmentally friendly airport is critical to us. Working together we have successfully implemented cutting edge safety technology including the Runway Status Lights and the ASDE-X radar and constructed new airside facilities including Runway 14/32, Taxiway Mike and other taxiway modifications. Our ability to implement these improvements at Logan is based in part on continuing to work on measures that minimize environmental impacts from various landside and airside operations.

One such important operational measure that has been identified is single/reduced engine taxiing. Based on previous outreach to the air carrier community serving Boston Logan, it is clear to Massport that single or reduced engine taxiing is being utilized when deemed appropriate by the pilot. While fuel savings is a significant benefit and the primary motivation for air carriers, reducing aircraft emissions is also an important additional benefit and the primary environmental goal for encouraging single engine taxiing. It is our hope that the current level of implementation will continue or be expanded consistent with your safety procedures and subject to pilot discretion and operational conditions.

To better understand how single/reduced engine taxiing is being used at Boston Logan and inform the pilot community, the Massachusetts Institute of Technology undertook a survey of pilots at Boston Logan. The survey, funded by the FAA and supported by Massport, has provided important insight on how single engine taxiing is applied in general and at Boston Logan in particular. The major findings of the survey are:

- Single engine taxiing is "quite prevalent in current operations".
- 95% responded that fuel conservation was important
- 70% of the respondents indicated that their airlines encourage the use of single engine taxiing
- Single engine taxiing is used more on arrivals than departures

- Boston Logan's Runways 33L and 27R are the top departure runways where single engine taxiing is used to get to the runway end. Runways 9 and 15R are the top departure runways where single engine taxiing is not used to get to the runway end (due to short taxiing distances)

- Identified operational practices to reduce taxi-out fuel burn included:

    - shutting down all engines during long delays,

    - shutting down or controlling the use of APUs,

    - minimizing thrust and controlling speed on taxiways

    - Delaying engine start until engine use is necessary.

Key reasons why single engine taxiing might not be used are primarily related to safety (e.g., bad weather, need for pilot to keep "heads up") or operational needs (e.g., anticipated short taxi time) or engine warm up/warm down requirements. For more detail findings of the survey enclosed please find a copy of an article published earlier this year in International Airport Review highlighting the survey.

I encourage you to share these findings and the attached article with your flight crews and want to thank you for the continued use of single or reduced engine taxiing procedures at Logan, subject, of course, to pilot judgment, engine performance considerations, operational conditions and, above all, safety. In the meantime if you have any questions or would like to discuss any aspect of this letter/survey, please feel free to contact me or Mr. Flavio Leo at 617-568-3528 at your earliest convenience.

A Survey of Airline Pilots Regarding Fuel Conservation Procedures for Taxi Operations

By Regina Clewlow, Hamsa Balakrishnan, Tom Reynolds, and R. John Hansman
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Aircraft taxi operations are a significant source of energy consumption and emissions at airports. In 2007, an estimated 4,000 tons of hydrocarbons, 8,000 tons of nitrogen oxides and 45,000 tons of carbon monoxide were emitted through taxi-out operations at U.S. airports[1]. These pollutants contribute to low-altitude emissions, directly impact local nonattainment of air pollution standards, and represent an endangerment to human health and welfare.

Given increasing fuel prices and concern about aviation-related environmental impacts, airlines have implemented a number of practices to reduce fuel burn during ground operations. Such strategies include minimizing use of the auxiliary power unit, controlling speed on the taxiway system, and reducing surface congestion and delays by holding aircraft at the gate. Researchers from the Massachusetts Institute of Technology's International Center for Air Transportation and the Partnership for AiR Transportation Noise and Emission Reduction conducted a survey of airline pilots at Boston Logan International Airport to assess their attitudes towards fuel conservation during taxi operations, and to document current fuel conservation practices, particularly single-engine taxi procedures.

This study found that the majority of pilots believe that fuel conservation is important; their motivation to conserve fuel is mainly driven by concerns about their airlines' economic viability, as well as the environmental impacts of aviation. The study also found that single-engine taxiing is quite prevalent in current operations, especially arrivals, and identified some of the practical challenges surrounding such procedures.

Survey of Pilots at BOS

With the cooperation of the Massachusetts Port Authority, MIT researchers conducted a web- and paper-based survey of pilots at BOS between August and December 2009. Links to the web survey were sent via e-mail to station managers and chief pilots for all airlines at BOS. Print copies, along with prepaid return envelopes and a drop-off folder, were also placed in the crew lounges. Participation in the survey was voluntary and the responses were anonymous. Sixty-four survey responses were received, representing most major carriers and one low-cost carrier; however, there was significant representation from 2-3 airlines. Forty-three of the respondents were captains, and 19 were first officers. Thirteen pilots indicated that BOS was their base airport. Half the pilots flew through BOS an average of 5.4 times a week, while the other half only flew through BOS an average of seven times per year. (The overall average was 2.8 times per month.) The average flight experience among the respondents was 22 years, with an average of eight years on their current aircraft.

Because the survey was conducted using a convenience sample, there is potential bias in the survey results: for example, those who are more concerned with fuel conservation are potentially more

[1] H. Balakrishnan, I. Deonandan, and I. Simaiakis. Opportunities for reducing surface emissions through airport surface movement optimization. Technical report, Massachusetts Institute of Technology, 2008. Technical report Number ICAT-2008-7.

likely to have completed our survey. Nevertheless, the survey yielded useful responses regarding current fuel saving practices, as well as pilots' experiences using single-engine taxi procedures.

General Attitudes towards Fuel Conservation

More than 95% of pilots responding to the survey indicated that fuel conservation is important to them, with 80% indicating that it is very important, and 16% indicating that it is somewhat important. These results are higher than recent studies on conservation and the environment, including studies by the Pew Center on Global Climate Change, Yale University, and George Mason University, which find that Americans' support for conservation ranges from 55% to 80%. However, as mentioned, our results may be biased as a result of our survey method.

Pilots indicated that motivating factors for fuel conservation included general economic and financial concerns, concerns about their airline's profitability, and concerns about the environment and emissions. With fuel accounting for a significant portion of airline operating costs, it is understandable that pilots' interests in fuel conservation are largely driven by economic concerns.

Taxi-out Fuel Burn Estimates

Pilots were asked to estimate the average taxi-out time at their base airports, what they would consider an excessive taxi-out time, and the estimated fuel burn (assuming that all the engines were being used). The results are shown in Table 1. Also included in the table are the average taxi-out times for 2009, as reported by the Aviation System Performance Metrics database.

Based on the survey results, pilots estimated an average (normal) taxi time to be roughly 20 minutes, and excessive taxi times ranged between approximately 30 and 90 minutes. The *additional fuel burn* due to excessive taxi-out times, as estimated by pilots, ranged between 225 and 500 kg per flight, depending on the airport. Applying information on the types of aircraft flown by survey respondents (combining data from the JP Airline Fleet Database and ICAO Engine Emissions Databank[2]), the taxi-out fuel burn for this survey group was estimated to be about 550 kg per flight.

Table 1. Pilots' Estimates of Taxi-out Times and Fuel Burn by Airport

Base Airport	Count	Average taxi-out time from ASPM (min)	Normal taxi-out times, pilot estimates (min)	Taxi-out fuel burn, pilot estimates (kg)	Excessive taxi-out times, pilot opinions (min)
All	59	N/A	20.1	225	41.7
ATL	8	21.8	20.3	252.5	39.4
BOS	9	18.3	13.7	278.6	30.6
EWR	2	25.7	25.0	317.5	67.5
JFK	8	31.1	38.8	437.4	93.1
LGA	2	24.4	32.5	340.2	82.5
LHR	16	N/A	19.5	764.0	32.2

[2] Bucher and Company, JP Airline Fleets International (2006/2007), 2006; ICAO Engine Emissions Databank, Issue 15, 2008.

Operational Practices to Reduce Taxi-out Fuel Burn

Pilots were asked which fuel conservation strategies were encouraged by their airlines during taxi operations, besides single-engine taxi procedures (which were assessed in more depth in the survey). The most common strategies cited were:

- shutting down all engines during long delays
- shutting down, or controlling use of, apus
- minimizing thrust and controlling speed on taxiways
- delaying engine start until engine use is necessary.

Pilots from international carriers noted that at most non-U.S. airports, delays are absorbed at the gate (instead of on the taxiway system), and that they often shut down all engines during gate holds. The majority of both U.S. and international pilots indicated that they shut down all engines during long delays, either at the gate or in airport holding-areas. For example, at Boston Logan Airport, the local air traffic controllers often hold aircraft on certain taxiways depending on the runway configuration being used.

Single-Engine Taxi Procedures

One potential strategy to reduce aircraft surface emissions is the use of single-engine taxi operations; that is, when a single engine is shut down/left off during taxiing on a twin-engine aircraft, or one to two engines are shut down/ left off on a four-engine aircraft. Prior research has indicated that single-engine taxiing can reduce surface emissions by up to 50%[3], although the savings may be lower because of the need to have higher thrust from the engine that is being used, and the fuel needed for cross-bleed starts. The survey respondents thought that single-engine taxiing would result in a 37% reduction in fuel burn, on average.

A majority of survey respondents (70%) indicated that their airlines encourage them to use single-engine taxi procedures, with 40% indicating that they are strongly encouraged to use them, and 31% indicating that they are encouraged. When asked further about the frequency of single-engine taxi use, it was found that these procedures were widely used on arrivals (52% of pilots reported using them more than 75% of the time), while they were infrequently used on departures (54% of pilots reported using them less than 10% of the time).

Operational Challenges Associated with Single-Engine Taxiing

Although single-engine taxiing may appear to be a simple and effective method to reduce fuel burn during surface operations, there are a number of perceived problems associated with the procedure. The four main challenges identified by respondents were:

- excessive thrust and associated issues
- maneuverability problems, particularly related to tight taxiway turns and weather
- problems starting the second engine
- distractions and workload issues

Given that there are maneuverability concerns associated with single-engine taxi procedures, we asked pilots if there are certain conditions under which single-engine taxi procedures were not used. As expected, many pilots indicated that they would not use single-engine taxi procedures with low visibility or tight taxiway turns (due to problems turning into the operating engine). However,

[3] V. Kumar, L. Sherry, and T. Thompson, "Analysis of Emissions Inventory for 'Single-Engine Taxi-Out' Operations," Proceedings International Conference on Research in Air Transportation (ICRAT-2008), Fairfax, VA, February 2008.

nearly half of the pilots surveyed indicated that they would use single-engine taxiing on wet taxiways.

Cold starts did not appear to be a significant factor affecting use of single-engine taxi procedures. A majority of pilots (67%) indicated that if they were departing in the morning after their aircraft had been sitting idle overnight, it would not affect their decision to use single-engine taxiing.

Survey respondents were asked to list any other conditions when they would not use single-engine taxi procedures. The most frequent responses were:

- ice or snow
- high gross weight
- short taxi-times, uncertainty of departure time and position in the takeoff queue, and changes in runway assignments
- hot days on asphalt surfaces

Engine Shutdown Procedures

Based on their airline and equipment flown, a majority of pilots (80%) shut down or leave off a specific engine when utilizing single engine taxi procedures. Although many pilots cited "procedure" or "habit" as their primary reason for shutting down or leaving off a specific engine during single engine taxiing, it is also driven by which engines power essential aircraft systems such as hydraulics and brakes.

Other key considerations include which side the cargo doors are on, aircraft cooling, and the taxiway configuration at the airport (e.g. how many right or left turns will the aircraft need to make during taxi-out or taxi-in).

On departures, pilots wait until an average of 4.6 minutes before takeoff before starting the last engine, and 3.1 minutes after landing to shut down an engine.

Runway Configuration Issues

One of the key reasons that pilots might not use single-engine taxi procedures is that they might anticipate a short taxi-out or taxi-in time. Most pilots indicated that in order to consider using single-engine taxiing for arrivals, the expected taxi-in time would have to exceed 10 minutes (on average); for departures, they would need to expect their taxi time to exceed 20 minutes. For example, at Boston Logan Airport, pilots indicated that they do not typically use single-engine taxi-out procedures to runways 9, 4L, and 15R, which are closest to the gates. The most common reason cited for not using single-engine taxiing at BOS was the proximity of the gate to the runway, and the resultant short taxi time. However, there were other reasons cited for not using the procedure, including:

- length of queue
- complex layout
- busy taxiway areas

Advanced Queue Management Strategies and a Willingness to Wait

Researchers at MIT are currently investigating advanced queue management strategies that would minimize surface fuel burn and emissions. Such strategies might hold aircraft at the gate or in holding areas in order to minimize taxi time, while also aiming to minimize delay. When pilots were asked whether they would be willing to wait at the gate if their position in a takeoff queue could be

guaranteed, 61% indicated that they would *definitely* be willing to wait, and an additional 16% indicated that they would *probably* be willing to wait.

Conclusions

A majority of pilots responding to this survey believe fuel conservation is an important issue, and that this belief is primarily motivated by concerns about the cost of fuel, company profitability, and the impact of aviation on the environment. A majority of airlines appear to encourage single-engine taxi procedures, as well as a variety of other fuel conservation measures.

The survey found that a majority of pilots used single-engine taxi procedures on arrival at airports, while a fewer number of them used single-engine taxi on departures. Key reasons cited for not using these procedures were either safety-related, or associated with practical reasons (such as short taxi distances for some runways at BOS). Single-engine taxi procedures differed between aircraft in terms of which engines were left off, and for how long. Even though this survey was based on a convenience sample, it provided some useful insights regarding airline pilots' attitudes to fuel consumption, as well as information on the use of fuel conservation measures such as single-engine taxiing.

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