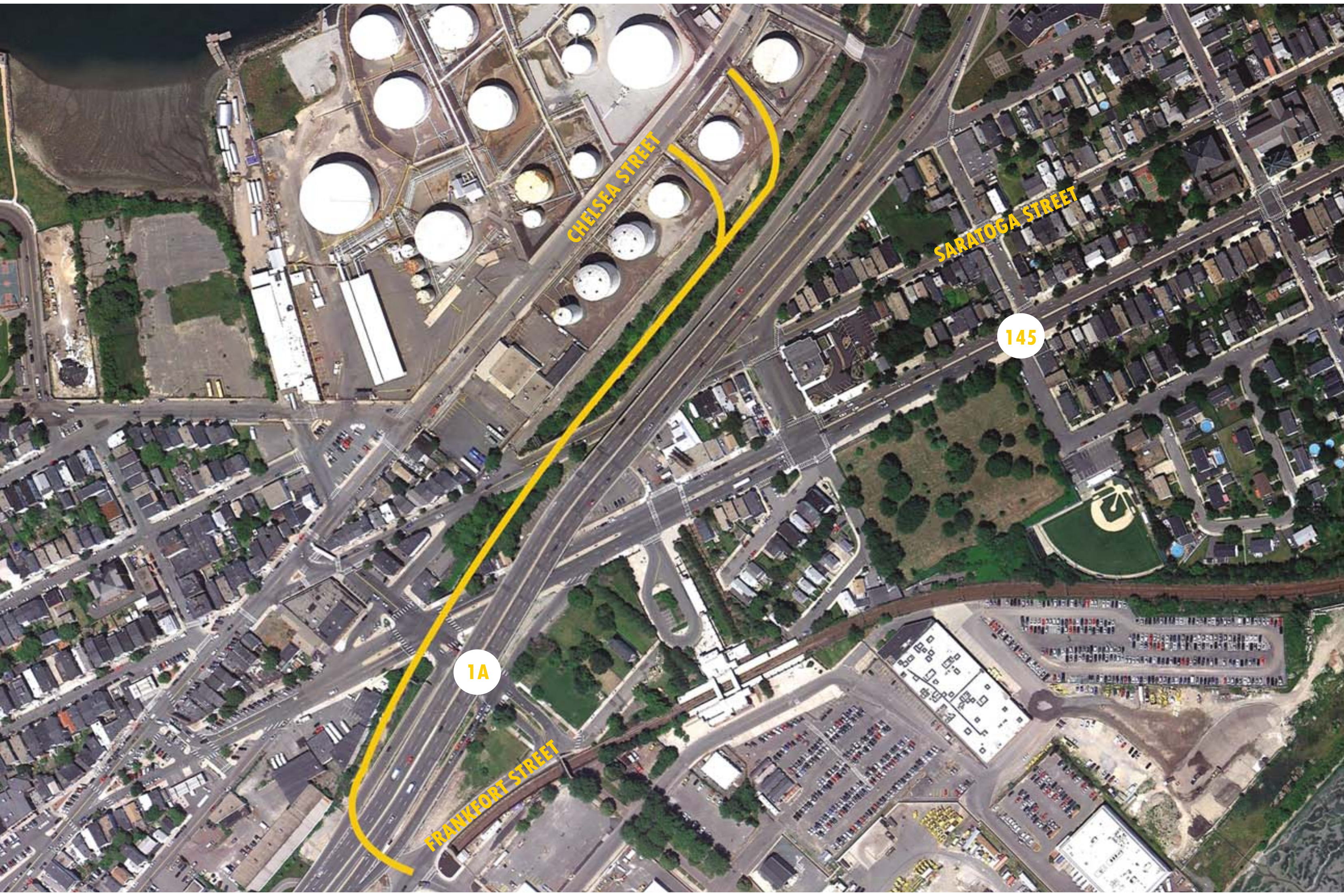
ENF



East Boston/Chelsea Bypass
Environmental Notification Form

Submitted To:
Executive Office of Energy and Environmental Affairs

Submitted By:
Massachusetts Port Authority

October 2010

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

October 15, 2010

Secretary Ian A. Bowles
Executive Office of Energy and Environmental Affairs
Attn: MEPA Office
100 Cambridge Street - Suite 900
Boston, Massachusetts 02114

Re: Proposed East Boston - Chelsea Bypass Road
East Boston, Massachusetts

Dear Secretary Bowles:

The Massachusetts Port Authority (Massport) is pleased to submit the enclosed Environmental Notification Form (ENF) for construction of the East Boston-Chelsea Bypass (the Project or Bypass), a new limited-access haul road connecting Frankfort Street at Boston Logan International Airport (Logan Airport or Airport) and Chelsea Street in the vicinity of the new Chelsea Street Bridge in East Boston. The 2,225 foot project alignment is primarily located along an unused CSX rail corridor that was recently acquired by the Commonwealth of Massachusetts.

The Bypass is intended to improve commercial traffic access to Logan Airport; by diverting traffic to the Bypass, traffic congestion on East Boston streets will be reduced, and traffic safety in East Boston will be improved. The Bypass would provide an alternative to existing roadway connections through East Boston's Day Square and the Neptune Road corridor, which have closely-spaced intersections, irregular roadway geometry, and significant vehicular congestion. The Bypass is being planned, designed, constructed, and will be operated by Massport.

The new roadway is intended to accommodate Airport-related traffic, consisting of commercial vehicles, cargo vehicles, Massport shuttle buses, and Massachusetts Bay Transportation Authority (MBTA) buses serving Logan Airport. The Bypass will ease congestion on neighborhood streets by shifting some of the largest and slowest moving traffic to the new roadway. Shifting Airport traffic and buses to the Bypass will reduce local roadway congestion, and improve commercial traffic flow. The improved traffic flow is expected to yield both safety and air quality benefits.

The new Bypass will consist of two 12-foot travel lanes (one in each direction) and four-foot shoulders. The project includes a comprehensive stormwater management system, new lighting, reconstruction of failing retaining walls and installation of new roadway signs and signals. A portion of the existing below-grade fuel pipeline that serves Logan Airport, which is located within the former CSX right-of-way, will be replaced. Bypass construction is planned to commence in 2011 with a goal of having the Bypass in operation by late 2012, following an estimated 14-16 month construction period.

The new roadway, will be over one quarter mile in length, and therefore meets the MEPA review trigger for preparation of an ENF; however the project does not meet or exceed any automatic EIR review thresholds. In order to present a comprehensive picture of project operational and environmental benefits and impacts, the ENF form has been supplemented by including analyses of project area traffic, air quality and noise effects. As described in the ENF supplement and appendices, the Bypass will reduce congestion on several key community roadways and intersections. These improved roadway movements will provide a benefit in terms of transportation efficiency and reduced vehicle emissions. The noise analysis also confirms that relocation of the truck and bus traffic will not have an adverse noise impact on the few residences in close proximity to the new roadway corridor.

It is anticipated that the ENF will be noticed in the October 25th edition of the *Environmental Monitor* followed by an extended 30-day public comment period which would close on November 24, 2010. The Secretary's Certificate would be expected on or about December 1, 2010. Copies of the ENF have been distributed in accordance with the requirements set forth in the MEPA regulations as well as to those individuals and organizations listed in the attached distribution list (Attachment A).

A MEPA consultation session will be held at the Logan Office Center, One Harborside Drive, East Boston, MA at **10:30 am on Wednesday, November 10th, 2010**. In addition to a brief overview of the project and the MEPA process, Massport will provide a bus to the project area for a site walk of the project right-of-way.

We appreciate your consideration of this ENF and look forward to continuing to work with you and your staff on the review of this Project. Please do not hesitate to contact me at (617) 568-3524 or Paul Christner at 617-568-3120 should you require additional information or clarification pertaining to the enclosed information.

Sincerely,

MASSACHUSETTS PORT AUTHORITY

Stewart Dalzell
Deputy Director, Environmental Planning and Permitting

cc: Distribution List
P. Christner/MPA

Enclosure: ENF/supplemental materials

ENF

East Boston/Chelsea Bypass Environmental Notification Form

Submitted To:
Executive Office of Energy and Environmental Affairs

Submitted By:
Massachusetts Port Authority

In Association With:
Fay, Spofford & Thorndike
HMMH

October 2010

Commonwealth of Massachusetts
Executive Office of Environmental Affairs ■ MEPA Office

ENF Environmental Notification Form

For Office Use Only Executive Office of Environmental Affairs
EOEA No.: MEPA Analyst: Phone: 617-626-

The information requested on this form must be completed to begin MEPA Review in accordance with the provisions of the Massachusetts Environmental Policy Act, 301 CMR 11.00.

Project Name: **East Boston-Chelsea Bypass**		
Street: **East Boston-Chelsea Bypass (between Frankfort Street and Chelsea Street, East Boston)**		
Municipality: Boston	Watershed: Boston Harbor	
Universal Transverse Mercator Coordinates: 19333494E 4694238N to 19333240E 4693599N	Latitude: 42.3845N to 42.3787N Longitude: 71.0226W to 71.0255W	
Estimated commencement date: **2011**	Estimated completion date: **2012**	
Approximate cost: **$20,000,000 (construction costs)**	Status of project design: 25 %complete	
Proponent: **Massachusetts Port Authority**		
Street: One Harborside Drive, Suite 200S		
Municipality: Boston	State: MA	Zip Code: 02128
Name of Contact Person From Whom Copies of this ENF May Be Obtained: Stewart Dalzell		
Firm/Agency: Massachusetts Port Authority	Street: One Harborside Drive, Suite 200S	
Municipality: Boston	State: MA	Zip Code: 02128
Phone: (617) 568-3507	Fax: (617) 568-3518	E-mail: sdalzell@massport.com

Does this project meet or exceed a mandatory EIR threshold (see 301 CMR 11.03)?
☐Yes ☒No

Has this project been filed with MEPA before?
☐Yes (EOEA No.__________) ☒No

Has any project on this site been filed with MEPA before?
☐Yes (EOEA No.__________) ☒No

Is this an Expanded ENF (see 301 CMR 11.05(7)) requesting:
- a Single EIR? (see 301 CMR 11.06(8)) ☐Yes ☒No
- a Special Review Procedure? (see 301CMR 11.09) ☐Yes ☒No
- a Waiver of mandatory EIR? (see 301 CMR 11.11) ☐Yes ☒No
- a Phase I Waiver? (see 301 CMR 11.11) ☐Yes ☒No

Identify any financial assistance or land transfer from an agency of the Commonwealth, including the agency name and the amount of funding or land area (in acres): **MA Department of Transportation (MassDOT) has recently completed the taking of a rail right-of-way (ROW) formerly owned by CSX. A portion of the rail ROW will be used to build the East Boston-Chelsea Bypass. MassDOT will transfer ownership of this portion of the ROW to Massport.**

Are you requesting coordinated review with any other federal, state, regional, or local agency?
☐ Yes(Specify_________________________) ☒ No

List Local or Federal Permits and Approvals: **National Pollution Discharge Elimination System permit, Order of Conditions from the Boston Conservation Commission, and NEPA Compliance.**

Which ENF or EIR review threshold(s) does the project meet or exceed (see 301 CMR 11.03):

☐ Land
☐ Water
☐ Energy
☐ ACEC
☐ Rare Species
☐ Wastewater
☐ Air
☐ Regulations
☐ Wetlands, Waterways, & Tidelands
☒ Transportation
☐ Solid & Hazardous Waste
☐ Historical & Archaeological Resources

Summary of Project Size & Environmental Impacts	Existing	Change	Total	State Permits & Approvals
LAND				☒ Order of Conditions ☐ Superseding Order of Conditions ☐ Chapter 91 License ☐ 401 Water Quality Certification ☐ MHD or MDC Access Permit ☐ Water Management Act Permit ☐ New Source Approval ☐ DEP or MWRA Sewer Connection/ Extension Permit ☐ Other Permits (*including Legislative Approvals*) – Specify:
Total site acreage	4.4. acres			
New acres of land altered		3.5 acres*		
Acres of impervious area	0.3 acres	1.8 acres	2.1 acres	
Square feet of new bordering vegetated wetlands alteration		0		
Square feet of new other wetland alteration		0		
Acres of new non-water dependent use of tidelands or waterways		N/A		
STRUCTURES				
Gross square footage	N/A	N/A	N/A	
Number of housing units	N/A	N/A	N/A	
Maximum height (in feet)	N/A	N/A	N/A	
TRANSPORTATION				
Vehicle trips per day	0	1,000**	1,000**	
Parking spaces	N/A	N/A	N/A	
WATER/WASTEWATER				
Gallons/day (GPD) of water use	N/A	N/A	N/A	
GPD water withdrawal	N/A	N/A	N/A	
GPD wastewater generation/ treatment	N/A	N/A	N/A	
Length of water/sewer mains (in miles)	N/A	N/A	N/A	

* All areas previously altered.
**These trips are commercial and transit trips that will be shifted from existing roadways to the new Bypass road. The Bypass is not projected to carry any significant number of new trips.

CONSERVATION LAND: Will the project involve the conversion of public parkland or other Article 97 public natural resources to any purpose not in accordance with Article 97?

☐Yes (Specify_________________________________) ☒No

Will it involve the release of any conservation restriction, preservation restriction, agricultural preservation restriction, or watershed preservation restriction?

☐Yes (Specify_________________________________) ☒No

RARE SPECIES: Does the project site include Estimated Habitat of Rare Species, Vernal Pools, Priority Sites of Rare Species, or Exemplary Natural Communities?

☐Yes (Specify_________________________________) ☒No

HISTORICAL /ARCHAEOLOGICAL RESOURCES: Does the project site include any structure, site or district listed in the State Register of Historic Place or the inventory of Historic and Archaeological Assets of the Commonwealth?

☐Yes (Specify_________________________________) ☒No

If yes, does the project involve any demolition or destruction of any listed or inventoried historic or archaeological resources?

☐Yes (Specify_________________________________) ☒No

AREAS OF CRITICAL ENVIRONMENTAL CONCERN: Is the project in or adjacent to an Area of Critical Environmental Concern?

☐Yes (Specify_________________________________) ☒No

PROJECT DESCRIPTION: The project description should include **(a)** a description of the project site, **(b)** a description of both on-site and off-site alternatives and the impacts associated with each alternative, and **(c)** potential on-site and off-site mitigation measures for each alternative (*You may attach one additional page, if necessary*.)

Purpose and Need: **The proposed East Boston-Chelsea Bypass (Bypass) is intended to reduce roadway congestion and improve safety in East Boston by providing a new limited-access roadway connection between Boston-Logan International Airport (Logan Airport or Airport) and Chelsea Street near the new Chelsea Street Bridge. The Bypass would provide an alternative to existing roadway connections through East Boston's Day Square and the Neptune Road corridor, which have closely-spaced intersections, irregular roadway geometry, and significant vehicular congestion. The Bypass is being planned, designed, constructed, and will be operated by the Massachusetts Port Authority (Massport).**

The new roadway will accommodate traffic, including commercial vehicles, cargo vehicles, Massport shuttle buses, and Massachusetts Bay Transportation Authority (MBTA) buses serving Logan Airport. The Bypass will ease congestion on neighborhood streets by shifting some of the largest and slowest moving traffic to the new roadway. Shifting Airport traffic to the Bypass will reduce local roadway congestion, and improve commercial traffic flow. The improved traffic flow is expected to yield both safety and air quality benefits.

Project Site: **The project site consists of an abandoned rail corridor, which was recently acquired by MassDOT. The project area runs north to south in a depressed cut between Frankfort Street and Chelsea Street. The 2,225-foot long right-of-way has an average 32-foot width; the overall site totals approximately 4.4 acres located primarily between Chelsea Street and Route 1A in East Boston, MA. The northern end of the project area is primarily industrial and abuts a fuel/oil storage facility to the west and an elevated roadway (Route 1A) to the east. The corridor runs under Saratoga Street and Bennington Street, and runs along a few commercial and residential properties.**

Alternatives Analysis: **As described below, three alternatives are evaluated: a *No-Build* and two *Build* alternatives. Massport is proposing to build the Spur Alignment Alternative. Temporary easements and traffic detours may be required of the project during construction and will be addressed during the final**

design phase. Use of the Bypass road in these alternatives would be limited to commercial vehicles, cargo trucks, Massport shuttle buses, and MBTA transit buses.

The following summarizes the three alternatives:

I. ***No-Build*: would preserve the existing physical infrastructure in the study area, with the exception of infrastructure projects that are proposed for completion independent of this project (e.g., reconstruction of the Chelsea Street Bridge, reconstruction of the Frankfort Street and Lovell Street intersection). Project benefits would not be realized.**

II. ***Spur Alignment (via Beck Street) Alternative (Proposed Project):***

The Spur Alignment would be a two-lane roadway connecting Frankfort Street (in the vicinity of Lovell Street) at Logan Airport in the south to Chelsea Street (south of Curtis Street) in the north. The northern section of the roadway will be split into a one way pair with the southbound lane intersecting Chelsea Street at Beck Street and the northbound lane intersecting Chelsea Street using a former rail spur slightly north of Beck Street. Figure 3 in the ENF supplement shows a concept plan for the Spur Alignment. The proposed alignment has the benefit of being located between the existing fuel farm along Chelsea Street and the Route 1A corridor, in an area of primarily industrial and commercial properties. Nearly one half of the route parallels the existing fuel storage facility along Chelsea Street. Only a short section of the alignment in the vicinity of Bennington Street abuts residential property.

The total length of proposed Bypass road is approximately 2,225 linear feet and the typical roadway width will be 32 feet with a cross section of two 12-foot travel lanes, one in each direction, and 4-foot shoulders on either side. The overall width of the rail corridor within the limits of each bridge abutment is 33 feet, which would restrict the roadway cross section directly under the bridges. The Bypass will be primarily below grade and cross under two bridges: Bennington Street (No. B-16-71) and Saratoga Street (No. B-16-70).

The southern or airport terminus of the Bypass would be aligned with Lovell Street at Frankfort Street, as the roadway emerges from beneath the Route 1A viaduct. This intersection would be served by a traffic signal, and the intersection design would incorporate a bicycle/pedestrian path that will link the East Boston Greenway with Bennington Street. The northern terminus will form two intersections with Chelsea Street spaced approximately 200 feet apart that will function as a one way pair; the northern intersection would be unsignalized. The southbound traffic will enter the Bypass road along the current Beck Street while the northbound traffic will follow the existing rail spur alignment.

III. ***Northerly Alignment (under Curtis Street) Alternative*:**

This alternative considered a two-lane roadway in the existing railroad corridor, connecting Frankfort Street (in the vicinity of Lovell Street) in the south to Chelsea Street (south of the Chelsea Street Bridge) in the north. Figure 6 in the ENF supplement shows a conceptual design of the Northerly Alignment alternative. The Northerly Alignment is the same as the Spur Alignment in the southern end. At the northern end, in this alternative, the Bypass would not use the Beck Street spur, but instead continue under Curtis Street and intersect Chelsea Street at a point just south of the Chelsea Street Bridge. This alternative would require a new signalized intersection at the Bypass and Chelsea Street.

This alternative would also require land takings from two additional commercial properties along the railway corridor.

Because of the required takings, additional cost, as well as potential traffic concerns due to the proximity of the Chelsea Street Bridge, Massport rejected the Northerly Alignment Alternative. The takings required for the northerly alignment have the potential to slow the progress of the project significantly and increase the overall budget without significant additional transportation benefits.

LAND SECTION – all proponents must fill out this section

I. Thresholds / Permits

A. Does the project meet or exceed any review thresholds related to **land** (see 301 CMR 11.03(1)
___ Yes __X__ No; if yes, specify each threshold:

II. Impacts and Permits

A. Describe, in acres, the current and proposed character of the project site, as follows:

	Existing	Change	Total
Footprint of buildings	**0**	**0**	**0**
Roadways, parking, and other paved areas	**0.3**	**1.8**	**2.1**
Other altered areas (describe)	**0**	**1.4**	**1.4**
Undeveloped areas	**0**	**0**	**0**

The project corridor includes a former railroad right-of-way, totaling approximately 4.4 acres. The corridor has been heavily disturbed and is poorly drained; approximately 0.3 acres is currently paved and 1.8 acres will be converted to new paved roadway as a result of the project. The remaining 1.4 acres of project site alteration will be as a result of cut and fill work associated with construction. Overall, the net increase in impervious surface will be 1.8 acres of new roadway.

B. Has any part of the project site been in active agricultural use in the last three years?
___ Yes __X__ No; if yes, how many acres of land in agricultural use (with agricultural soils) will be converted to nonagricultural use?

C. Is any part of the project site currently or proposed to be in active forestry use?
___ Yes __X__ No; if yes, please describe current and proposed forestry activities and indicate whether any part of the site is the subject of a DEM-approved forest management plan:

D. Does any part of the project involve conversion of land held for natural resources purposes in accordance with Article 97 of the Amendments to the Constitution of the Commonwealth to any purpose not in accordance with Article 97? ___ Yes __X__ No; if yes, describe:

E. Is any part of the project site currently subject to a conservation restriction, preservation restriction, agricultural preservation restriction or watershed preservation restriction? ___ Yes __X__ No; if yes, does the project involve the release or modification of such restriction? ___ Yes ___ No; if yes, describe:

F. Does the project require approval of a new urban redevelopment project or a fundamental change in an existing urban redevelopment project under M.G.L.c.121A? ___ Yes __X__ No; if yes, describe:

G. Does the project require approval of a new urban renewal plan or a major modification of an existing urban renewal plan under M.G.L.c.121B? Yes ___ No __X__ ; if yes, describe:

H. Describe the project's stormwater impacts and, if applicable, measures that the project will take to comply with the standards found in DEP's Stormwater Management Policy:
Construction of the Bypass will include installation of a comprehensive stormwater management system. The system will incorporate Best Management Practices and will include an Operation and Maintenance Plan. During the permitting process, the stormwater management system will be reviewed by the City of Boston Conservation Commission and Department of Environmental Protection. The ENF supplement presents details of the proposed stormwater management system. Massport will install bio-swales and underground drainage pipes pumping back to Logan Airport's stormwater pump station at the West Outfall.

I. Is the project site currently being regulated under M.G.L.c.21E or the Massachusetts Contingency Plan? Yes __X__ No ___ ; if yes, what is the Release Tracking Number (RTN)? **See Table below:**

Project Area MCP Sites	
MassDEP Release Tracking Number (RTN)	**Site Location/Address**
3-23556	160 McLellan Hwy, East Boston
3-22229	Old Rail Road Bed, 467 Chelsea St., East Boston
3-23189	Manhole at Intersection of Curtis Street and Chelsea Street, East Boston
3-29113	467 Chelsea St., East Boston

J. If the project is sited is within the Chicopee or Nashua watershed, is it within the Quabbin, Ware, or Wachusett subwatershed? ___ Yes __X__ No; if yes, is the project site subject to regulation under the Watershed Protection Act? ___ Yes ___ No

K. Describe the project's other impacts on land: **N/A**

III.. Consistency

A. Identify the current municipal comprehensive land use plan and the open space plan and describe the consistency of the project and its impacts with that plan(s):
The *East Boston Master Plan* was completed in 2000, and includes the proposed project as a recommendation for providing a more direct connection between Logan Airport and the Chelsea Street Bridge. The East Boston-Chelsea Bypass (also referred to as the "Bypass Road" and "Connector Road" in the East Boston Master Plan) would help alleviate traffic congestion on local roads and improve traffic flow between Logan Airport and Chelsea. Relieving congestion in the Day Square, Eagle Square, Neptune Road corridor will improve local roadway access and pedestrian safety.

B. Identify the current Regional Policy Plan of the applicable Regional Planning Agency and describe the consistency of the project and its impacts with that plan:
The proposed Bypass is recommended in *Journey to 2030: The Regional Transportation Plan* prepared by the Boston Metropolitan Planning Organization (adopted October 2009). The project would have a positive impact on East Boston by providing an alternate route for airport traffic, improve traffic flow between Chelsea and Logan Airport and reduce commercial truck traffic at local intersections.

C. Will the project require any approvals under the local zoning by-law or ordinance (i.e. text or map amendment, special permit, or variance)? Yes ___ No __X__ ; if yes, describe:

D. Will the project require local site plan or project impact review?
___ Yes __X__ No; if yes, describe:

RARE SPECIES SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **rare species or habitat** (see 301 CMR 11.03(2))? ___ Yes __X__ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **rare species or habitat**? ___ Yes __X__ No

C. If you answered "No" to both questions A and B, proceed to the **Wetlands, Waterways, and Tidelands Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Rare Species section below.

II. Impacts and Permits

A. Does the project site fall within Priority or Estimated Habitat in the current Massachusetts Natural Heritage Atlas (attach relevant page)? ___ Yes ___ No. If yes,

1. Which rare species are known to occur within the Priority or Estimated Habitat (contact: Environmental Review, Natural Heritage and Endangered Species Program, Route 135, Westborough, MA 01581, allowing 30 days for receipt of information):
2. Have you surveyed the site for rare species? ___ Yes ___ No; if yes, please include the results of your survey.
3. If your project is within Estimated Habitat, have you filed a Notice of Intent or received an Order of Conditions for this project? ___ Yes ___ No; if yes, did you send a copy of the Notice of Intent to the Natural Heritage and Endangered Species Program, in accordance with the Wetlands Protection Act regulations? ___ Yes ___ No

B. Will the project "take" an endangered, threatened, and/or species of special concern in accordance with M.G.L. c.131A (see also 321 CMR 10.04)? ___ Yes ___ No; if yes, describe:

C. Will the project alter "significant habitat" as designated by the Massachusetts Division of Fisheries and Wildlife in accordance with M.G.L. c.131A (see also 321 CMR 10.30)? ___ Yes ___ No; if yes, describe:

D. Describe the project's other impacts on rare species including indirect impacts (for example, stormwater runoff into a wetland known to contain rare species or lighting impacts on rare moth habitat):

WETLANDS, WATERWAYS, AND TIDELANDS SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **wetlands, waterways, and tidelands** (see 301 CMR 11.03(3))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits (or a local Order of Conditions) related to **wetlands, waterways, or tidelands**? _X_ Yes ___ No; if yes, specify which permit:
Order of Conditions from the Boston Conservation Commission for work within a coastal resource area (i.e. land subject to coastal storm flowage).

C. If you answered "No" to both questions A and B, proceed to the **Water Supply Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Wetlands, Waterways, and Tidelands Section below.

II. Wetlands Impacts and Permits

A. Describe any wetland resource areas currently existing on the project site and indicate them on the site plan:

A portion of the proposed Bypass is located within Land Subject to Coastal Storm Flowage, within a depressed cut (former CSX rail corridor), between Chelsea Street and Route 1A.

B. Estimate the extent and type of impact that the project will have on wetland resources, and indicate whether the impacts are temporary or permanent:

Coastal Wetlands	Area (in square feet) or Length (in linear feet)
Land Under the Ocean	___
Designated Port Areas	___
Coastal Beaches	___

Coastal Dunes ____________________
Barrier Beaches ____________________
Coastal Banks ____________________
Rocky Intertidal Shores ____________________
Salt Marshes ____________________
Land Under Salt Ponds ____________________
Land Containing Shellfish ____________________
Fish Runs ____________________
Land Subject to Coastal Storm Flowage __**Approx. 7,740 cubic yards**________

Inland Wetlands
Bank ____________________
Bordering Vegetated Wetlands ____________________
Land under Water ____________________
Isolated Land Subject to Flooding ____________________
Bordering Land Subject to Flooding ____________
Riverfront Area ____________________

C. Is any part of the project
1. a limited project? ___ Yes _**X**__ No
2. the construction or alteration of a dam? ___ Yes _**X**__ No; if yes, describe:
3. fill or structure in a velocity zone or regulatory floodway? ___ Yes _**X**__ No
4. dredging or disposal of dredged material? ___ Yes _**X**__ No; if yes, describe the volume of dredged material and the proposed disposal site:
5. a discharge to Outstanding Resource Waters? ___ Yes _**X**__ No
6. subject to a wetlands restriction order? ___ Yes _**X**__ No; if yes, identify the area (in square feet):

D. Does the project require a new or amended Order of Conditions under the Wetlands Protection Act (M.G.L. c.131A)? _**X**__ Yes ___ No; if yes, has a Notice of Intent been filed or a local Order of Conditions issued? ___ Yes _**X**__ No; if yes, list the date and DEP file number:______________. Was the Order of Conditions appealed? ___ Yes ___ No. Will the project require a variance from the Wetlands regulations? ___ Yes ___ No.

E. Will the project:
1. be subject to a local wetlands ordinance or bylaw? ___ Yes _**X**__ No
2. alter any federally-protected wetlands not regulated under state or local law? ___ Yes _**X**__ No; if yes, what is the area (in s.f.)?

F. Describe the project's other impacts on wetlands (including new shading of wetland areas or removal of tree canopy from forested wetlands): **N/A**

III. Waterways and Tidelands Impacts and Permits

A. Is any part of the project site waterways or tidelands (including filled former tidelands) that are subject to the Waterways Act, M.G.L.c.91? ___ Yes _**X**__ No; if yes, is there a current Chapter 91 license or permit affecting the project site? ___ Yes ___ No; if yes, list the date and number:

B. Does the project require a new or modified license under M.G.L.c.91? ___ Yes _**X**__ No; if yes, how many acres of the project site subject to M.G.L.c.91 will be for non-water dependent use?
Current ___ Change ___ Total ___

C. Is any part of the project
1. a roadway, bridge, or utility line to or on a barrier beach? ___ Yes _**X**__ No; if yes, describe:
2. dredging or disposal of dredged material? ___ Yes _**X**__ No; if yes, volume of dredged material ______

3. a solid fill, pile-supported, or bottom-anchored structure in flowed tidelands or other waterways? ___ Yes _X__ No; if yes, what is the base area? _______
4. within a Designated Port Area? ___ Yes _X__ No

D. Describe the project's other impacts on waterways and tidelands: **N/A**

IV. Consistency:
A. Is the project located within the Coastal Zone? ___ Yes _X__ No; if yes, describe the project's consistency with policies of the Office of Coastal Zone Management:

B. Is the project located within an area subject to a Municipal Harbor Plan? ___ Yes _X__ No; if yes, identify the Municipal Harbor Plan and describe the project's consistency with that plan:

WATER SUPPLY SECTION

I. Thresholds / Permits
A. Will the project meet or exceed any review thresholds related to **water supply** (see 301 CMR 11.03(4))? ___ Yes _X__ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **water supply**? ___ Yes _X__ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Wastewater Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Water Supply Section below.

II. Impacts and Permits
A. Describe, in gallons/day, the volume and source of water use for existing and proposed activities at the project site:

	Existing	Change	Total
Withdrawal from groundwater	________	________	________
Withdrawal from surface water	________	________	________
Interbasin transfer	________	________	________
Municipal or regional water supply	________	________	________

B. If the source is a municipal or regional supply, has the municipality or region indicated that there is adequate capacity in the system to accommodate the project? ___ Yes ___ No

C. If the project involves a new or expanded withdrawal from a groundwater or surface water source,
1. have you submitted a permit application? ___ Yes ___ No; if yes, attach the application
2. have you conducted a pump test? ___ Yes ___ No; if yes, attach the pump test report

D. What is the currently permitted withdrawal at the proposed water supply source (in gallons/day)? _____Will the project require an increase in that withdrawal?___ Yes ___ No

E. Does the project site currently contain a water supply well, a drinking water treatment facility, water main, or other water supply facility, or will the project involve construction of a new facility? ___ Yes ___ No. If yes, describe existing and proposed water supply facilities at the project site:

	Existing	Change	Total
Water supply well(s) (capacity, in gpd)	________	________	________
Drinking water treatment plant (capacity, in gpd)	________	________	________
Water mains (length, in miles)	________	________	________

F. If the project involves any interbasin transfer of water, which basins are involved, what is the direction of the transfer, and is the interbasin transfer existing or proposed?

G. Does the project involve
1. new water service by a state agency to a municipality or water district? ___ Yes ___ No
2. a Watershed Protection Act variance? ___ Yes ___ No; if yes, how many acres of alteration?
3. a non-bridged stream crossing 1,000 or less feet upstream of a public surface drinking water supply for purpose of forest harvesting activities? ___ Yes ___ No

H. Describe the project's other impacts (including indirect impacts) on water resources, quality, facilities and services:

III. Consistency -- Describe the project's consistency with water conservation plans or other plans to enhance water resources, quality, facilities and services:

WASTEWATER SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **wastewater** (see 301 CMR 11.03(5))? ___ Yes _X__ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **wastewater**? ___ Yes _X__ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Transportation -- Traffic Generation Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Wastewater Section below.

II. Impacts and Permits

A. Describe, in gallons/day, the volume and disposal of wastewater generation for existing and proposed activities at the project site (calculate according to 310 CMR 15.00):

	Existing	Change	Total
Discharge to groundwater (Title 5)	________	________	________
Discharge to groundwater (non-Title 5)	________	________	________
Discharge to outstanding resource water	________	________	________
Discharge to surface water	________	________	________
Municipal or regional wastewater facility	________	________	________
TOTAL	________	________	________

B. Is there sufficient capacity in the existing collection system to accommodate the project? ___ Yes ___ No; if no, describe where capacity will be found:

C. Is there sufficient existing capacity at the proposed wastewater disposal facility?___ Yes ___ No; if no, describe how capacity will be increased:

D. Does the project site currently contain a wastewater treatment facility, sewer main, or other wastewater disposal facility, or will the project involve construction of a new facility? ___ Yes ___ No. If yes, describe as follows:

	Existing	Change	Total
Wastewater treatment plant (capacity, in gpd)	________	________	________
Sewer mains (length, in miles)	________	________	________
Title 5 systems (capacity, in gpd)	________	________	________

E. If the project involves any interbasin transfer of wastewater, which basins are involved, what is the direction of the transfer, and is the interbasin transfer existing or proposed?

F. Does the project involve new sewer service by an Agency of the Commonwealth to a municipality or sewer district? ___ Yes ___ No

G. Is there any current or proposed facility at the project site for the storage, treatment, processing, combustion or disposal of sewage sludge, sludge ash, grit, screenings, or other sewage residual materials? ___ Yes ___ No; if yes, what is the capacity (in tons per day):

	Existing	Change	Total
Storage	________	________	________
Treatment, processing	________	________	________
Combustion	________	________	________
Disposal	________	________	________

H. Describe the project's other impacts (including indirect impacts) on wastewater generation and treatment facilities:

III. Consistency -- Describe measures that the proponent will take to comply with federal, state, regional, and local plans and policies related to wastewater management:

A. If the project requires a sewer extension permit, is that extension included in a comprehensive wastewater management plan? ___ Yes ___ No; if yes, indicate the EOEA number for the plan and describe the relationship of the project to the plan

TRANSPORTATION -- TRAFFIC GENERATION SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **traffic generation** (see 301 CMR 11.03(6))? __ _ Yes **X** __ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **state-controlled roadways**? ___ Yes _**X**__ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Roadways and Other Transportation Facilities Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Traffic Generation Section below.

II. Traffic Impacts and Permits

A. Describe existing and proposed vehicular traffic generated by activities at the project site:

	Existing	Change	Total
Number of parking spaces	_______	________	_______
Number of vehicle trips per day	________	________	________
ITE Land Use Code(s):			

B. What is the estimated average daily traffic on roadways serving the site?

Roadway	Existing	Change	Total
1. ____________________	________	________	________
2. ____________________	________	________	________
3. ____________________	________	________	________

C. Describe how the project will affect transit, pedestrian and bicycle transportation facilities and services:

III. Consistency -- Describe measures that the proponent will take to comply with municipal, regional, state, and federal plans and policies related to traffic, transit, pedestrian and bicycle transportation facilities and services:

ROADWAYS AND OTHER TRANSPORTATION FACILITIES SECTION

I. Thresholds

A. Will the project meet or exceed any review thresholds related to **roadways or other transportation facilities** (see 301 CMR 11.03(6))? __X__ Yes ___ No; if yes, specify, in quantitative terms:

The project includes construction of a new roadway, totaling one-quarter or more miles in length.

B. Does the project require any state permits related to **roadways or other transportation facilities**? ___ Yes __X__ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Energy Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Roadways Section below.

II. Transportation Facility Impacts

A. Describe existing and proposed transportation facilities at the project site:

	Existing	Change	Total
Length (in linear feet) of new or widened roadway	**0**	**2,225**	**2,225**
Width (in feet) of new or widened roadway	**0**	**32**	**32**

Other transportation facilities:

B. Will the project involve any

1. Alteration of bank or terrain (in linear feet)? **No**
2. Cutting of living public shade trees (number)? **No**
3. Elimination of stone wall (in linear feet)? **No**

III. Consistency -- Describe the project's consistency with other federal, state, regional, and local plans and policies related to traffic, transit, pedestrian and bicycle transportation facilities and services, including consistency with the applicable regional transportation plan and the Transportation Improvements Plan (TIP), the State Bicycle Plan, and the State Pedestrian Plan:

The proposed project is consistent with federal, state, regional and local plans and policies. The project is included in the Boston Metropolitan Planning Organization's Regional Transportation Plan (adopted October 2009).

The project's southern area will maintain the link between the East Boston Greenway and Bennington Street – a designated City of Boston bicycle route.

The Bypass will be designed so that the MBTA can operate 60-foot articulated buses.

ENERGY SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **energy** (see 301 CMR 11.03(7))? ___ Yes __X__ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **energy**? ___ Yes __X__ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Air Quality Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Energy Section below.

II. Impacts and Permits

A. Describe existing and proposed energy generation and transmission facilities at the project site:

	Existing	Change	Total
Capacity of electric generating facility (megawatts)	________	________	________
Length of fuel line (in miles)	________	________	________
Length of transmission lines (in miles)	________	________	________
Capacity of transmission lines (in kilovolts)	________	________	________

B. If the project involves construction or expansion of an electric generating facility, what are

1. the facility's current and proposed fuel source(s)?
2. the facility's current and proposed cooling source(s)?

C. If the project involves construction of an electrical transmission line, will it be located on a new, unused, or abandoned right of way?___ Yes ___ No; if yes, please describe:

D. Describe the project's other impacts on energy facilities and services:

III. Consistency -- Describe the project's consistency with state, municipal, regional, and federal plans and policies for enhancing energy facilities and services:

AIR QUALITY SECTION

I. Thresholds

A. Will the project meet or exceed any review thresholds related to **air quality** (see 301 CMR 11.03(8))? ___ Yes _**X**__ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **air quality**? ___ Yes _**X**__ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Solid and Hazardous Waste Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Air Quality Section below.

II. Impacts and Permits

A. Does the project involve construction or modification of a major stationary source (see 310 CMR 7.00, Appendix A)?___ Yes ___ No; if yes, describe existing and proposed emissions (in tons per day) of:

	Existing	Change	Total
Particulate matter	________	________	________
Carbon monoxide	________	________	________
Sulfur dioxide	________	________	________
Volatile organic compounds	________	________	________
Oxides of nitrogen	________	________	________
Lead	________	________	________
Any hazardous air pollutant	________	________	________
Carbon dioxide	________	________	________

B. Describe the project's other impacts on air resources and air quality, including noise impacts:

III. Consistency

A. Describe the project's consistency with the State Implementation Plan:

B. Describe measures that the proponent will take to comply with other federal, state, regional, and local plans and policies related to air resources and air quality:

SOLID AND HAZARDOUS WASTE SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **solid or hazardous waste** (see 301 CMR 11.03(9))? ___ Yes _X__ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **solid and hazardous waste**? ___ Yes _X__ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Historical and Archaeological Resources Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Solid and Hazardous Waste Section below.

II. Impacts and Permits

A. Is there any current or proposed facility at the project site for the storage, treatment, processing, combustion or disposal of solid waste? ___ Yes ___ No; if yes, what is the volume (in tons per day) of the capacity:

	Existing	Change	Total
Storage	________	________	________
Treatment, processing	________	________	________
Combustion	________	________	________
Disposal	________	________	________

B. Is there any current or proposed facility at the project site for the storage, recycling, treatment or disposal of hazardous waste? ___ Yes ___ No; if yes, what is the volume (in tons or gallons per day) of the capacity:

	Existing	Change	Total
Storage	________	________	________
Recycling	________	________	________
Treatment	________	________	________
Disposal	________	________	________

C. If the project will generate solid waste (for example, during demolition or construction), describe alternatives considered for re-use, recycling, and disposal:

D. If the project involves demolition, do any buildings to be demolished contain asbestos?

___ Yes ___ No

E. Describe the project's other solid and hazardous waste impacts (including indirect impacts):

III. **Consistency**--Describe measures that the proponent will take to comply with the State Solid Waste Master Plan:

HISTORICAL AND ARCHAEOLOGICAL RESOURCES SECTION

I. Thresholds / Impacts

A. Is any part of the project site a historic structure, or a structure within a historic district, in either case listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? ___ Yes _X__ No; if yes, does the project involve the demolition of all or any exterior part of such historic structure? ___ Yes ___ No; if yes, please describe:

B. Is any part of the project site an archaeological site listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? ___ Yes _X__ No; if yes, does the project involve the destruction of all or any part of such archaeological site? ___ Yes ___ No; if yes, please describe:

C. If you answered "No" to all parts of both questions A and B, proceed to the **Attachments and Certifications** Sections. If you answered "Yes" to any part of either question A or question B, fill out the remainder of the Historical and Archaeological Resources Section below.

D. Have you consulted with the Massachusetts Historical Commission? ___ Yes ___ No; if yes, attach correspondence

E. Describe and assess the project's other impacts, direct and indirect, on listed or inventoried historical and archaeological resources:

II. Consistency -- Describe measures that the proponent will take to comply with federal, state, regional, and local plans and policies related to preserving historical and archaeological resources:

ATTACHMENTS:

1. Plan, at an appropriate scale, of existing conditions of the project site and its immediate context, showing all known structures, roadways and parking lots, rail rights-of-way, wetlands and water bodies, wooded areas, farmland, steep slopes, public open spaces, and major utilities.
2. Plan of proposed conditions upon completion of project (if construction of the project is proposed to be phased, there should be a site plan showing conditions upon the completion of each phase).
3. **Original** U.S.G.S. map or good quality **color** copy (8-½ x 11 inches or larger) indicating the project location and boundaries
4. List of all agencies and persons to whom the proponent circulated the ENF, in accordance with 301 CMR 11.16(2).
5. Other:

CERTIFICATIONS:

1. The Public Notice of Environmental Review has been/will be published in the following newspapers in accordance with 301 CMR 11.15(1):

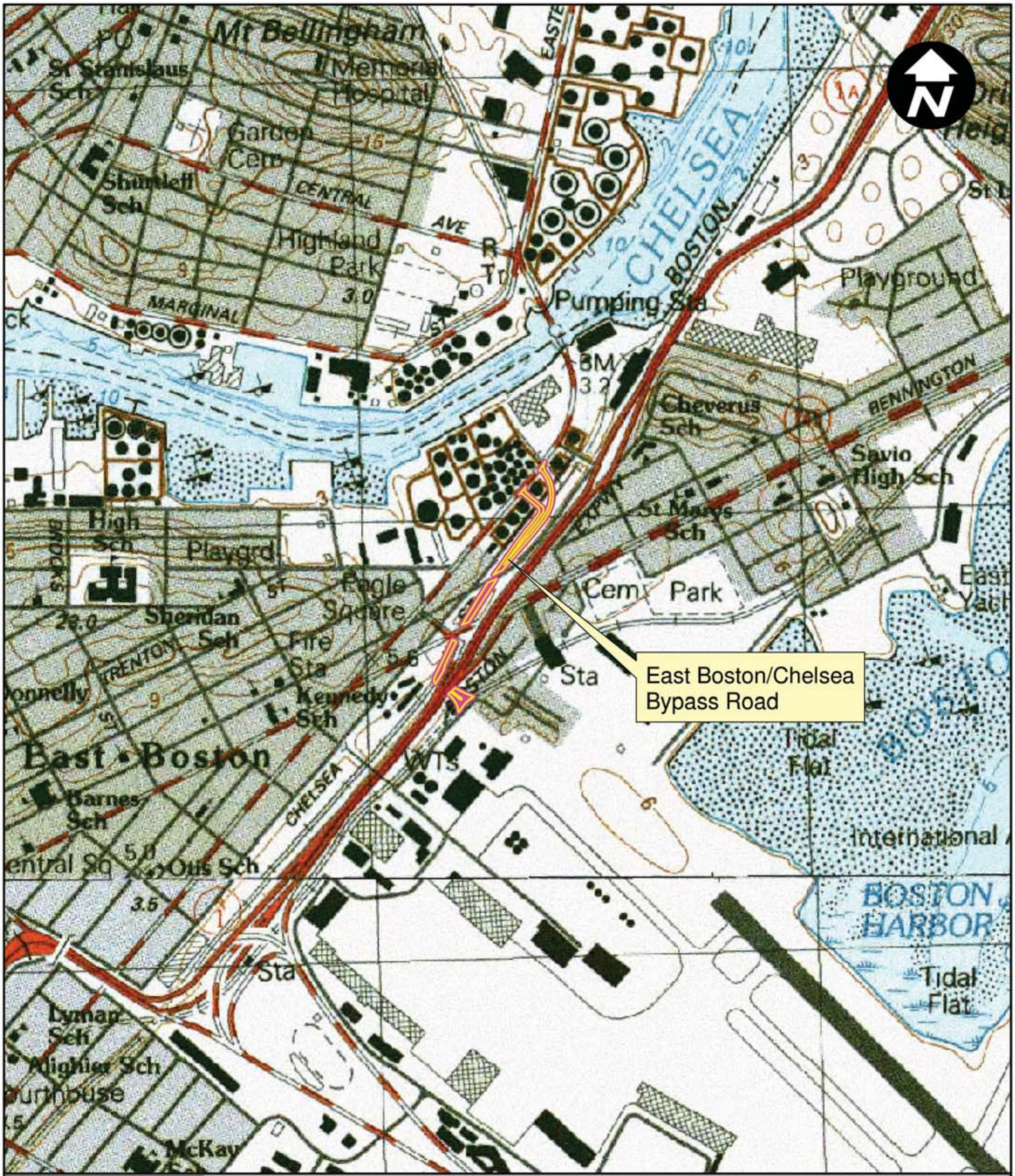
Boston Herald 10/22/10

East Boston Times 10/20/10

2. This form has been circulated to Agencies and Persons in accordance with 301 CMR 11.16(2).

10/15/10	[signature]		
Date	Signature of Responsible Officer or Proponent	Date	Signature of person preparing ENF (if different from above)

Name (print or type): Lowell L. Richards, III	Name (print or type)
Firm/Agency Massport	Firm/Agency
Street : One Harborside Drive, Suite 200S	Street
Municipality/State/Zip: East Boston, MA 02128	Municipality/State/Zip
Phone 617-568-3507	Phone



0 — 1,000 Feet

massport

Map Source: Office of Geographic Information (MassGIS), Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs

FIGURE 1 - LOCUS MAP

MPA Project No. L-932

East Boston / Chelsea Bypass Road

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1. Project Background and Description

The proposed East Boston-Chelsea Bypass (Bypass) is intended to provide a new limited-access roadway connection between Boston-Logan International Airport (Logan Airport or Airport) and Chelsea Street near the new Chelsea Street Bridge. By diverting traffic to the Bypass, traffic congestion on East Boston streets will be reduced, and traffic safety in East Boston will be improved. The Bypass would provide an alternative to existing roadway connections through East Boston's Day Square and the Neptune Road corridor, which have closely-spaced intersections, irregular roadway geometry, and significant vehicular congestion. The Bypass is being planned, designed, constructed, and will be operated by the Massachusetts Port Authority (Massport).

The new roadway will accommodate Airport-related traffic, consisting of commercial vehicles, cargo vehicles, Massport shuttle buses, and Massachusetts Bay Transportation Authority (MBTA) buses serving Logan Airport. The Bypass will ease congestion on neighborhood streets by shifting some of the largest and slowest moving traffic to the new roadway. Shifting Airport traffic and buses to the Bypass will reduce local roadway congestion, and improve commercial traffic flow. The improved traffic flow is expected to yield both safety and air quality benefits.

The project would have a positive impact on East Boston by providing an alternate route for airport traffic, improving traffic flow between Chelsea and Logan Airport and reducing truck traffic at local intersections. The project also creates opportunities for new or improved MBTA transit service between Chelsea and Logan Airport.

In consultation with MassDOT and the MBTA, Massport proposes to build the new roadway as quickly and efficiently as possible, with the goal of completing the project during the 2012 construction season. There is significant and long-standing community and government support for the project because of the benefits it will offer in removing truck and commercial traffic from congested neighborhood streets. Currently, trucks and commercial vehicles use residential streets in East Boston to travel between Chelsea and the Airport, resulting in traffic congestion and associated noise and potential safety issues. Large trucks and commercial vehicles are not best suited for small residential streets with pedestrians, bicyclists, and school zones. The proposed Bypass will be primarily below grade and travel primarily through an industrial area of East Boston, which is more compatible with large truck and commercial vehicle traffic.

The proposed route (the Spur Alignment) would be a two-lane roadway in an abandoned CSX railroad corridor, connecting Frankfort Street (in the vicinity of Lovell Street) at Logan Airport in the south to Chelsea Street (south of Curtis Street) in the north. Figure 2 shows the location of the right of way. The northern part of the roadway will be split into a one-way pair with the southbound lane intersecting Chelsea Street at Beck Street and the northbound lane intersecting Chelsea Street using a former rail spur slightly north of Beck Street. Figure 3 shows a concept plan for the Spur Alignment. The proposed alignment has the benefit of being located between the existing fuel storage facility along Chelsea Street and the Route 1A corridor, in an area of primarily industrial and commercial properties.

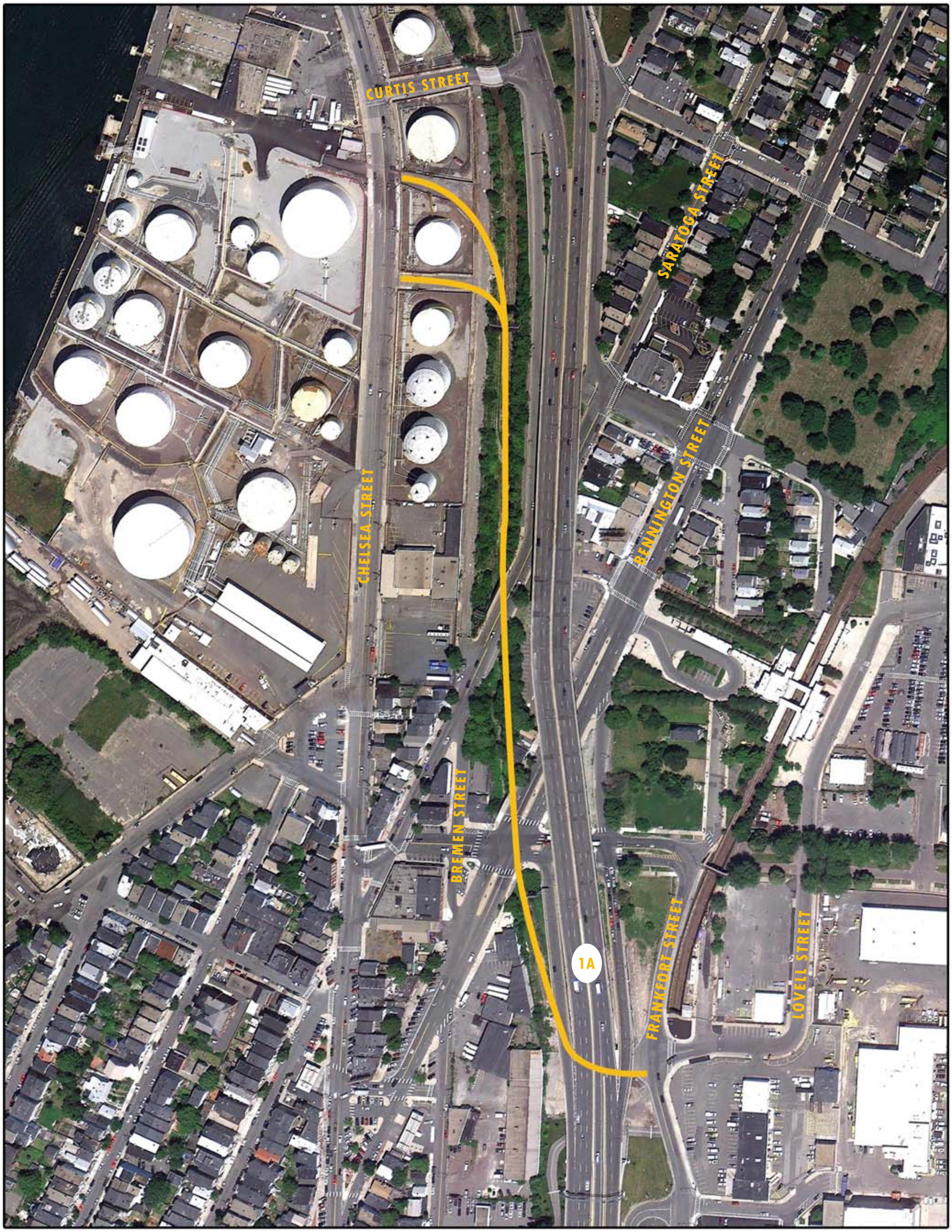

FIGURE 2 - EAST BOSTON CHELSEA BYPASS ROAD

MPA Project No. L-932

East Boston / Chelsea Bypass Road

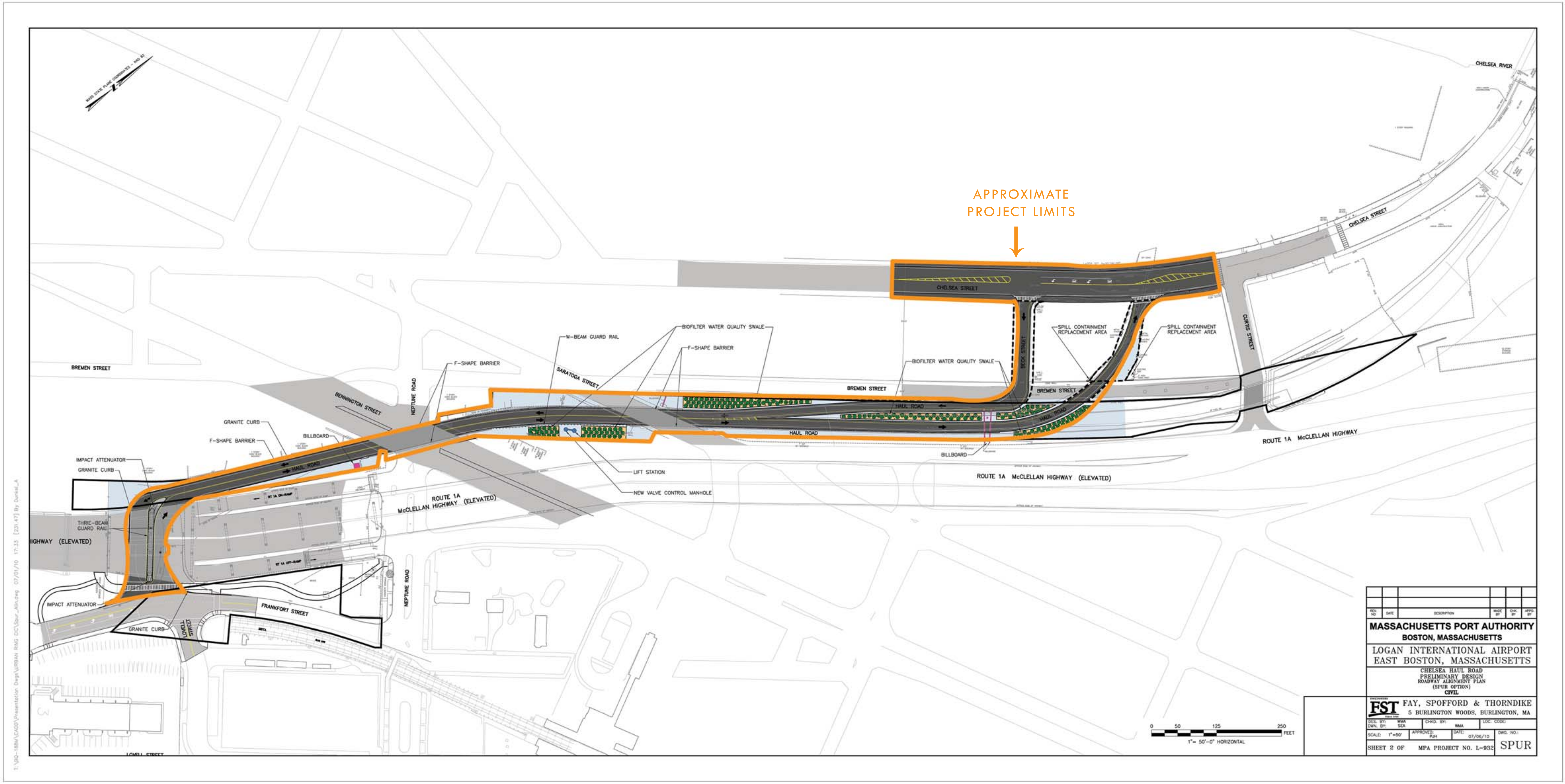

FIGURE 3 - PROPOSED PROJECT/SPUR ALIGNMENT

MPA Project No. L-932
East Boston / Chelsea Bypass Road

Nearly one half of the route parallels the existing fuel storage facility along Chelsea Street. Only a short section of the alignment, in the vicinity of Bennington Street, abuts any residential property.

The total length of the proposed Bypass road is approximately 2,225 linear feet and the typical roadway width will be 32 feet with a cross section of two 12-foot travel lanes, one in each direction. The overall width of the rail corridor within the limits of each bridge abutment is 33 feet, which would restrict the roadway cross section directly under the bridges. Figure 4 shows a typical cross section for the proposed roadway. The Bypass will be primarily below grade and cross under two bridges: Bennington Street (No. B-16-71) and Saratoga Street (No. B-16-70).

The southern or airport terminus of the Bypass would be aligned with Lovell Street at Frankfort Street, as the roadway emerges from beneath the Route 1A viaduct. This intersection would be served by a traffic signal (installed by a prior project), and the intersection design would maintain a bicycle / pedestrian path that will link the East Boston Greenway with Bennington Street. The northern terminus will form two closely spaced intersections with Chelsea Street that will function as a one way pair; the northern intersection would be unsignalized.

To evaluate the potential effects of shifting a portion of the existing commercial traffic to a new corridor, air quality and noise analyses were conducted and are presented in sections 5.2 and 5.3 respectively. The studies indicate that the improved traffic flows will reduce vehicle emissions. In addition, the project will not have an adverse noise impact on the few residences adjacent to the new alignment.

As discussed in Section 5.5, a majority of the project alignment is located within the 100 year Flood Hazard Zone of the Chelsea River. The proposed roadway improvements will result in some filling within the 100-year flood zone. No adverse impacts are anticipated. A comprehensive stormwater management system will be constructed as part of the project. The system will be designed to handle the 10-year storm and incorporates a series of water quality measures to improve the quality of stormwater discharged from the site. There will be no discharge of stormwater to the Chelsea River. Section 5.6 provides details of the proposed stormwater management system.

2. Existing Conditions and Site Context

The project site consists of an abandoned rail corridor recently acquired by MassDOT. The project area runs north to south and the majority of it is in a depressed cut between Frankfort Street at Logan Airport and Chelsea Street near the new Chelsea Street Bridge. The 2,225-foot long right-of-way has an average width of 32-feet; the overall site totals approximately 4.4 acres. The northern end of the project area is primarily industrial and abuts a fuel/oil storage facility to the west and an elevated roadway (Route 1A) to the east. The southern end runs under the Saratoga Street and Bennington Street bridges, and runs along a few commercial and residential properties.

The current conditions of the right-of-way are consistent with an abandoned urban rail right-of-way. It has not been maintained and there is vegetative overgrowth, litter, graffiti on the

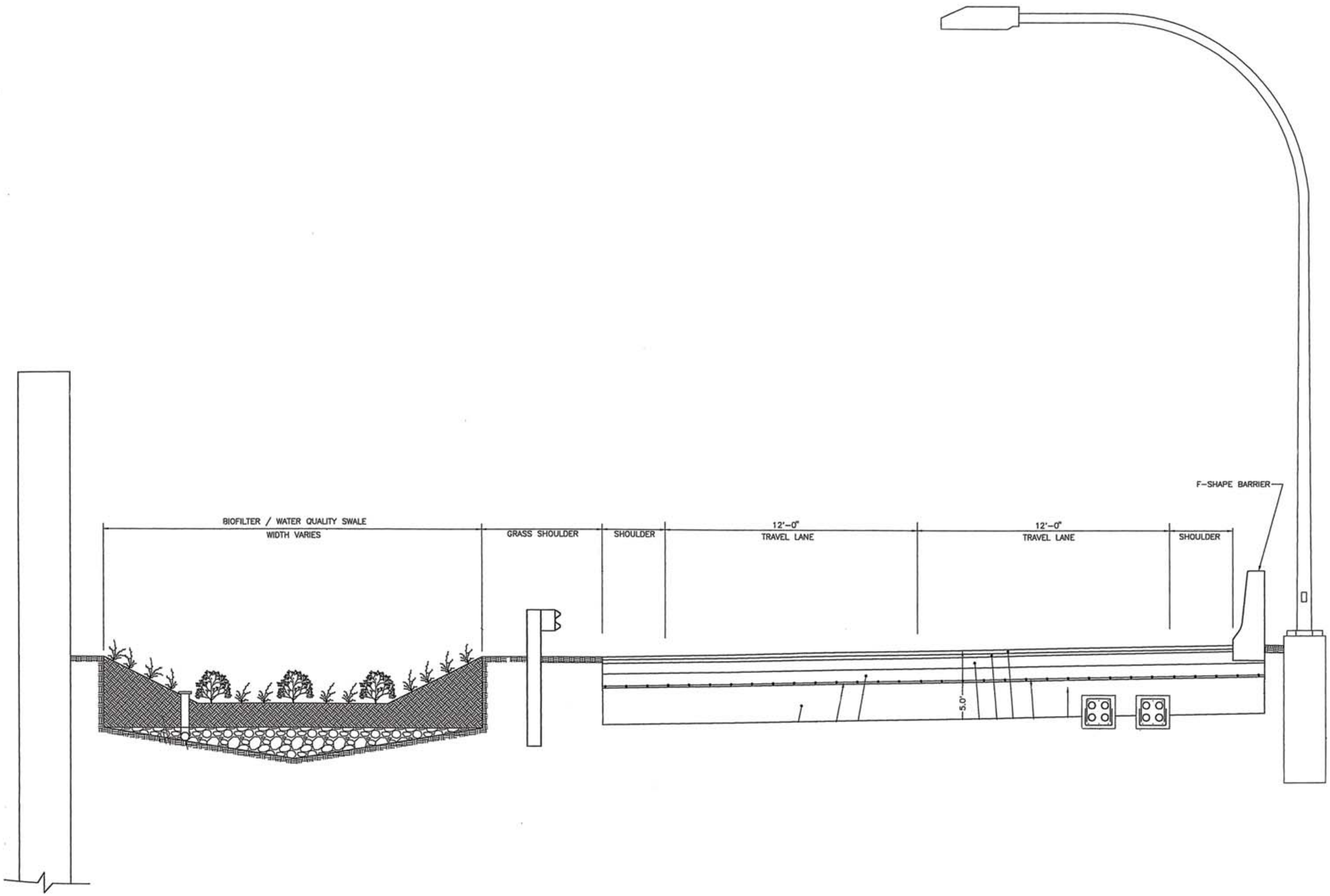

FIGURE 4 - TYPICAL BYPASS CROSS-SECTION

MPA Project No. L-932

East Boston / Chelsea Bypass Road

bridge abutments and concrete retaining walls, and areas of significant standing water, indicating poor drainage. Figure 5 shows photographs of existing conditions.

An eight-inch jet fuel line installed in the early 1970's runs under the right-of-way between the tank farm and Logan Airport.

MassDOT will transfer ownership of the Bypass right-of-way to Massport. Most of the site is currently owned or controlled by MassDOT as a result of the taking of CSX right-of-way. The remainder of the site is expected to be taken by MassDOT and then transferred to Massport before construction is scheduled to begin in 2011.

3. Consistency with Prior Planning

The proposed project is consistent with federal, state, regional and local plans and policies.

The *East Boston Master Plan* was completed in 2000, and includes the proposed project as a recommendation for providing a more direct connection between Logan Airport and the Chelsea Street Bridge. The East Boston-Chelsea Bypass (also referred to as the "bypass road" and "Connector Road" in the East Boston Master Plan) would help alleviate traffic congestion on local roads and improve traffic flow between Logan Airport and Chelsea. Relieving congestion in Day Square and the Neptune Road corridor will improve local roadway access and pedestrian safety.

The proposed Bypass is recommended in *Journey to 2030: The Regional Transportation Plan* prepared by the Boston Metropolitan Planning Organization (adopted October 2009). (Please note that the project is commonly referred to in MPO documents as the East Boston Haul Road.)

The project will maintain the link between the East Boston Greenway and Bennington Street – a designated City of Boston bicycle route. The project is being coordinated with Massport's Airport Edge Buffer program as well as City of Boston projects in the vicinity.

Finally, the project is consistent with regional transit planning. The Bypass will be designed so that the MBTA can operate 60-foot articulated buses.

View of Bridge Looking South
Bennington Street/Neptune Road

View of Saratoga Street
Bridge Looking South

View Looking South
Towards Saratoga Street

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FIGURE 5 - EXISTING CONDITIONS

MPA Project No. L-932
East Boston / Chelsea Bypass Road

4. Alignment Alternatives

In developing the proposed project, Massport carefully evaluated two alignments each with a different northern terminus: one based on past conceptual plans, which would terminate north of Curtis Street; and the proposed alignment, which would terminate south of Curtis Street. For the purpose of this environmental review, we compare the proposed project to a no-build alternative scenario.

The following summarizes the alternatives considered:

I. No-Build Alternative

This alternative would not change the existing physical infrastructure in the study area, with the exception of infrastructure projects that are proposed for completion independent of this project (e.g., reconstruction of the Chelsea Street Bridge, reconstruction of the Frankfort Street and Lovell Street intersection). Truck, bus and commercial traffic would continue to use congested neighborhood streets. The rail right-of-way would stay in a state of disrepair. The No-Build Alternative would not produce any benefits of the project including reduced roadway congestion, enhanced pedestrian and bike safety and reduced emissions.

II. Spur Alignment *(Proposed Project)*

As described earlier, the Spur Alignment is the proposed alignment for the Bypass. The Spur Alignment can be constructed more quickly and at a lower cost than the Northerly Alignment, thus the benefits will be realized sooner and at a lower cost. The Spur Alignment is the alternative that Massport can advance most quickly and efficiently.

The Spur Alignment proposes a two-lane roadway connecting Frankfort Street (in the vicinity of Lovell Street) in the south to Chelsea Street (south of Curtis Street) in the north. The northern part of the roadway will be split into a one way pair with the southbound lane intersecting Chelsea Street at Beck Street and the northbound lane intersecting Chelsea Street using a rail spur slightly north of Beck Street. Figure 3 shows a preliminary design drawing for the spur alignment.

III. Northerly Alignment (under Curtis Street) Alternative

This alternative was an initial concept developed several years ago and considered a two-lane roadway in the existing railroad corridor, connecting Frankfort Street (in the vicinity of Lovell Street) in the south to Chelsea Street (between Curtis Street and the Chelsea Street Bridge) in the north. Figure 6 shows a proposed conceptual design of the Northerly Alignment alternative. The Northerly Alignment is the same as the Spur Alignment in the southern end. At the northern end, this alternative would not use the Beck Street spur, but instead continue under Curtis Street and intersect Chelsea Street at a point just south of the Chelsea Street Bridge. This alternative would require a new signalized intersection at the Bypass and Chelsea Street.

This alternative would also require land takings from two additional commercial properties along the railway corridor. Finally, the Northerly Alignment appears to have a potential to cause traffic back-ups on the Chelsea Street Bridge which can be avoided with the Spur Alignment.

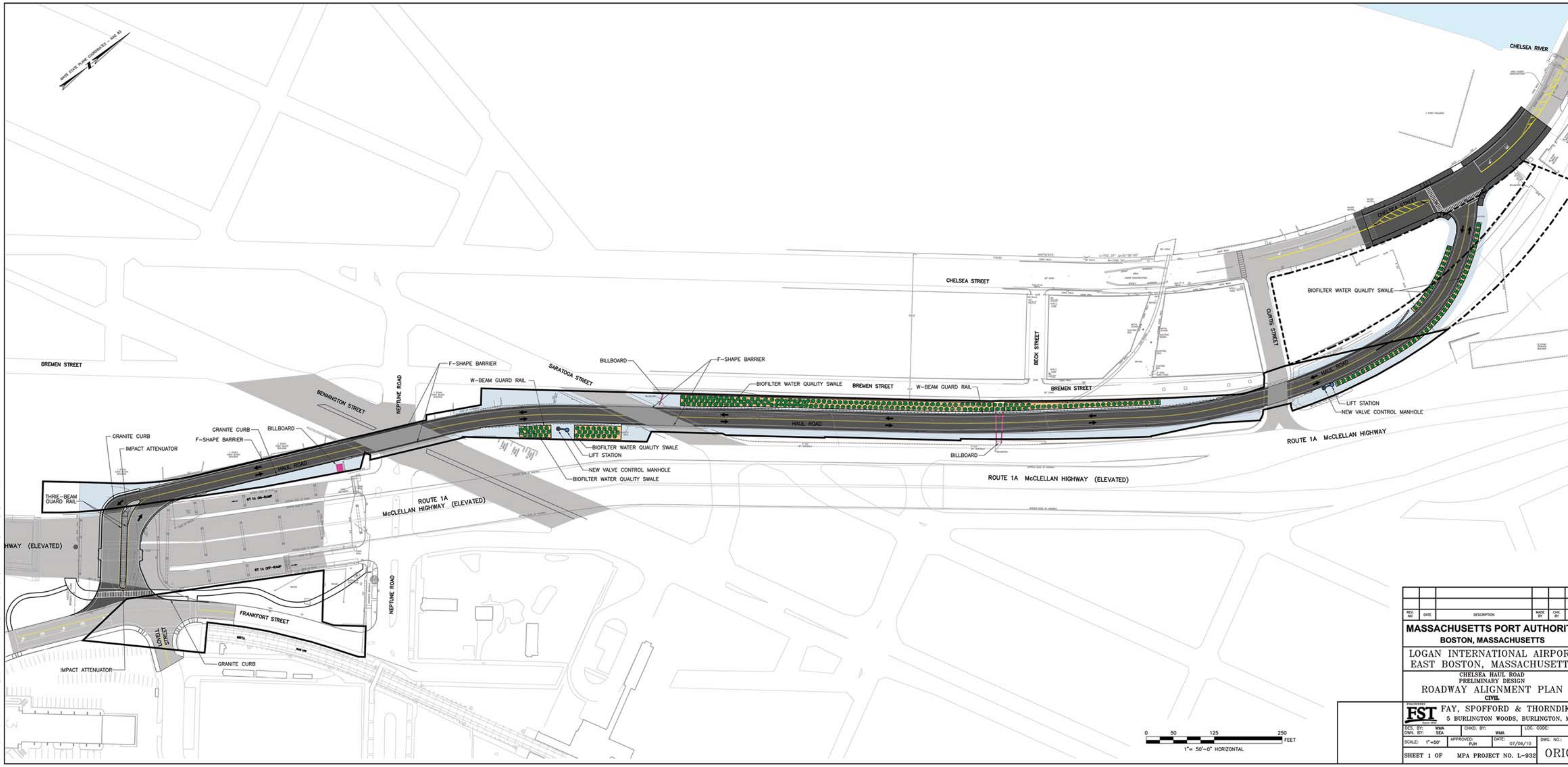

FIGURE 6 - NORTHERLY ALIGNMENT

MPA Project No. L-932

East Boston / Chelsea Bypass Road

5. Assessment of Impacts and Potential Beneficial Measures

5.1. Transportation and Traffic Forecasts

Construction of the East Boston-Chelsea Bypass will improve traffic conditions in the East Boston residential neighborhood and remove commercial and truck traffic from local streets. Several traffic analyses were developed to evaluate and confirm the benefits of the Bypass.

The Boston MPO's Central Transportation Planning Staff (CTPS) used the MPO regional travel demand model to analyze the Bypass Road and its effects on nearby traffic. The methodology used in the CTPS model is provided in Appendix C. Table 1 below is a summary of the CTPS traffic analysis and it shows significant reductions in truck traffic on streets close to the Bypass road. Specifically:

- The Bypass will produce its most notable reductions in traffic on Chelsea Street (between Neptune Rd. and Curtis St.) and on Neptune Rd. (between Chelsea/Bremen and Vienna/Route 1A).

- The Bypass will reduce bus and truck traffic on Chelsea Street by an average of 45% and overall traffic on Chelsea Street by over 4% compared to the no-build condition.

- The Bypass will reduce bus and truck traffic on Neptune Road by an average of 64% and overall traffic on Neptune Road by 13% compared to the no-build condition.

- Between 2007 (the base model year) and 2020, traffic in the Day Square area is expected to grow on average by almost 8%. If the Bypass is built, this growth will be limited to 6.3%. Thus, for the Day Square area, traffic overall will be reduced by about 1.6% by the construction of the Bypass, including a nearly 12% overall reduction of truck and bus traffic.

Intersection level of service (LOS) analyses were performed on the southern and northern termini of the Bypass road and nearby intersections. Based on the Highway Capacity Manual and engineering practices level of service refers to the delay time experienced by vehicles at an intersection. LOS A is the shortest delay time and LOS F is the longest delay time.

The northern intersection of the Bypass Road with Chelsea Street will operate at LOS B in the morning peak hour and LOS C in the evening peak hour. The intersection of Curtis Street and Chelsea Street, just north of the Bypass, will operate at LOS C in the morning peak hour and continue to operate at LOS F in the evening peak hour. The analysis demonstrates that the Bypass will not affect the LOS at this intersection; the intersection would continue to operate at the same LOS even if the Bypass was not built.

The southern intersection of the Bypass with Frankfort Street will operate at LOS C in both morning and evening peak periods. The Route 1A northbound off-ramp and

Comparison of Average Daily Traffic Volume Changes in Day Square Area

East Boston-Chelsea Bypass: Build vs. No-Build

Street	Location	Direction	2007 Base Year Daily Traffic	2020 No-Build Daily Traffic	2020 Build Daily Traffic	2020 Build vs. No-Build: Change in Traffic	2020 Build vs. No-Build: Change in Bus & Truck Traffic	2020 Build vs. No-Build: Change in Automobile Traffic
Roadway Links with the Most Significant Changes								
Chelsea St	Between Eagle St and Curtis St	NB	8,303	9,236	8,600	-6.9%	-61.4%	0.0%
Chelsea St	Between Curtis St and Eagle St	SB	5,123	5,536	5,240	-5.3%	-60.9%	0.0%
Chelsea St	Between Neptune Rd and Eagle St	NB	8,970	9,790	9,280	-5.2%	-48.6%	-1.7%
Chelsea St	Between Eagle St and Neptune Rd	SB	7,860	8,570	8,550	-0.2%	-7.4%	0.0%
Average Change in Traffic on Chelsea Street						*-4.4%*	*-44.6%*	*-0.4%*
Neptune Rd	Between Bennington St and Vienna St	EB	1,543	1,596	1,300	-18.5%	-69.5%	0.0%
Neptune Rd	Between Vienna St and Bennington St	WB	6,303	6,986	6,350	-9.1%	-61.4%	0.0%
Neptune Rd	Between Bremen St and Bennington St	EB	2,263	2,366	2,070	-12.5%	-67.9%	0.0%
Neptune Rd	Between Bennington St and Bremen St	WB	5,183	5,666	4,910	-13.3%	-56.3%	-6.7%
Average Change in Traffic on Neptune Road						*-13.4%*	*-63.8%*	*-1.7%*
Roadway Links with Modest Changes								
Bennington St	Between Vienna St and Neptune Rd	SB	12,410	13,770	13,740	-0.2%	-7.3%	0.0%
Frontage Road	Between Curtis St and Swift St	SB	6,780	7,050	7,020	-0.4%	-7.5%	0.0%
Swift Street	Between Saratoga St and Bennington	EB	2,680	2,850	2,820	-1.1%	-17.6%	0.0%
Remaining Roadway Links will not be Impacted by the Build Scenario								
Average Growth Over Base Year (All Day Square Area Roadways)			**n/a**	**7.9%**	**6.3%**	-1.5%	-11.6%	

Notes: 1. Traffic corresponds to Average Weekday Daily Traffic (AWDT)
2. Build alternative refers to a limited-access (truck, bus, commercial vehicles) Bypass Road terminus at Chelsea Street at Beck Street.

Source: Central Transportation Planning Staff

massport

TABLE 1 - Traffic Modeling

MPA Project No. L-932

East Boston / Chelsea Bypass Road

Frankfort Street will operate at LOS A in the morning peak period and LOS C in the evening peak period. Table 2 below shows a summary of the LOS analysis and more complete analysis showing traffic volumes is provided in Appendix C.

Table 2: Intersection Peak-Period LOS Analysis for Bypass Preferred Build Scenario*

Intersection	AM Peak LOS	PM Peak LOS
Bypass and Chelsea Street (unsignalized)	B	C
Curtis Street and Chelsea Street (unsignalized)**	C	F
Bypass and Frankfort Street	C	C
Rt. 1A NB Off-ramp and Frankfort Street**	A	C

**LOS year for the first two intersections is 2020; for the second two intersections it is 2013*
*** Existing intersection*

5.2. Air Quality

In support of the ENF preparation, Massport retained Harris Miller Miller & Hanson Inc. (HMMH) to conduct an air quality analysis of the proposed East Boston-Chelsea Bypass. The study consisted of a mesoscale (e.g. qualitative comparison of build to no-build) and microscale (e.g. quantitative) analysis of mobile source emissions in the project area based on the Central Transportation Planning Staff (CTPS) traffic study and FST's *Draft Traffic Analysis Report* (both documents are included in Appendix C). The mesoscale analysis was performed to assess the change in total volatile organic compounds (VOCs) and nitrogen oxides (NO_x) in pounds per day (lbs/day) associated with motor vehicle emissions for the proposed project alignment compared to the No-build condition for the year 2020. Motor vehicle emissions were estimated using the EPA-approved MOBILE6.2 emission model. Since the project is introducing a new roadway to the area, a microscale analysis was performed to evaluate the project's air quality impact at nearby residences along the new Bypass roadway for comparison to the National Ambient Air Quality Standards (NAAQS). The EPA-approved CAL3QHC dispersion model along with MOBILE6.2 generated emission rates were used to estimate concentrations of carbon monoxide (CO), nitrogen dioxides (NO_x) and particulate matter (PM_{10} and $PM_{2.5}$) from motor vehicles at residential locations at Bennington Street and Neptune Road.

The mesoscale and microscale analyses were performed using standard methodologies approved by the Environmental Protection Agency (EPA) and Massachusetts Department of Environmental Protection (MassDEP) for determining mobile emission rates and ambient concentrations of pollutants from mobile sources.

The mesoscale analysis shows a slight decrease in daily VOC and NO_x emissions of 0.08 and 0.09 pounds per day, respectively, compared to the No-build condition for all the roadway segments studied. The mesoscale analysis was further refined to evaluate only the roadway segments affected by the proposed Bypass roadway. The refined mesoscale analysis shows that by lowering traffic volumes (e.g. automobiles, trucks, buses) at most of the local roadways compared to the No-build condition, the proposed Bypass yields a net benefit (e.g. reduction) in emissions of NO_x and VOC at these roadways. Table 3 summarizes the results of the mesoscale analysis. The complete air quality analysis is included in Appendix A.

Table 3 Mesoscale Analysis Summary for Proposed Project Compared to the No-build

Pollutant	Time	Units	Proposed Project	No-Build (NB)	Change in Emissions (PP –NB)	Percent Difference (PP-NB)
VOC	Daily	Pounds/day	15.24	15.32	-0.08	-0.52%
NO_x	Daily	Pounds/day	15.01	15.10	-0.09	-0.59%

The results of the microscale analysis show the CAL3QHC modeled concentrations added to the MassDEP monitored background concentrations are below the NAAQS for all four pollutants and averaging periods at all modeled receptor locations. Complete details of the microscale analysis are presented in Appendix A.

Table 4 CAL3QHC Modeled Concentrations Plus Monitored Background Compared to the NAAQS

Pollutant	Averaging Period	CAL3QHC Intersection Modeled Concentration (ug/m^3)	CAL3QHC Bypass Road Concentration (ug/m^3)	DEP Monitored Background Level ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	National Ambient Air Quality Standard ($\mu g/m^3$)
NO_x	Annual	0.1	0.3	41	41.40	100
	1-Hour	10	3.03	133	146.03	188
CO	1-Hour	0.5	0.001	1,832	1832.50	40,000
	8-Hour	0.35	0.0007	1,145	1145.35	10,000
PM_{10}	24-Hour	0.004	0.03	39	39.03	150
	Annual	0.001	0.007	23	23.01	50
$PM_{2.5}$	24-Hour	0.004	0.03	28	28.03	35
	Annual	0.001	0.007	11	11.31	15

5.3. Noise

Harris Miller Miller & Hanson Inc. (HMMH) was retained by Massport to conduct a noise evaluation of the proposed East Boston-Chelsea Bypass. Since the project is exclusively a new roadway, HMMH used standard Federal Highway Administration (FHWA) and Massachusetts Department of Transportation (MassDOT) noise impact analysis procedures. These noise regulations and guidelines are somewhat different from those of the Federal Aviation Administration and the Massachusetts Department of Environmental Protection, which would be used for projects other than roadway improvements.

An inspection of the study corridor by HMMH revealed that the only area where the proposed Bypass has the potential to affect noise-sensitive properties (residential, schools, recreation areas) is where the Project corridor crosses Bennington and Saratoga Streets, near some single- and multi-family homes.

A noise measurement program was conducted by HMMH to determine existing noise levels in the area, and to conduct some traffic classification counts to supplement the traffic analysis. Noise levels measured at three locations currently exceed the FHWA's Noise Abatement Criteria, due to the existing high volume of traffic on the local streets. The FHWA's Traffic Noise Model (TNM) was employed to compute the loudest-hour noise conditions for Existing (2007) conditions and the future 2020 Build conditions with the proposed Bypass, using existing and forecast traffic data provided by Massport (from the Central Transportation Planning Staff (CTPS) traffic analysis). The noise model was validated using traffic counted during the noise measurement program.

Noise levels at most of the nearest residential homes are computed to increase only very slightly, by less than one-half decibel, from the Existing to the 2020 Build case. These increases are due to the expected small growth in traffic volumes over the 13-year period (approx. 6 to 12%), and not due to the proposed Bypass. For the two 2-family homes along Bennington Street with back yards directly adjacent to the Bypass corridor, noise level increases are projected to be up to one decibel from the Existing to Build cases. One decibel or smaller increases in the level of a sound are generally thought to be not perceptible to people except under laboratory conditions.

The existing and future noise levels in one of the two residential back yards adjacent to the Bypass are below the FHWA noise impact criterion of 66 dBA. However, in the other residential yard at 394 Bennington St., the existing loudest-hour L_{eq} noise level is computed at 67 dBA under Existing 2007 conditions. The projected noise level would increase by one decibel to 68 dBA under future Build conditions with the Bypass. This yard represents the only property in the study area affected by noise. A noise barrier along the Bypass would not eliminate the noise impact because the other sources of noise are on the other side of the house and would not be blocked by such a barrier. Because a noise barrier noise abatement is not feasible, it will not be considered further in this project. Additionally, these properties have recently been sound insulated by Massport.

Table 5 Computed Existing and Future Build Noise Levels

Site No.	Address	DUs	Computed PM Peak period Leq (dBA)*			
				Future Build 2020		
			Existing 2007	Existing roads only	Bypass road only	All Roads
M-1	398 Bennington St. MF 2nd Row	2	**70.7**	**70.9**	49.2	**70.9**
M-2	546 Saratoga St. SF 1st Row	1	**66.1**	**66.3**	53.2	**66.5**
M-3	511 Saratoga St. CO 1st Row	0	63.3	63.8	47.0	63.9
P-01F	394 Bennington St. MF 2nd Row	0	**71.7**	**72.0**	50.5	**72.0**
P-01B	394 Bennington St. MF 1st Row	2	**67.0**	**67.3**	60.3	**68.1**
P-02B	398 Bennington St. MF 1st Row	2	64.5	64.8	54.2	65.2
P-03	544 Saratoga St. MF 1st Row	4	**66.2**	**66.6**	50.6	**66.7**
P-04	542 Saratoga St. MF 1st Row	3	**66.2**	**66.5**	48.8	**66.6**
P-05	540 Saratoga St. MF 1st Row	3	**66.1**	**66.4**	47.7	**66.5**
P-06	538 Saratoga St. MF 1st Row	2	**66.0**	**66.4**	46.5	**66.4**
P-07	534 Saratoga St. MF 1st Row	3	**65.5**	**65.8**	45.3	**65.8**
P-08	526 Saratoga St. MF 2nd Row	3	65.3	**65.6**	44.8	**65.6**
P-09	524 Saratoga St. MF 2nd Row	3	**65.6**	**65.8**	45.7	**65.8**
P-10	522 Saratoga St. MF 2nd Row	3	65.4	**65.6**	45.6	**65.6**
P-11	520 Saratoga St. MF 3rd Row	3	**65.6**	**65.8**	44.3	**65.8**
P-12	518 Saratoga St. MF 3rd Row	3	65.4	65.4	43.6	65.4
P-13	516 Saratoga St. MF 3rd Row	3	**65.5**	**65.6**	43.6	**65.6**
P-14	512 Saratoga St. MF 3rd Row	3	**65.5**	**65.6**	44.2	**65.6**

Note: Sound levels shown in **bold** font reflect noise impact – levels that approach or exceed the FHWA NAC

Appendix B presents the complete Noise Technical Report.

5.4. Soils Management

No site-specific information has been obtained to date regarding site environmental conditions related to presence of oil and hazardous materials. Based on the site location and historic use of the corridor as a railroad right-of-way, it is anticipated that the excavated soils may contain levels of contaminants commonly found with such use, such as creosote, petroleum, and polyaromatic hydrocarbons. Specific testing of soil and groundwater will be conducted prior to construction to evaluate the conditions and requirements for special handling or transport of excavated materials from the site.

Similar conditions were found along the portion of the right-of-way that passes through the nearby Bremen Street Park. That site was successfully remediated and now serves as public open space, including community gardens.

Any contaminated materials will be handled in accordance with the Massachusetts Contingency Plan and the Massport Soils Management Policy.

5.5. Wetland/Wildlife Resources

The alignment of the proposed East Boston-Chelsea Bypass follows an abandoned railroad right of way. The area is highly disturbed and many sections are covered with debris. Portions of the timber retaining walls are failing. There are no vegetated wetlands within the alignment; however a majority of the corridor within the project area is within the 100-year flood zone of the Chelsea River. Figure 7 shows the Federal Emergency Management Administration (FEMA) Flood Insurance Rate Map (FIRM). In accordance with 310 CMR 10.47, areas within the 100-year flood plain are defined as land subject to coastal storm flowage. Approximately 7,740 cubic yards of material will be placed within land subject to coastal storm flowage to create connections from the depressed corridor to Chelsea Street. Since this area is tidally influenced, no compensatory storage is required.

The project corridor does not include any areas within the ten year floodplain or within 100 feet of the banks of the Chelsea River or any bordering vegetated wetland or vernal pool. Furthermore, the project area has been extensively altered by the former rail activity, tracks and ballast and more recent abandonment such that any former wildlife habitat functions have been effectively eliminated. As such, the project corridor is not considered significant to the protection of wildlife habitat.

The MA Natural Heritage and Endangered Species Program (NHESP) has reviewed the project and confirmed that the project does not occur within Estimated Habitat of Rare Wildlife or Priority Habitat as indicated in the Massachusetts Natural Heritage Atlas (13th Edition). Therefore, the project is not required to be reviewed for compliance with the rare wildlife species section of the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.37, 10.59 & 10.58(4)(b)) or the MA Endangered Species Act Regulations (321 CMR 10.18). A copy of the NHESP correspondence is included as Appendix D.

Portions of the former rail corridor are highly compacted and any former drainage structures appear inoperative such that the low points of the corridor currently support standing water. The design for the new stormwater drainage systems incorporates a series of biofilter water quality swales that will improve runoff water quality and enhance recharge potential along the new roadway. There will be no stormwater discharge to the Chelsea River. A conceptual plan of the proposed stormwater management system is included as Figures 8a and 8b. Stormwater will be pumped back to the stormwater lift station the Central Artery Tunnel constructed adjacent to the Airport MBTA Station for discharge through the oil/water separator at West Outfall at Logan Airport.

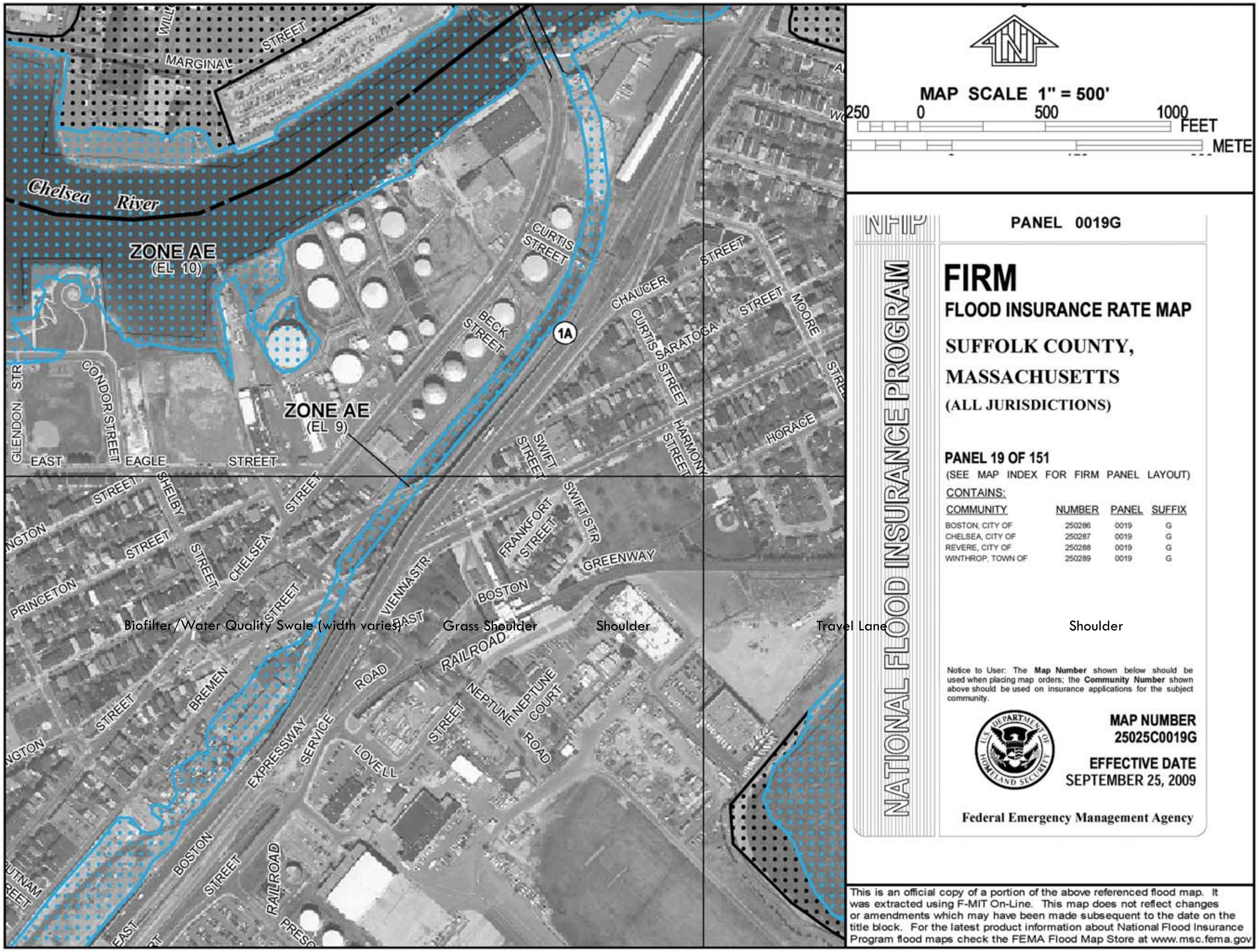

FIGURE 7 - FEMA FLOOD INSURANCE MAP

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East Boston / Chelsea Bypass Road

5.6. Stormwater Management

Under the state stormwater management regulations at 314 CMR 9.00, the East Boston-Chelsea Bypass qualifies as a Redevelopment Project. As such, it is required to meet the following standards to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice (BMP) requirements of Standards 4, 5, and 6. Standard 2: Peak Rate Attenuation is not applicable due to the project site is located in land subject to coastal storm flowage and stormwater discharge is to a coastal flooding resource area (Boston Harbor). The project must and will meet Standards 1, 8, 9, and 10 in full. The above standards address both water quality (pollutants) and water quantity (flooding, low base flow and recharge).

A preliminary layout of the proposed stormwater management system within the project area is illustrated on the attached Preliminary Design Plans (Figures 8A and 8B). The storm drainage system facilities are designed for the 10-yr storm event. As summarized below, the storm management system will meet the MassDEP Stormwater Standards to the maximum extent practicable.

In general, stormwater runoff along the right-of-way will flow via gravity to a new pump station located at the roadway low point. The new pump station will discharge stormwater via force main to an existing drainage manhole located off-site in the vicinity of the Frankfort Street/Route 1A Northbound (NB) Ramp intersection which in turn flows to the existing I-90/Route 1A Interchange Pump Station which discharges to Boston Harbor via the existing oil/water separator and bar screen at Logan Airport's West Outfall. No stormwater conveyances will discharge to the Chelsea River.

The proposed stormwater management facilities comprise an open and closed drainage system with specific Low Impact Development (LID) measures and Best Management Practices (BMPs) for controlling the stormwater discharges. LID/BMP's measures include minimizing soil and vegetation disturbance, use of "country drainage" versus curb at selected locations, grass channels, biofilter swales, deep sump/hooded catch basins, underground storage chambers, a construction period pollution prevention/soil erosion and sediment control plan, operations and maintenance plan, and a "No Illicit Discharge Compliance Statement", etc.

Implementing these measures will result in the removal of greater than 80 percent of the Total Suspended Solids (TSS) from the stormwater runoff and also provide the required water quality treatment volume associated with ½ inch of runoff from the project impervious surfaces. Additional water quality and quantity measures such as underground storage chambers, riprap aprons, and level spreaders will be implemented to protect the existing surface water bodies and improve existing conditions.

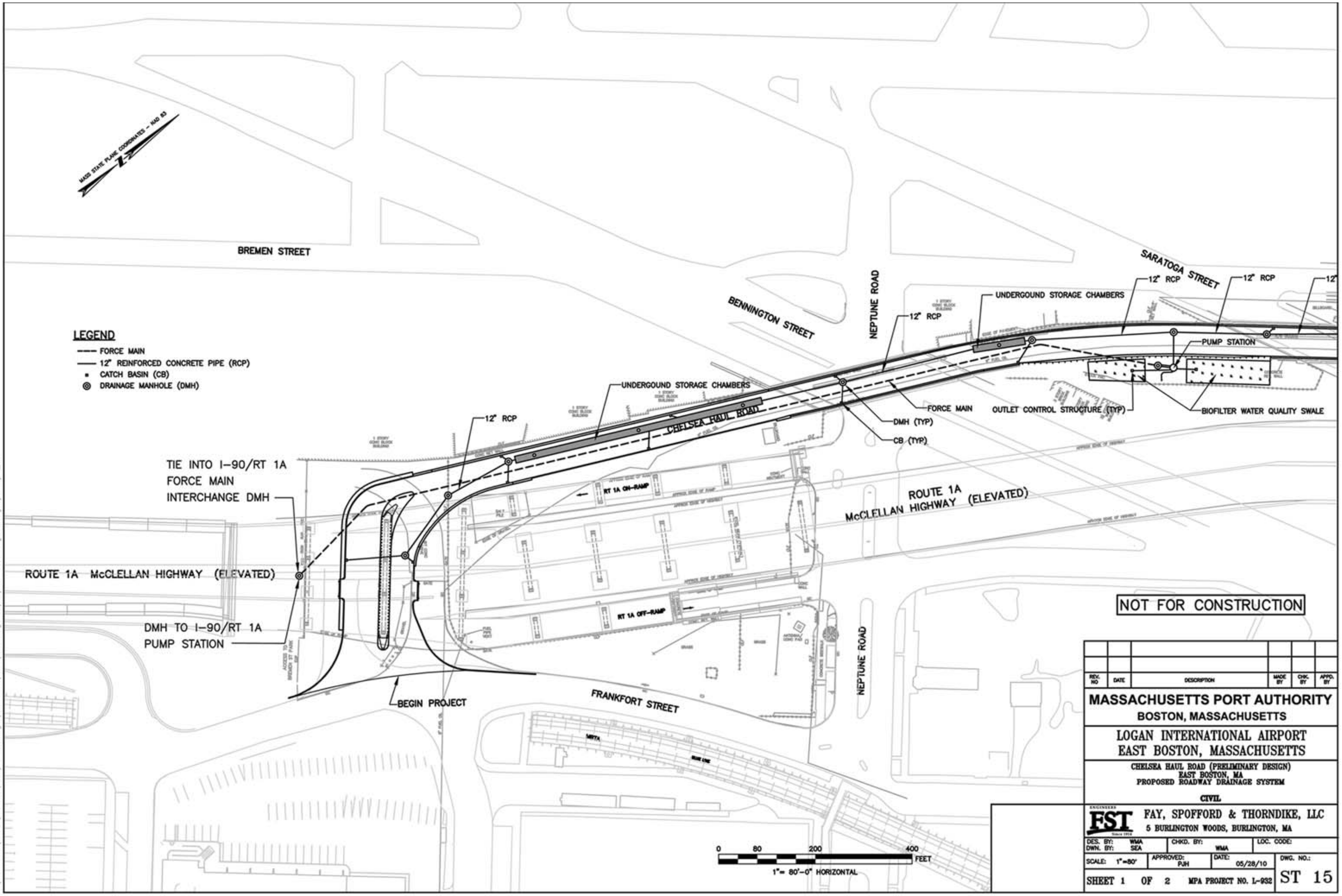

FIGURE 8A - DRAINAGE PLAN FOR SPUR ALIGNMENT 1

MPA Project No. L-932
East Boston / Chelsea Bypass Road

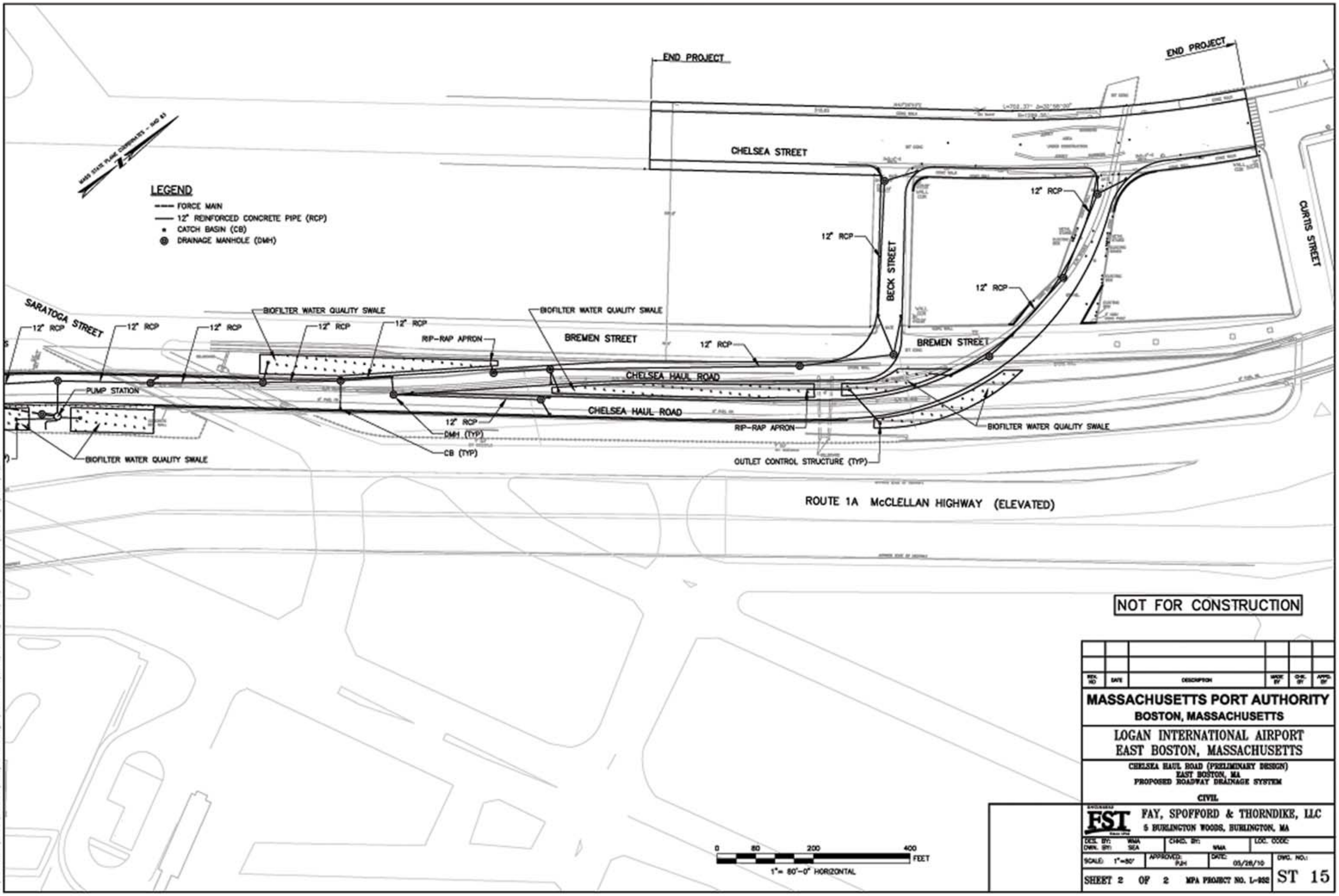

FIGURE 8B - DRAINAGE PLAN FOR SPUR ALIGNMENT 2

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East Boston / Chelsea Bypass Road

The Stormwater Management Standards

1. *No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.*
   This standard is applicable to the project and will be met.

2. *Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.*
   Not Applicable; the project is in an area subject to coastal storm flowage.

3. *Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.*
   The project incorporates bioswales designed to enhance infiltration in excess of existing conditions.

4. *Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when:*

   a. *Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;*
   b. *Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and*
   c. *Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.*
   The proposed bioswales will meet these requirements.

5. *For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as*

provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.
The proposed bioswales will meet this requirement

6. *Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.*
   Not Applicable; the project is not within the Zone II or Interim Wellhead Protection Area of a public water supply, and there are no new stormwater discharges near or to any other critical area,

7. *A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.*
   This standard is applicable to the project and will be met.

8. *A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.*
   A construction phase stormwater management plan will be developed and implemented.

9. A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.
   An operations phase stormwater management plan will be developed and implemented.

10. All illicit discharges to the stormwater management system are prohibited. **The project does not include any illicit discharges to the stormwater management system.**

5.7. Street Lighting

New street lighting will be installed along the proposed Bypass. Energy efficient overhead LED lighting will be installed along the alignment. Lighting will be designed to minimize disturbance outside of the right-of-way, particularly adjacent to residential areas. The few residences directly adjacent to the right-of-way are elevated well above the proposed road surface.

5.8. Landscape

The narrow, depressed corridor provides very limited opportunities for landscaping. Where space permits, vegetated bioswales will be installed as a water quality measure. Other areas outside the paved road surface are expected to be grassed or covered with other pervious surfacing materials.

5.9. Construction Impacts/Solid Waste Management

Construction activities on the site will include activities such as excavation, installation of underground utilities, site grading, paving, retaining wall construction, and landscaping. Construction impacts will be temporary. Construction activities will occur during daylight hours when other community noise sources contribute to higher ambient noise levels. Appropriate noise control measures will be included consistent with the City of Boston Municipal Code including, for example, electric power rather than diesel generators, and well-maintained mufflers for construction equipment. Construction vehicles will be required to use designated routes to access the site.

Comprehensive soil erosion and sediment control plans will be implemented at the outset of construction and maintained throughout the construction phase in accordance with the NPDES construction general permit Stormwater Pollution Prevention Plan (SWPPP). Contaminated soils identified during construction will be handled in accordance with the Massachusetts Contingency Plan (MCP) and Massport Soil Handling and Disposal Guidelines.

Massport will manage solid waste in accordance with all rules and regulations and will employ its Sustainable Design Standards and Guidelines to salvage and reuse any demolition materials encountered or generated as a result of construction.

Some minor traffic disruption may occur at each end of the roadway during construction. Massport will strive to minimize the time that this occurs.

5.10. Protection of Existing Jet Fuel Line

To accommodate the Bypass, the roadway alignment will require construction of new retaining walls and fill will be required for the connection to Beck Street and the spur; consequently, approximately 750 feet of the jet fuel line will need to be relocated.

The existing jet fuel line including its cathodic protection components located within the proposed Bypass Road alignment will be protected from damage during the roadway construction. Precautions to guard against any movement or settlement of the fuel line will be provided during proposed utilities work near the existing fuel line facility.

The Authority is holding discussions with the owners of the fuel line regarding opportunities to replace the line for the full length of the proposed Bypass during project construction. This replacement would avoid excavation for repairs or replacement at a future date.

6. Permitting

Construction of the East Boston-Chelsea Bypass road is expected to require the following environmental permits and/or approvals:

Local Permits
Boston Conservation Commission Order of Conditions: Since work is proposed within the 100-year flood zone (Land Subject to Coastal Storm Flowage) for Chelsea River, a Notice of Intent (NOI) will be submitted to the Boston Conservation Commission.

Boston Water and Sewer Commission Sewer Permit. New hydrants for fire protection will require a permit from the Boston Water and Sewer Commission.

State Permits
Massachusetts Environmental Policy Act (MEPA): An Environmental Notification Form (ENF) is required because the project involves construction of a new roadway of at least ¼ mile. The project does not meet any MEPA thresholds requiring preparation of an Environmental Impact Report.

*401 Water Quality Certification (WQC)**:*** The project is not expected to require an individual WQC. Any related issues are expected to be handled through the Boston Conservation Commission Order of Conditions.

Federal Permits
National Environmental Policy Act (NEPA): NEPA review is only required when a federal action is involved in the project. It is anticipated that the East Boston-Chelsea Bypass will ultimately be included on Logan's Airport Layout Plan (ALP). Modification of the ALP requires review and approval by the Federal Aviation Administration (FAA). That FAA action is subject to review under NEPA. Categorical Exclusion (CE) documentation would be filed for consideration by the FAA after MEPA review is completed.

Federal Aviation Administration (FAA) Notice of Construction: Prior to construction, an FAA Notice of Construction Form 7460 will be submitted to the regional FAA Office. FAA will determine whether the project may cause temporary or permanent impacts to airspace, and will provide recommendations for any markings and beacons.

USEPA National Pollutant Discharge Elimination System (NPDES) General Permit for Construction-Related Stormwater Discharge: Required for construction disturbing one or more acres of land.

7. Community Outreach

Massport's Office of Government and Community Affairs (OGCA) regularly informs interested parties about projects being developed by the Authority. In addition, Massport personnel provide frequent project updates to elected representatives from East Boston (including the City Councilor, State Representative, and State Senator). In addition, a public meeting and site walk will be held as part of this ENF process.

8. ENF Distribution

This Environmental Notification Form has been distributed to Federal, state, and city agencies and to parties listed in this Chapter (see Table 3). 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; and interested individuals and community groups.

Printed copies of the ENF may be requested from **Paul Christner, Senior Transportation Planner,** Massport, Suite 200 South, Second Floor, Logan Office Center, One Harborside Drive, East Boston, MA 02128, telephone (617) 568-3120, e-mail:pchristner@massport.com.

In addition, printed copies and CD's of this ENF are available for review at the public libraries listed in Table 3, below:

Table 6: ENF Distribution

P = Print copy of the ENF provided
C = CD copy of the ENF provided

Federal Government

U.S. Senators and Representatives			
U.S. Representative Ed Markey Attn: Patrick Lally 188 Concord Street, Suite 102 Framingham, MA 01702	C	U.S. Representative Michael E. Capuano Attn: Danny Ryan 110 First Street Cambridge, MA 02141	C
U.S. Senator John Kerry 218 Russell Senate Office Building Second Floor Washington, DC 20510 Attn: Cheri M. Rolfes	C	U. S. Senator Scott Brown JFK Federal Building 55 New Sudbury Street Boston, MA 02203 Attn: Lydia Goldblatt	C

U.S. Environmental Protection Agency

EPA New England (Region 1) Attention: NPDES Permit Division 1 Congress Street, Suite 1100 Boston, MA 02114	P	Elizabeth Higgins Congram, Regional Administration U.S. EPA, New England Region (Region 1) 1 Congress Street, Suite 1100 Boston, MA 02114	P

Federal Aviation Administration

Richard Doucette Manager Environmental Programs Federal Aviation Administration New England Region 12 New England Executive Park, Box 510 Burlington, MA 01803	P	Ralph Nicosia-Rusin Manager Airport Capacity Program Federal Aviation Administration New England Region 12 New England Executive Park, Box 510 Burlington, MA 01803	P

Federal Highway Administration

Damaris Santiago, Environmental Engineer FHWA Massachusetts Division 55 Broadway, 10th Floor Cambridge, MA 02142	P		

State Government

Massachusetts Senate/House of Representatives

Senate President Therese Murray Massachusetts State House, Room 330 Boston, MA 02133	C	Speaker Robert A. DeLeo Massachusetts State House, Room 356 Boston, MA 02133	C
Senator Steven Baddour Massachusetts State House, Room 513 Boston, MA 02133	C	Representative Joseph C. Wagner Massachusetts State House, Room 134 Boston, MA 02133	C
Senator John A. Hart Massachusetts State House, Room 109C Boston, MA 02133	C	Representative Kathi-Anne Reinstein Massachusetts State House, Room 167 Boston, MA 02133	C
Senator Anthony Petruccelli Massachusetts State House, Room 413B Boston, MA 02133	C	Representative Eugene L. O'Flaherty Massachusetts State House, Room 136 Boston, MA 02133	C
Representative Brian Wallace Massachusetts State House, Room 472 Boston, MA 02133	C	Representative Carlo Basile Massachusetts State House, Room 39 Boston, MA 02133	C

Executive Office of Energy and Environmental Affairs

Secretary Ian A. Bowles (submitted herein) Executive Office of Energy and Environmental Affairs Attn: Alicia McDevitt, Director MEPA Office 100 Cambridge Street, Suite 900 Boston, MA 02114	P	Alicia McDevitt, MEPA Director Executive Office of Energy and Environmental Affairs, MEPA Office 100 Cambridge Street, Suite 900 Boston, MA 02114	P
Executive Office of Energy and Environmental Affairs – Policy Director Undersecretary for Policy 100 Cambridge Street, Suite 900 Boston, MA 02114	P	Executive Office of Energy and Environmental Affairs Department of Energy Resources Attn: John Ballam 100 Cambridge Street, Suite 900 Boston, MA 02114	P

Massachusetts Department of Environmental Protection

Laurie Burt, Commissioner Department of Environmental Protection One Winter Street Boston, MA 02108	C	John D. Viola, Deputy Regional Director Northeast Regional Office Department of Environmental Protection 205B Lowell Street Wilmington, MA 01887	C
Nancy Baker, MEPA Coordinator Northeast Regional Office Department of Environmental Protection 205B Lowell Street Wilmington, MA 01887	C	Rachel Freed, Section Chief Wetlands and Waterways – NERO Department of Environmental Protection 205B Lowell Street Wilmington, MA 01887	C

Jerome Grafe Department of Environmental Protection – BWP One Winter Street, 10th Floor Boston, MA 02108	C	Department of Environmental Protection Attention: Nancy Seidman One Winter Street Boston, MA 02108	C
Iris Davis, Bureau of Waste Site Cleanup Section Chief Permits/Risk Reduction – NERO - DEP 205B Lowell Street Wilmington, MA 01887	C	Christine Kirby, Transportation Programs Department of Environmental Protection One Winter Street, 9th Floor Boston, MA 02108	C
Massachusetts Executive Office of Health and Human Services			
Suzanne K. Condon, Associate Commissioner Executive Office of Health and Human Services 250 Washington Street Boston, MA 02108	C		
Massachusetts Department of Conservation and Recreation			
Rick Sullivan Commissioner Department of Conservation and Recreation 251 Causeway Street, Suite 600 Boston, MA 02114-2104	C	Priscilla E. Geiges, Director Division of State Parks Department of Conservation and Recreation 251 Causeway Street, Suite 600 Boston, MA 02114	C
Massachusetts Department of Fisheries, Wildlife, and Environmental Law Enforcement			
Environmental Reviewer Massachusetts Wildlife & Environmental Law Enforcement Field Headquarters – Route 135 Westborough, MA 01581	C		
Massachusetts Department of Housing and Community Development			
Debra Jean Coordinator, State Clearinghouse Department of Housing and Community Development One Congress Street, Suite 1001 Boston, MA 02114-2023	C		
Massachusetts Coastal Zone Management			
Deerin Babb-Brott, Director Massachusetts Office of Coastal Zone Management 251 Causeway Street, Suite 900 Boston, MA 02114-2119	C		
Massachusetts Department of Transportation (MassDOT)			
Jeffrey Mullan, Secretary MassDOT 10 Park Plaza, Suite 3170 Boston, MA 02116	C	Luisa Paiewonsky, Administrator, Highway Division MassDOT 10 Park Plaza, Room 3510 Boston, MA 02116	C
MassDOT – Public/Private Development Unit Attn: Lionel Lucien 10 Park Plaza Boston, MA 02116	C	Jessica Kenny, MEPA/MEPA Coordinator MassDOT 10 Park Plaza, Room 4260 Boston, MA 02116	C
David Mohler Executive Director (Deputy Secretary for Planning) Massachusetts Department of Transportation Office of Transportation Planning 10 Park Plaza, Room 4150 Boston, MA 02116	C		

Central Transportation Planning Staff

Karl Quackenbush, Deputy Director
Central Transportation Planning Staff
10 Park Plaza, Room 2150
Boston, MA 02116 C

Anne McGahan, Principal Planner
Central Transportation Planning Staff
10 Park Plaza, Suite 2150
Boston, MA 02116 C

MassDOT, Aeronautics Commission

Christopher Willenborg, Administrator
MassDOT, Aeronautics Division
Logan Office Center
One Harborside Drive
East Boston, MA 02128 C

Massachusetts Bay Transportation Authority

Andrew P. Brennan
Manager of Environmental Affairs
Mass. Bay Transportation Authority (MBTA)
10 Park Plaza, Room 3910
Boston, MA 02116 C

Joe Cosgrove
Director of Planning
Mass. Bay Transportation Authority (MBTA)
10 Park Plaza
Boston, MA 02116 C

Metropolitan Area Planning Council

Marc Draisen, Executive Director
Metropolitan Area Planning Council
60 Temple Place, 6th Floor
Boston, MA 02111 C

Massachusetts Department of Public Safety

Mary Elizabeth Hefferman, Secretary
Massachusetts Department of Public Safety
One Ashburton Place
Boston, MA 02108 C

Massachusetts Port Authority

John A. Quelch
Board Chairman
Massachusetts Port Authority
One Harborside Drive
East Boston, MA 02128-2909 C

Paul J. McNally
Board Member
Massachusetts Port Authority
One Harborside Drive
East Boston, MA 02128-2909 C

Ranch C. Kimball
Board Member
Massachusetts Port Authority
One Harborside Drive
East Boston, MA 02128-2909 C

Frederic Mulligan
Board Member
Massachusetts Port Authority
One Harborside Drive
East Boston, MA 02128-2909 C

Jeffrey Mullan
Board Member
Massachusetts Port Authority
One Harborside Drive
East Boston, MA 02128-2909 C

Massachusetts Water Resource Authority

Massachusetts Water Resource Authority
Attn: Marianne Connolly
Program Manager, Regulatory Compliance
100 First Avenue
Charlestown Navy Yard
Boston, MA 02129 C

City of Boston

Boston Office of the Mayor

Thomas Menino, Mayor
City of Boston
One City Hall Square
Boston, MA 02201 C

Boston Transportation Department

Tom Tinlin, Commissioner Boston Transportation Department One City Hall, Room 721 Boston, MA 02201	P	Robert D'Amico, Senior Planner Boston Transportation Department One City Hall Plaza, Room 721 Boston, MA 02201	P
James Gillooly, Deputy Commissioner Boston Transportation Department One City Hall, Room 721 Boston, MA 02201	P		

Boston Environment Department

Bryan Glascock, Director Boston Environment Department One City Hall Square, Room 805 Boston, MA 02201	C	Maura Zlody City of Boston Environment Department, Room 805 One City Hall Plaza Boston, MA 02201	C
		Chris Busch/Conservation Commission Boston Environment Department One City Hall Square, Room 805 Boston, MA 02201	P

Boston Redevelopment Authority

John F. Palmieri, Director Boston Redevelopment Authority One City Hall Square, Room 959 Boston, MA 02210	C		

Boston Parks and Recreation Department

Antonia Pollak, Commissioner Boston Parks and Recreation Department 1010 Massachusetts Avenue Boston, MA 02118	C		

Boston Public Health Commission

Dr. Barbara Ferrer, Executive Director Boston Public Health Commission 1010 Massachusetts Avenue Boston, MA 02118	C		

Boston Environmental Services Cabinet

Nancy Grilke, Chief of Staff Environmental Services Cabinet City Hall, Room 603 Boston, MA 02201	C	James Hunt, Chief of Environmental and Energy Services City Hall, Room 603 Boston, MA 02201	C

Boston Water and Sewer Commission

John P. Sullivan, PE, Chief Engineer Boston Water and Sewer Commission 980 Harrison Avenue Boston, MA 02119	C	Tom Daly, PE, Senior Design Engineer Boston Water and Sewer Commission 980 Harrison Avenue Boston, MA 02119	C

Boston City Clerk's Office

Rosario Salerno, Boston City Clerk One City Hall Square Boston, MA 02201	C		

Boston City Council

Maureen E. Feeney, District Councilor, 3 Boston City Council Boston City Hall Boston, MA 02201	C	Robert Consalvo, District Councilor, 5 Boston City Council Boston City Hall Boston, MA 02201	C
Felix Arroyo, Councilor-At-Large Boston City Council Boston City Hall Boston, MA 02201	C	Ayanna Pressely, Councilor-At-Large Boston City Council Boston City Hall Boston, MA 02201	C
Bill Linehan District Councilor, 2 Boston City Council Boston City Hall Boston, MA 02201	C	Salvatore LaMattina, District Councilor, 1 Boston City Council Boston City Hall Boston, MA 02201 Attn: Janet Knott	C
Stephen J. Murphy, Councilor-At-Large Boston City Council Boston City Hall Boston, MA 02201	C	Charles Turner, District Councilor, 7 Boston City Council Boston City Hall Boston, MA 02201	C
John Connolly, Councilor-At-Large Boston City Council Boston City Hall Boston, MA 02201	C	Michael P. Ross , Council President Boston City Council Boston, City Hall Boston, MA 02201	C
Mark Ciommo, District 9 Council Boston City Council Boston City Hall Boston, MA 02201	C	Charles C. Yancey, District Councilor, 4 Boston City Council Boston City Hall Boston, MA 02201	C

City of Chelsea

Stephen Sarikas, Chairman Chelsea Conservation Commission Chelsea City Hall 500 Broadway Chelsea, MA 02150	C	Jay Ash, City Manager Chelsea City Hall 500 Broadway Chelsea, MA 02150	C
John DePriest, Director of Planning and Development Chelsea Conservation Commission Chelsea City Hall 500 Broadway Chelsea, MA 02150	C		

City of Revere

Mayor Thomas Ambrosino Revere City Hall 291 Broadway Revere, MA 02151	C	City Clerk's Office Revere City Hall 291 Broadway Revere, MA 02151	C

City of Winthrop

James McKenna Town Manager Winthrop Town Hall One Metcalf Square Winthrop, MA 02152	C	Town Council Winthrop Town Hall One Metcalf Square Winthrop, MA 02152	C

Libraries

Boston Public Library Main Branch 666 Boylston Street Boston, MA 02117	P	Revere Public Library 179 Beach Street Revere, MA 02151	P
Boston Public Library East Boston Branch 276 Meridian Street East Boston, MA 02128	P	Boston Public Library Orient Heights Branch 18 Barnes Avenue East Boston, MA 02128	P

Winthrop Public Library One Metcalf Square Winthrop, MA 02151	P	Chelsea Public Library 569 Broadway Chelsea, MA 02150	P
State Transportation Library, Public Review 10 Park Plaza Boston, MA 92116-3973	P		
Community Groups and Interested Parties			
East Boston Community			
Karen Maddalena, Chairperson Jeffries Point Neighborhood Association 4 Lamson Street East Boston, MA 02128	C	Mary Ellen Welch East Boston Greenways 225 Webster Street East Boston, MA 02128	P
Michael Sulprizio Representative Carlo Basile' s Office Massachusetts State House, Room 39 Boston, MA 02133	C	Debra Cave Eagle Hill Association 106 White Street East Boston, MA 02128	C
Neffo Cappuccio East Boston Chamber of Commerce 296 Bennington Street East Boston, MA 02128	C	Ida Lamattina, President Gove Street Citizens Committee 123 Cottage Street East Boston, MA 02128	P
Joseph E. Steffano, Jr. 2 Swift Terrace East Boston, MA 02128	C	Gail Miller Attn: Air Inc. 232 Orient Avenue East Boston, MA 02128	C
Ernani DeAraujo Mayor's Office of Neighborhood Services Boston, City Hall – Room 205 Boston, MA 02201	C	Fran Rowan 7 Thurston Street East Boston, MA 02128	C
Lauri Webster 46 Martin Road Milton, MA 02186	C	Aaron Toffler AIR Inc. 45 Marion Street East Boston, MA 02128	C

Organizations and Other Interested Parties			
Association for Public Transportation, Inc. P.O. Box 51029 Boston, MA 02205-1029	C		
John Vitagliano 19 Seymour Street Winthrop, MA 02152	C	Fred Salvucci 6 Leicester Street Brighton, MA 02135	C
Captain Frank Mancini Boston Police – District 7th 69 Paris Street East Boston, MA 02128	C	Peter L. Koff, Esquire Engel & Schultz, LLP 265 Franklin Street , #1801 Boston, MA 02110	C
Richard Kennelly, Jr. Conservation Law Foundation 62 Summer Street Boston, MA 02116	C	Vivien Li, Executive Director Boston Harbor Association 374 Congress Street, Suite 307 Boston, MA 02210	C
K. Dunn Gifford, President Comm. For Regional Transportation 15 Hilliard Street Cambridge, MA 02138	C	James Bryan McCaffrey, Chapter Director Massachusetts Chapter Sierra Club 10 Milk Street (294 Washington Street) Boston, MA 02108	C
MAPC MetroFuture Steering Committee Somerville Transportation Equity Partnership Mystic View Task Force (of Somerville) 13 Highland Avenue, Apt. #3 Somerville, MA 02143	C	Albert F. Caldarelli, President East Boston Community Development Corporation 72 Marginal Street East Boston, MA 02128	C

Wampanoag Tribe of Gay Head (Aquinnah) Bettina Washington, Acting Tribal Historic Preservation Officer 20 Black Brook Road Aquinnah, MA 02535-1546	C	Mr. Thomas Bruno Orient Heights Neighborhood Council 21 Annavoy Street East Boston, MA 02128	C
Ms. Valerie Burns EB Greenways 62 Summer Street Boston, MA 02110	C	Ms. Karen Buttiglieri Waterfront Development Advisory Committee 56 Beachview Road East Boston, MA 02128	C
Ms. Mary Berninger 156 Saint Andrew Road East Boston, MA 02128	C	Mr. Pat Capogreco Italia Unita 182 Orient Avenue East Boston, MA 02128	C
Ms. Lisa Capaogreco Italia Unita 35 Bennington Street East Boston, MA 02128	C	Ms. Maria Conti EB Piers PAC 44 Saratoga Street East Boston, MA 02128	C
Mrs. Joey Cuzzi East Boston YMCA 215 Bremen Street East Boston, MA 02128	C	Dr. Edith DeAngelis EB Piers PAC 100 Brooksby Village Drive Peabody, MA 01960	C
Mr. Sal DiStefano BRA One City Hall Square Boston, MA 02201	C	Mr. John Dudley Chamber of Commerce 296 Bennington Street East Boston, MA 02128	C
Mr. Ron Hardaway 118 Bayswater Street East Boston, MA 02128	C	Ms. Bernadine Joslin EB Piers PAC 71 Liverpool Street East Boston, MA 02128	C
Mr. Andrew Keneally 156 Porter Street East Boston, MA 02128	C	Mr. Robert Megna 454 Saratoga Street East Boston, MA 02128	C
Mr. Patrick Moscaritolo 60 Orient Avenue East Boston, MA 02128	C	Mr. Clark Moulaison East Boston Main Streets 146 Maverick Street East Boston, MA 02128	C
Ms. Fran Riley Harborside Community Center 312 Border Street East Boston, MA 02128	C	Mr. Joseph Ruggiero Ruggiero/Mazzarella Funeral Home 971 Saratoga Street East Boston, MA 02128	C
Mr. Robert Strelitz EB Piers PAC 1 Brigham Street East Boston, MA 02128	C	Mr. Paul Travaglini First Priority Credit Union 100 Swift Terrace East Boston, MA 02128	C
Mr. Derek Brodin First Priority Credit Union 100 Swift Terrace East Boston, MA 02128	C	Logan Airport Employee TMA Attn: Doug Wheaton One Harborside Drive, Suite 200S East Boston, MA 02128	C

Appendix A
Air Quality Technical Report

Air Quality Report

Proposed East Boston-Chelsea Bypass Project

HMMH Report No. 304450.1
October 2010

Prepared for:

Massport
One Harborside Drive, Suite 200S
East Boston, MA 02128

Prepared by:

Philip DeVita

HARRIS MILLER MILLER & HANSON INC.

Harris Miller Miller & Hanson Inc.
77 South Bedford Street
Burlington, MA 01803
T 781.229.0707
F 781.229.7939

Contents

Tables

1 INTRODUCTION

Harris Miller Miller & Hanson Inc (HMMH) has prepared this air quality analysis for the Massachusetts Port Authority (Massport) in support of an Expanded Environmental Notification Form (ENF) under the Massachusetts Environmental Policy Act (MEPA) for the proposed East Boston-Chelsea Bypass Project ("Project"). Figure 1 shows the proposed bypass roadway. The Project will consist of a 2,225 foot two-lane roadway in the existing abandoned railroad corridor connecting Frankfort Street (southern extent) to Chelsea Street (northern extent). The Bypass Project would provide an alternative to the existing roadway connections through Day Square, Eagle Square, and the Neptune Road Corridor. The Project is expected to reduce vehicle trip volumes and alleviate congestion at these roadways and provide limited-access roadway connection between Logan Airport and the new Chelsea Street Bridge. Under the Proposed Project, non-commercial automobiles will be prohibited from using the bypass roadway. The new roadway will accommodate commercial vehicles, cargo trucks, taxis, Massport shuttle buses, and Massachusetts Bay Transportation Authority (MBTA) buses.

The air quality study consisted of a mesoscale (e.g. qualitative) and microscale (e.g. quantitative) analysis of mobile source emissions in the project area. A mesoscale analysis was performed to assess the change in total volatile organic compounds (VOCs) and nitrogen oxides (NO_x) in pounds per day (lbs/day) associated with motor vehicle emissions for the Proposed Project compared to the No-build condition for the year 2020. Since the Boston area is designated a non attainment area for ozone, the mesoscale analysis typically evaluates the overall impact of VOC and NO_x (i.e. ozone precursors) emissions affiliated with the project. Since the Project is introducing a new roadway to the area, a microscale analysis was performed to evaluate the Project's local air quality impact at the few nearby residences along the new bypass roadway compared to the National Ambient Air Quality Standards (NAAQS).

The modeling analysis was performed using standard methodologies approved by the Environmental Protection Agency (EPA) and Massachusetts Department of Environmental Protection (MADEP) for determining ambient concentrations from mobile sources.

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Proposed Bypass Road

Underpass

East Boston - Chelsea Bypass Project

Figure 1
Proposed Roadway Location

N
S

0 300 600 Feet

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2 Mesoscale Analysis

A mesoscale analysis was performed to evaluate the regional impact of the mobile source emissions affiliated with the Project. Typically, a mesoscale analysis is performed when the number of vehicle trips per day ("vtd") will exceed the MADEP threshold of 3,000 vtd from office developments or 6,000 vtd for other non-residential projects. Typically these thresholds only apply to new projects or existing projects where the new traffic generated by the project would exceed these thresholds. The Project will generate far less than the MADEP thresholds; however, the analysis was conducted to demonstrate that mobile source emissions in the surrounding neighborhood will be reduced by moving some of the truck and bus traffic off the neighborhood streets onto the proposed bypass road. The analysis includes both an estimate of the volatile organic carbon ("VOC") and nitrogen oxide (NO_x) emissions associated with the No build and Proposed Project conditions.

2.1 Mesoscale Methodology

A mesoscale analysis predicts the change in overall emissions due to the Project. The total vehicle pollutant burden was estimated for the No-build and Proposed Project conditions for 2020 based on the traffic analysis performed by the Central Transportation Planning Staff (CTPS).

For each condition modeled, the EPA MOBILE6.2 computer program was used to estimate motor vehicle emissions of VOC/NO_x on the surrounding roadway networks based on vehicle speed and vehicle miles traveled. The change in regional emissions due to the Project is then estimated by multiplying changes in traffic volumes by the roadway length to obtain vehicle miles traveled (VMT)[1]. The VMT is then multiplied by an emission factor (grams per vehicle mile traveled) based on an average vehicle speed in miles per hour ("mph") to obtain emissions in pounds per day.

2.2 Intersection Selection

Intersections chosen for analysis were based on their level of service (LOS), which indicated the level of delay at the intersection with A being the least delayed and F the most. Intersection selection criteria for a mesoscale analysis is typically based on the area where the intersections will operate at LOS D or worse, and where traffic increases from the project are ten percent or greater. Since the primary purpose of the Project is to alleviate traffic volumes from the nearby roadways, all the intersections and roadways from the CTPS study were analyzed for the Proposed Project and compared to the No-build conditions. In addition to the CTPS study area, a more refined analysis was conducted to evaluate the net emission reductions from only the roadways affected by the Project (i.e. the roadway segments that will see either an increase or decrease in traffic).

[1] Vehicle Miles Traveled (VMT) – the average daily traffic multiplied by the roadway link length.

The traffic volumes and vehicle speeds provided by CTPS (Appendix A of this report) form the basis of the mesoscale study.

2.3 Emissions Calculation MOBILE6.2

The EPA MOBILE6.2[2] computer program was used to estimate motor vehicle emissions (e.g. automobiles, trucks, and buses) on the roadway network for both the No-build and Proposed Project conditions. Emissions data calculated by the MOBILE6.2 model are based on motor vehicle operations typical of peak periods. The Commonwealth's statewide annual Inspection and Maintenance ("I&M") Program was included, as well as state specific vehicle age registration distribution. The MOBILE6.2 inputs are based on the latest guidance issued by MADEP[3] including updated inputs to the model. Emission estimates derived from MOBILE6.2 for VOCs/NO_x are based on the worst case of either wintertime or summertime conditions.

MOBILE6.2 output parameters are provided in Appendix B of the air quality report.

2.4 Mesoscale Results

The mesoscale results for 2020 are presented in Table 2-1 for the Proposed Project compared to the No-build condition for all the roadways studied in the CTPS traffic analysis. The results show a slight decrease in daily VOC and NO_x emissions of 0.08 and 0.09 pounds per day, respectively, compared to the No-build condition.

Table 2-1 Mesoscale Analysis Summary for Proposed Project Compared to the No-build

Pollutant	Time	Units	Proposed Project	No-Build (NB)	Change in Emissions (PP –NB)	Percent Difference (PP-NB)
VOC	Daily	Pounds/day	15.24	15.32	-0.08	-0.52%
NO_x	Daily	Pounds/day	15.01	15.10	-0.09	-0.59%

The analysis was further refined to estimate the net change in emissions for only the roadways affected by the Project (i.e. the removal of truck and bus traffic from local roadways onto the bypass roadway). There are a total of 16 surrounding roadway segments that will be affected by the Project not including the new bypass road. Table 2-2 presents the net change in VOC and NO_x emissions for those affected roadways. The refined analysis shows that the Proposed Project will result in lower traffic volumes compared to the No-build at most of the local roadways which corresponds to a net benefit in emissions of NO_x and VOC at these roadways.

[2] MOBILE6.2 is an EPA computer model that calculates emission factors for hydrocarbons, carbon monoxide, and oxides of nitrogen form gasoline and diesel fueled highway motor vehicles

[3] MADEP: February 12, 2003 memorandum for MOBILE6 inputs for performing microscale and mesoscale analysis. Inputs are based on the latest MOBILE6 inputs provided by MADEP on 7/02/10

Table 2-2 Refined Mesoscale Analysis Summary for Proposed Project Compared to the No Build for Affected Roadways Only

Roadway	Change in Buses VOC Emissions (lbs/day)	Change in Car VOC Emissions (lbs/day)	Change in Truck VOC Emissions (lbs/day)	Change in Buses NO_x Emissions (lbs/day)	Change in Car NO_x Emissions (lbs/day)	Change in Truck NO_x Emissions (lbs/day)
Bennington Street SB (Vienna to Neptune Road)	0	-0.001	0	0	-0.005	0
Frontage Road SB (Beck Street to Swift Street)	0	-0.001	0	0	-0.009	0
Chelsea Street NB (Curtis Street to Eagle Street)	-0.046	-0.066	0	-0.297	-0.243	0
Chelsea Street SB (Curtis Street to Eagle Street	-0.046	-0.004	0	-0.297	-0.014	0
Chelsea Street NB (Eagle Street to Neptune Road)	0	-0.023	-0.006	0	-0.085	-0.004
Chelsea Street SB (Eagle Street to Neptune Road)	0	-0.001	0	0	-0.005	0
Neptune Road EB (Frankfort Street to Vienna Street)	-0.010	0.012	0.005	-0.058	0.041	0.003
Neptune Road WB (Frankfort Street to Vienna Street)	-0.010	-0.012	0	-0.058	-0.041	0
Neptune Road EB (Vienna Street to Bennington Street)	-0.015	-0.001	0	-0.087	-0.004	0
Neptune Road WB (Vienna Street to Bennington Street)	-0.015	-0.021	0	-0.087	-0.071	0
Neptune Road EB (Bennington Street to Bremen Street)	-0.012	-0.001	0	-0.068	-0.003	0
Neptune Road WB (Bennington Street to Bremen Street)	-0.012	-0.007	-0.010	-0.068	-0.023	-0.006
Swift Street EB (Bennington Street to Saratoga Street)	0	-0.001	0	0	-0.004	0
Swift Street EB (Chaucer Street to Frontage Road)	0	-0.001	0	0	-0.003	0
Total Net Benefit to local Roadways	**-0.167**	**-0.128**	**-0.011**	**-1.021**	**-0.467**	**-0.007**

In summary, the mesoscale analysis results show a net air quality benefit at local roadways compared to the No-build condition by removing truck and bus traffic from the nearby roadways onto the bypass roadway. This reduces traffic congestion and idling, which reduces the overall levels of vehicle emissions.

3 Microscale Analysis

The microscale analysis examines ambient impacts due to traffic queues at nearby intersections or from roadway segments. Typically, CO is used in microscale studies to indicate roadway pollutant levels since it is the most abundant pollutant emitted by motor vehicles and can result in so-called "hot spot" (high concentration) locations around congested intersections. For this analysis, nitrogen oxide (NO_x) and particulate matter (PM_{10} and $PM_{2.5}$) from the vehicles were also evaluated as part of the study.

The widespread use of CO catalysts on late-model vehicles and the implementation of low sulfur diesel oil have reduced the occurrences of hotspots. Air quality modeling techniques (computer simulation programs) are typically used to predict ambient concentrations from roadways and intersections.

The microscale analysis was conducted using the latest versions of EPA MOBILE6.2 and CAL3QHC to estimate CO, NO_x, and particulate concentrations at nearby residential locations in accordance with EPA protocol.

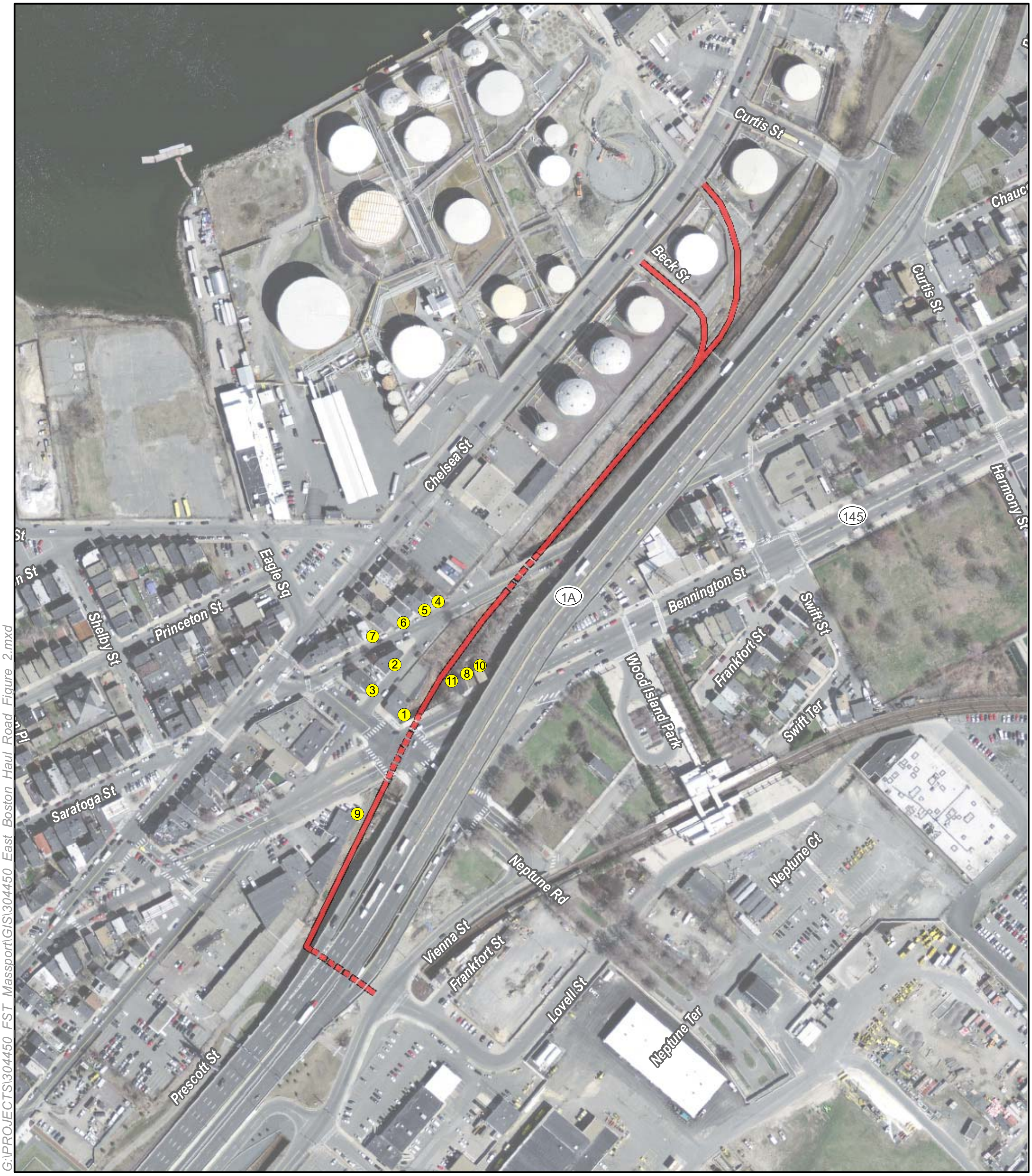
Emissions data calculated from the MOBILE6.2 emission model for the Proposed Project condition, along with traffic data were input into the CAL3QHC program to determine pollutant specific concentrations at nearby residential receptor locations. The modeled concentrations were added to MADEP monitored background levels for comparison to the NAAQS. The NAAQS have been established by the EPA and MADEP for these pollutants to protect the public health (known as primary standards) with an adequate margin of safety.

3.1 Roadway Selection

The Bypass roadway will pass under the Neptune Road and Bennington Street intersections and this is the only area where residential housing is located nearby to the bypass road. Since these are the closest residential units affected by the new bypass roadway; this intersection including the proposed bypass road was evaluated for comparison to the NAAQS.

3.2 Receptors

A total of 11 model receptors were identified at residential locations at the Neptune Road and Bennington Street intersection location area. These locations were chosen based on a land use field study conducted by HMMH and represent the closest residential locations to the new bypass roadway. Figure 2 shows the residential receptor locations used in the modeling.



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Air Quality Modeling Receptor Locations

Proposed Bypass Road

Underpass

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0 300 600 Feet

massport

East Boston - Chelsea Bypass Project

Figure 2
Air Quality Modeling Receptor Locations

HMMH HARRIS MILLER MILLER & HANSON INC.

3.3 Emissions Calculation

The MOBILE6.2 inputs are similar to the mesoscale analysis where MADEP provided MOBILE6.2 input files for the 2020 condition for CO, NO_x, and particulates. To estimate emissions from queuing at the intersection, idle emissions were calculated. The current version of MOBILE6.2 does not explicitly calculate idle emissions. However, idle emissions were obtained from a vehicle speed of 2.5 mph (the lowest speed MOBILE6 will model). The resulting emission rate given in (grams/mile) is then multiplied by 2.5 mph to estimate idle emissions (given in grams/hour). Moving emissions are calculated based on estimated speeds at which free-flowing vehicles travel through the intersection and along the bypass roadway.

3.4 CAL3QHC

The model typically employed to estimate impacts of emissions from mobile sources is the EPA-approved CAL3QHC model. The CAL3QHC model is used to estimate concentrations at receptors near intersections while cars are traveling or queuing based on worst case meteorological conditions and traffic data. Signal timings, vehicle speeds, traffic volume, and roadway dimensions were provided directly from Synchro modeling runs. CAL3QHC modeling is based on peak hourly traffic volumes. To obtain worst case peak hourly bus and truck volumes along the bypass roadway, it was assumed that 36 percent of the 3-hour CTPS volumes was attributed to a peak hourly volume based on hour by hour measured traffic at seven roadway locations in the Project area. See Appendix C of the ENF Supplement for the traffic volumes used in the analysis.

The CAL3QHC parameters are listed in Appendix C of the air quality report.

3.5 Background Air Quality Data

CAL3QHC modeled concentrations were added to monitored ambient background concentrations to obtain total concentrations for comparison to the NAAQS. The monitored ambient background includes concentrations from all of the other major and minor sources in the Boston area, including mobile sources (trucks, buses, cars, trains, planes, etc.). The monitored background provides the baseline from which to assess the added impact due to the proposed facility.

To estimate background pollutant levels representative of the area, the most recent Air Quality Data Report obtained from the EPA AIRS database for 2008 was reviewed. The highest concentrations from all the Boston monitors for each pollutant and averaging period was obtained. This is conservative, in that the highest overall concentrations were used regardless of the monitor's proximity to the project.

Consistent with the MADEP guidance, for short-term averages (i.e. 24-hour or less), the highest second highest values were used while the highest annual concentrations were used for the annual averaging period.

A summary of the background concentrations analyzed are presented in Table 3-1.

Table 3-1 Observed Ambient Concentrations and Background Levels

Pollutant	Averaging Period	DEP Monitor	2008	DEP Monitored Background Level (μg/m^3)	National Ambient Air Quality Standards (μg/m^3)
NO_x	1-hour	Kenmore Sq.	0.071 ppm	133	188
	Annual	Kenmore Sq.	0.022 ppm	41.0	100
CO	1-Hour	Kenmore Sq.	1.6 ppm	1,832	40,000
	8-Hour	Kenmore Sq.	1.0 ppm	1,145	10,000
PM_{10}	24-Hour	Kenmore Sq.	39 μg/m^3	39	150
	Annual	Kenmore Sq.	23 μg/m^3	23	50
$PM_{2.5}$	24-hour	Harrison Ave.	28 μg/m^3	28	35
	Annual	Kenmore Sq.	11. μg/m^3	11	15

3.6 Microscale Modeling Results

The CAL3QHC modeling results of the Bennington Street and Neptune Road intersection, including the new bypass road are presented in Table 3-2. These locations were selected based on proximity to residential units. The output from CAL3QHC is 1-hour concentrations. To convert to longer period averages, adjustment factors were employed to estimate concentrations from the maximum 1-hour values. For scaling to 3-hour, 8-hour, 24-hour and annual averages respectively, the following factors were employed: 0.9, 0.7, 0.4, and 0.1. The predicted concentrations of CO, NO_x and PM_{10}/$PM_{2.5}$ at the residential receptor locations were added to monitored background levels and compared with the NAAQS. The results of the analysis show that the CAL3QHC concentrations added to the monitored background concentrations are below the NAAQS for all four pollutants and averaging periods.

It should be noted that the short-term averaging periods of 1-hour, 3-hour, and 8-hour were not determined on a time specific interval over the day. They were determined based on the time of peak hourly traffic volumes affiliated with the site. For example, since the nighttime volumes will be lower than the PM peak volumes, short-term concentrations estimated in Table 3-2 during nighttime conditions will be lower.

Table 3-2 CAL3QHC Modeled Concentrations Plus Monitored Background Compared to the NAAQS

Pollutant	Averaging Period	CAL3QHC Intersection Modeled Concentration (ug/m^3)	CAL3QHC Bypass Road Concentration (ug/m^3)	DEP Monitored Background Level (μg/m^3)	Total Concentration (μg/m^3)	National Ambient Air Quality Standard (μg/m^3)
NO_x	Annual	0.1	0.3	41	41.40	100
	1-Hour	10	3.03	133	146.03	188
CO	1-Hour	0.5	0.001	1,832	1832.50	40,000
	8-Hour	0.35	0.0007	1,145	1145.35	10,000
PM_{10}	24-Hour	0.004	0.03	39	39.03	150
	Annual	0.001	0.007	23	23.01	50
$PM_{2.5}$	24-Hour	0.004	0.03	28	28.03	35
	Annual	0.001	0.007	11	11.31	15

Appendix A Traffic Data

Please request the CD version of the document to view this Appendix.

Appendix B MOBILE6.2 OUTPUT

Please request the CD version of the document to view this Appendix.

Appendix C CAL3QHC Output

Please request the CD version of the document to view this Appendix.

Appendix B
Noise Technical Report

Noise Analysis Technical Report
East Boston-Chelsea Bypass

East Boston, Massachusetts

HMMH Report No. 304450.002
October 2010

Prepared for:

Massachusetts Port Authority
and
Fay, Spofford & Thorndike Inc.

Noise Analysis Technical Report East Boston-Chelsea Bypass

East Boston, Massachusetts

HMMH Report No. 304450.002
October 2010

Prepared for:

Massachusetts Port Authority
One Harborside Drive, Suite 200S
East Boston, MA 02128-2909

Prepared by:

Christopher W. Menge
James E. Ferguson III

HARRIS MILLER MILLER & HANSON INC.

Harris Miller Miller & Hanson Inc.
77 South Bedford Street
Burlington, MA 01803
T 781.229.0707
F 781.229.7939

In Association with:

Fay, Spofford & Thorndike Inc.
15 Broad St., Suite 301
Boston, MA 02109

Executive Summary

Harris Miller Miller & Hanson Inc. (HMMH) was retained by the Massachusetts Port Authority (Massport) to conduct a noise evaluation of the proposed East Boston-Chelsea Bypass road in East Boston. The noise study was conducted for inclusion in a submittal of an Environmental Notification Form for the project, as required by the Massachusetts Environmental Policy Act. Since the project is exclusively a new roadway, HMMH used standard Federal Highway Administration (FHWA) and Massachusetts Department of Transportation (MassDOT) noise impact analysis procedures. These noise regulations and guidelines are somewhat different from those of the Federal Aviation Administration and the Massachusetts Department of Environmental Protection, which would be used for projects other than roadway improvements.

An inspection of the study corridor revealed that the only area where the proposed Bypass has the potential to impact noise-sensitive properties (residential, schools, recreation areas) is where the Project corridor crosses Bennington and Saratoga Streets, near some single- and multi-family homes.

A noise measurement program was conducted to determine existing noise levels in the area, and to conduct some traffic classification counts to supplement the traffic analysis. Noise levels measured at three locations currently exceed the FHWA's Noise Abatement Criteria, due to the high volume of traffic on the local streets. The FHWA's Traffic Noise Model (TNM) was employed to compute the loudest-hour noise conditions for Existing (2007) conditions and the future 2020 Build conditions with the proposed Bypass, using existing and forecast traffic data provided by Massport. The noise model was validated using traffic counted during the noise measurement program.

Noise levels at most of the nearest residential homes are computed to increase only very slightly, by less than one-half decibel, from the Existing to the 2020 Build case. These increases are due to the expected small growth in traffic volumes over the 13-year period (approx. 6 to 12%), and not due to the proposed Bypass. For the two 2-family homes along Bennington Street with back yards directly adjacent to the Bypass corridor, noise level increases are projected to be up to one decibel from the Existing to Build cases. Such small increases in noise level are not generally considered to be readily perceptible to people outside of a laboratory setting. Also, no noise impact will result from these increases, since MassDOT assesses impact where a "substantial increase" in existing noise of 10 decibels or more occurs.

The existing and future noise levels in one of the two yards adjacent to the Bypass are below the FHWA noise impact criterion of 66 dBA. However, in the other yard at 394 Bennington St., the existing loudest-hour L_{eq} noise level is computed at 67 dBA under Existing 2007 conditions, and it would increase by one decibel to 68 dBA under future Build conditions with the Bypass. This yard represents the only property in the study area impacted by noise, and therefore, noise abatement must be considered per FHWA and MassDOT requirements. However, providing abatement to this yard from Bypass noise in the form of a noise barrier along the Bypass would not eliminate the noise impact because the other, primary sources of noise at this property are on the other side of the house and would not be blocked by such a barrier. Therefore, noise abatement for the project is not acoustically feasible because it cannot achieve the minimum 5 dB of noise reduction required by FHWA and MassDOT. Because noise abatement is not feasible, it will not be considered further in this project.

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1 INTRODUCTION

Harris Miller Miller & Hanson Inc. (HMMH) was retained by the Massachusetts Port Authority (Massport) to conduct a noise evaluation of the proposed East Boston-Chelsea Bypass road in East Boston. The noise study was conducted for inclusion in a submittal of an Environmental Notification Form for the project, as required by the Massachusetts Environmental Policy Act. Since the project is a new roadway, HMMH used standard Federal Highway Administration (FHWA) and Massachusetts Department of Transportation (MassDOT) noise impact analysis procedures.

An inspection of the study corridor revealed that the only area where the proposed Bypass has the potential to impact noise-sensitive properties (residential, schools, recreation areas) is where the Project corridor crosses under Bennington and Saratoga Streets, near some single- and multi-family homes. Therefore the noise analysis focused only on this study area.

In the analysis, Existing (2007) conditions are compared to one design-year (2020) Build scenario, the Spur Alignment alternative.

This report describes the noise assessment criteria used, the existing noise environment including measurements, the noise prediction model and traffic data used in the model, the computed noise levels for existing and future conditions, and an assessment of potential noise impact in the study area.

2 NOISE ASSESSMENT CRITERIA

The noise impact of East Boston Bypass project was assessed in accordance with FHWA and MassDOT roadway noise assessment regulations and guidelines. These noise regulations and guidelines are different from those of the Federal Aviation Administration and the Massachusetts Department of Environmental Protection, which would be used for projects other than roadway improvements, but since the East Boston Bypass project is exclusively a roadway project, the FHWA/MassDOT criteria are the most appropriate. The FHWA regulations are set forth in 23 CFR Part 772[1]. In 1996, MassDOT's updated Noise Abatement Guidelines were approved by FHWA[2]. The MassDOT guidelines are included in Appendix A.

To assess the degree of traffic noise impact on human activity, the FHWA established Noise Abatement Criteria (NAC) for different categories of land use, as shown in Table 1. According to the regulations, traffic noise impact occurs when the predicted traffic noise levels approach or exceed the Noise Abatement Criteria, or when the predicted traffic noise levels substantially exceed the existing noise levels. The regulations further state that noise impact should be assessed for the loudest hour of the day in the design year.

Table 1 FHWA Noise Abatement Criteria

Activity Category	Leq(h)*	Description of Activity Category
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries and hospitals
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	--	Undeveloped lands
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums.

* Hourly A-weighted Sound Level (dBA).
Source: 23 CFR Part 772.

The NAC are given in terms of the hourly, A-weighted, equivalent sound level in decibels (dBA). Appendix B provides descriptions of the noise metrics used in this report. The A-weighted sound level is a single number measure of sound intensity with weighted frequency characteristics that corresponds to human subjective response to noise. Most environmental noise (and the A-weighted sound level) fluctuates from moment to moment, and it is common practice to characterize the fluctuating level by a single number called the equivalent sound level (L_{eq}). The L_{eq} is the value or level of a steady, non-fluctuating sound that represents the same sound energy as the actual time-varying sound evaluated over

[1] 23 CFR Part 772, as amended April 1, 2008 – "Procedures for Abatement of Highway Traffic Noise and Construction Noise," U.S. Department of Transportation, Federal Highway Administration.
[2] Massachusetts Highway Department, "Type I Noise Barrier Guidelines," approved 1 April 1996.

the same time period. For traffic noise assessment, L_{eq} is typically evaluated over a one-hour period, and may be denoted as $L_{eq(h)}$.

FHWA land use Category B includes exterior areas of residences, recreational areas, churches, playgrounds, and motels. FHWA and MassDOT define the exterior areas where noise levels are to be assessed as areas of “frequent human use,” such as patios, porches, yards, and pool areas. Within this category, only residences were identified in the East Boston study area, so only residences have been evaluated in this study. For Category B, noise impact is assumed to occur when predicted exterior noise levels, due to the Project, approach or exceed 67 dBA in terms of $L_{eq(h)}$ during the loudest hour of the day. MassDOT defines “approach” as within 1 decibel, therefore, the threshold for noise impact is where exterior noise levels are within 1 decibel of 67 dBA, $L_{eq(h)}$, or 66 dBA. Noise impact also would occur wherever Project noise causes a substantial increase over existing noise levels. MassDOT defines a substantial increase as an increase of 10 decibels or more above existing noise levels.

3 EXISTING NOISE ENVIRONMENT

Short-term noise measurements were conducted at three noise-sensitive residential sites in the project study area on August 5, 2010. The noise measurements, each about 30 minutes in duration, characterized existing noise levels in the area but were not necessarily conducted during the loudest hour of the day. These measurements included noise from local streets and Route 1A. Figure 1 in Section 4 shows the locations of each of the noise measurement sites graphically; they are shown with an “M” prefix.

The noise measurements were conducted using a Larson Davis 870 (ANSI Type I, “precision”) integrating sound level meter, with calibrations traceable to the National Institute of Standards and Technology (NIST). The data collection procedure involved measurements of individual one-minute L_{eq}s, so that periods including events that were not representative of the ambient noise environment or not traffic-related could be separated or excluded. Specifically, minutes that included such events were logged, and those with events not representative of the typical ambient environment were excluded from the computed totals. Minutes with representative noise events that were not related to traffic were separated, and the total measurement period L_{eq} was determined both with and without the minutes that included these events. By comparing the two totals, the significance of non-traffic events to the overall noise level can be determined for the measurement period.

The measured short-term noise levels appear in Table 2, as equivalent sound levels (L_{eq}). As described above and in Appendix B, the L_{eq} is a sound-energy average of the fluctuating sound level (in A-weighted decibels, dBA) measured over a specified period of time. The measurement time periods are shown in the table. One non-typical very loud truck event near the microphone was excluded from the measurement data set at Site M-2. Noise sources that were not related to typical vehicular traffic included loud horns near the microphone at Site M-3, but that noise was included in the measurement results under “Total L_{eq}” as shown in Table 2.

Table 2 Noise Measurement Site Data

Site No.	Address	Time	Total L_{eq} (dBA)	Traffic-only L_{eq} (dBA)
M-1	398 Bennington Street, Multi-family residential	10:40 AM – 11:10 AM	71	71
M-2	546 Saratoga Street, Single-family residential	1:10 PM – 1:40 PM	66	66
M-3	511 Saratoga Street, Commercial	11:45 AM – 12:15 PM	67	66

Site M-1 was located at a two-family home at 398 Bennington Street, one of the two homes closest to the Chelsea Bypass corridor. The measurement site was located near the front entrance of the home, along Bennington St. This site recorded the highest measured noise level, at 71 dBA L_{eq}, due to its close proximity to Bennington St. and also the increased noise level due to reverberation of Bennington St. traffic noise from the underside of the Route 1A overpass. The outdoor use area associated with this home as well as the nearby home also on Bennington St. is located on the back side of the home, away from Bennington St., but overlooking the right of way for the proposed Chelsea Bypass.

Site M-2 was located near the front entrance of a single-family home at 546 Saratoga Street, at the intersection with Bremen St. This home is one of the closest homes to the north of the Chelsea Bypass corridor, although they are all set back somewhat, compared with the homes on Bennington St. The measured L_{eq} at this home was 66 dBA in the early afternoon. As with the other sites, traffic noise on local streets dominated the noise environment. The frequent outdoor use area for this home is in the rear, and would be exposed to lower noise levels, due increased distance and shielding from the major noise sources.

Site M-3 was located at a commercial property along Bremen St., somewhat closer to the Chelsea Bypass corridor than Site M-2. The measured traffic-only L_{eq} at this location was 66 dBA, the same as Site M-2.

4 COMPUTED NOISE LEVELS

4.1 Noise Prediction Model

All traffic-noise computations for this study were conducted using the latest version of the FHWA Traffic Noise Model (FHWA TNM 2.5)[3]. The FHWA TNM incorporates state-of-the-art sound emissions and sound propagation algorithms, based on well-established theory or on accepted international standards. The acoustical algorithms contained within the FHWA TNM have been validated with respect to carefully conducted noise measurement programs, and show excellent agreement in most cases for sites with and without noise barriers.

The traffic data and project engineering drawings were provided by Massport and Fay, Spofford & Thorndike, Inc. (FST). The noise modeling accounted for such factors as propagation over different types of ground (acoustically soft and hard ground), significant shielding effects from local terrain and structures, distance from the road, traffic speed, and hourly traffic volumes including percentage of medium and heavy trucks. To fully characterize existing and future noise levels at all noise-sensitive land uses in the study area, 15 noise prediction receivers (or “sites”) were added to the TNM model, in addition to the three measurement sites.

4.2 Noise Model Validation

A validation of the noise modeling assumptions was conducted using the traffic counted on nearby roadways simultaneous with the noise measurement at each site as input to the TNM noise prediction model. Computed noise levels based on the counted traffic were compared to the measured noise levels, to confirm the assumptions about the acoustical shielding provided by intervening buildings and terrain, for example. The modeling assumptions were refined, as necessary, to obtain appropriate agreement

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[3] Menge, Christopher W., Christopher F. Rossano, Grant S. Anderson, Christopher J. Bajdek, FHWA Traffic Noise Model, Version 1.0: Technical Manual, Report No. FWHA-PD-96-010 and DOT-VNTSC-FHWA-98-2. Cambridge, MA: U.S. Department of Transportation, Research and Special Programs Administration, John A. Volpe National Transportation Systems Center, Acoustics Facility, February 1998.

between the computed and measured values. The validated modeling assumptions at the measurement sites and for the existing geometry were then extended to the future Build case alternative and applied at prediction locations where no measurements were made.

Computed noise levels at each of the measurement sites using the counted traffic as input to the model were within 2 decibels of the measured values except at Site M-1. At this site, reflected noise from the underside of the Route 1A overpass and noise from the Route 1A expansion joints increased the measured values by 3 decibels higher than the model computed. Therefore, the computed values of noise from the existing roadways at this site were increased by 3 decibels to account for these effects, which cannot be otherwise incorporated into the modeling. This increase was also extended to the adjacent home on Bennington St.

4.3 Traffic Data for Noise Prediction

The traffic volume and speed data for the study area used in this noise analysis represented the PM peak period, and were provided by Massport. The traffic data consists of vehicle volumes for automobiles and trucks. Since FHWA and MassDOT noise analysis separates trucks into two classes, medium trucks with 2 axles and 6 tires, and heavy trucks with more than 2 axles and 6 tires, HMMH used the truck classifications counted during the noise measurement program to classify the truck volumes provided for the Existing and Build cases. In the case of Route 1A, no traffic volume data were provided, so we used the traffic counted on Route 1A in our modeling. For the future Build case, we scaled up the Route 1A volumes based on the ratio of the existing to future volumes on the ramps to Route 1A, which were provided in the traffic data set.

The speeds provided by Massport included delay time associated with traffic signals. Such speeds are too low to be used in noise modeling, which need running speeds, without signal delay times. Therefore, as we often do in urban areas, HMMH used typical operating speeds based on observations in the field and the posted speed limits. Speeds used in the modeling ranged from 15 mph on Neptune Rd., to 45 mph on Route 1A. Details on the traffic data used in the noise modeling are provided in Appendix C.

4.4 Presentation of Results

Noise-sensitive land uses in the study area include single- and multi-family residences, three adjacent to the Chelsea Bypass, but the others set back. Commercial properties are located in the study area, but they have not been evaluated in this study. Figure 1 shows the locations of the measurement sites and the prediction sites in relation to the project improvements. The short-term measurement/prediction sites are shown with an “M” prefix, and the prediction-only sites are shown with a “P” prefix.

Table 3 presents the computed noise levels at each of the noise measurement and prediction sites, along with the site number (shown in Figure 1), the address, and number of dwelling units (“DUs”) associated with the site. All noise levels computed were the A-weighted equivalent sound level, or L_{eq}, in dBA (Appendix B provides a discussion of this descriptor). Loudest-hour noise levels were computed for Existing (2007) conditions and the design-year (2020) Build scenario Spur Alignment. One computed sound level at each site is shown for the Existing case, but three are shown for the Build case. The Build case noise levels shown are those from the existing roads alone, from the proposed

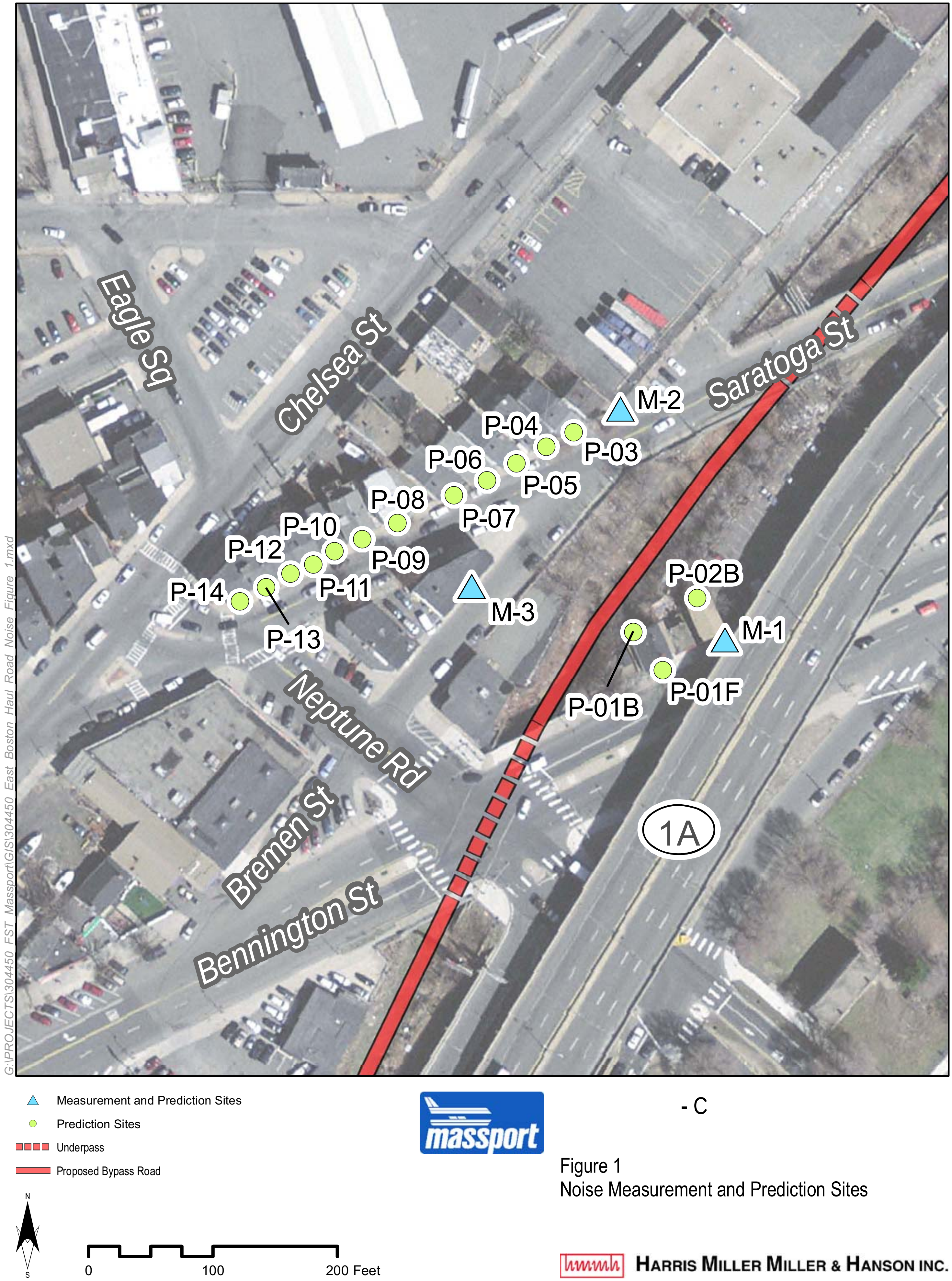

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Figure 1
Noise Measurement and Prediction Sites

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Table 3 Computed Existing and Future Build Noise Levels

			Computed PM Peak period Leq (dBA)*			
				Future Build 2020		
Site No.	Address	DUs	Existing 2007	Existing roads only	Bypass road only	All Roads
M-1	398 Bennington St. MF 2nd Row	2	**70.7**	**70.9**	49.2	**70.9**
M-2	546 Saratoga St. SF 1st Row	1	**66.1**	**66.3**	53.2	**66.5**
M-3	511 Saratoga St. CO 1st Row	0	63.3	63.8	47.0	63.9
P-01F	394 Bennington St. MF 2nd Row	0	**71.7**	**72.0**	50.5	**72.0**
P-01B	394 Bennington St. MF 1st Row	2	**67.0**	**67.3**	60.3	**68.1**
P-02B	398 Bennington St. MF 1st Row	2	64.5	64.8	54.2	65.2
P-03	544 Saratoga St. MF 1st Row	4	**66.2**	**66.6**	50.6	**66.7**
P-04	542 Saratoga St. MF 1st Row	3	**66.2**	**66.5**	48.8	**66.6**
P-05	540 Saratoga St. MF 1st Row	3	**66.1**	**66.4**	47.7	**66.5**
P-06	538 Saratoga St. MF 1st Row	2	**66.0**	**66.4**	46.5	**66.4**
P-07	534 Saratoga St. MF 1st Row	3	**65.5**	**65.8**	45.3	**65.8**
P-08	526 Saratoga St. MF 2nd Row	3	65.3	**65.6**	44.8	**65.6**
P-09	524 Saratoga St. MF 2nd Row	3	**65.6**	**65.8**	45.7	**65.8**
P-10	522 Saratoga St. MF 2nd Row	3	65.4	**65.6**	45.6	**65.6**
P-11	520 Saratoga St. MF 3rd Row	3	**65.6**	**65.8**	44.3	**65.8**
P-12	518 Saratoga St. MF 3rd Row	3	65.4	65.4	43.6	65.4
P-13	516 Saratoga St. MF 3rd Row	3	**65.5**	**65.6**	43.6	**65.6**
P-14	512 Saratoga St. MF 3rd Row	3	**65.5**	**65.6**	44.2	**65.6**

Note: Sound levels shown in **bold** font reflect noise impact – levels that approach or exceed the FHWA NAC

Chelsea Bypass roadway alone, and the total including the existing roads and Bypass. As shown in the table, computed noise levels that include all roadways range from 63 to 72 dBA L_{eq} (exterior) for Existing conditions, from 64 to 72 dBA L_{eq} (exterior) for the Build scenario. In the table, noise impact is shown with bold font, where the noise levels are computed to approach or exceed the FHWA Noise Abatement Criteria.

In general, computed Build noise levels are louder than Existing levels by only a few 10^{th}s of a decibel due to the small increase in background traffic volumes projected for the design year; these increases average about 10% on the local streets in the immediate study area. At sites that are set back from the proposed Bypass, the contribution to the total noise from traffic on the Bypass alone is 0.1 decibel or less. This small project-related increase is partly due to the already relatively high background noise levels in the study area, partly because the depressed Bypass is shielded by the edge of the cut, and partly because the Bypass has such low traffic volumes – only 48 trucks and buses per hour in both directions during the PM peak period.

The only sites where the Bypass road will cause greater than a 0.1 dBA increase in Existing noise levels are at the two two-family residential buildings on Bennington St. In the back yards of these homes, Build noise levels are predicted to be approximately 1 decibel greater than existing levels. At 398 Bennington St. (Site P-02B), the Existing L_{eq} is computed to be 64.5 dBA, and the Build level with the Bypass is

65.2 dBA. These noise levels are both below the FHWA Noise Abatement Criteria so would not result in an impact. It is generally acknowledged that such small increases in noise are not considered readily perceptible outside of a laboratory setting. Further, this increase is not significant because the MassDOT threshold for a “substantial increase” in existing noise is 10 decibels. At 394 Bennington St., (Site P-01B), the Existing L_{eq} is 67.0 dBA, and the Build level with the Bypass is projected at 68.1 dBA; a predicted increase of 1.1 dBA. Because the Build noise levels at this location will equal or exceed 66 dBA it is considered to be impacted.

5 NOISE IMPACT ASSESSMENT

The East Boston-Chelsea Bypass project is not expected to result in any operational/traffic noise impact in the community; construction activities would be expected to result in short-term increases. Only very small increases in noise levels are expected from the 2007 Existing to the 2020 Build condition. At most noise-sensitive residential properties in the study area these very slight increases in noise are due to the small growth in local street traffic expected over the 13-year period (approx. 6 to 12%), independent of the Bypass project. At two residential buildings, 394 and 398 Bennington Street, increases in traffic noise levels of up to one decibel are expected due to the Bypass project. However, such small increases are not considered readily perceptible to people outside of a laboratory setting.

Noise levels at the fronts of many of the homes in the study area along Saratoga Street exceed the FHWA’s Noise Abatement Criteria currently, and are expected to exceed the NAC in the future as well, with or without the Bypass project. At two of the homes, at 522 and 526 Saratoga Street, noise levels are projected to increase by only 2/10 decibel, from just below the impact threshold to just above it. However, it is important to point out that these noise exposures are not to the exterior portions of the properties that receive frequent outdoor use. Those patios and yards are on the backs of these homes, shielded from the noise on Saratoga Street, which is the primary cause of the impact noise levels at the front of the homes. Therefore, the common outdoor use areas of these homes are not exposed to noise impact from roadways near the Project or the Project itself.

The only common outdoor use area in the study area that is projected to be exposed to noise impact is in the back yard of the two-family home at 394 Bennington St. In this yard, the existing loudest-hour L_{eq} noise level is computed to be 67 dBA under Existing 2007 conditions, and it would increase to 68 dBA under future Build conditions with the Bypass. The impact at this home results because the Build noise level exceeds the FHWA NAC, not because of the increase, which is less than the 10 decibels required to represent a “substantial increase” in existing noise. In accordance with FHWA and MassDOT regulations, based upon predicted Build noise level, the project was required to consider the feasibility of providing noise abatement. Providing abatement to the yard of the two-family home from Bypass noise in the form of a noise barrier along the Bypass would not eliminate the noise impact, because the other, primary sources of noise at this property are on the other side of the house and would not be blocked by the barrier. Therefore, noise abatement for the project is not acoustically feasible because it cannot achieve the minimum 5 dB of noise reduction required by FHWA and MassDOT. Because noise abatement is not feasible, it will not be considered further in this project.

Appendix A MASSACHUSETTS DEPARTMENT OF TRANSPORTATION NOISE ABATEMENT GUIDELINES

This appendix includes pertinent portions of the Noise Abatement Guidelines of the Massachusetts Department of Transportation, approved in April 1996 by the Federal Highway Administration.

The Massachusetts Department of Transportation Type I Noise Abatement Guidelines

The following are the Massachusetts Department of Transportation guidelines for determining the need, feasibility and reasonableness of noise abatement measures for proposed highway construction and improvement projects. The Massachusetts Department of Transportation, in cooperation with the Federal Highway Administration, will make the final determination on all noise abatement related issues. Primary responsibility for highway noise abatement is with MassDOT Environmental Division. No commitment to noise abatement should be made without prior consultation with the Environmental Division. It is the policy of the MassDOT to establish and periodically update guidelines for the Type I Noise Abatement Projects.

23 CFR 772 will be the guiding document for all proposed highway projects that require analysis of or abatement of highway traffic noise.

1.) Consideration for Protection.

Predict the exterior, worst hour, design year noise levels, based on the difference between the future Build / No-build noise levels.

MassDOT Guideline:

An area is considered for protection when the exterior, worst hour, design year noise level (Leq(h)) either (1) approaches t within I dB) or exceeds the Noise Abatement Criteria for the corresponding land use category, or (2) exceeds the existing loudest hour noise level by 10 dB or more.

2.) Feasibility

Can a substantial noise reduction be achieved given the existing geometry? Topography, cross streets, ramps, driveways and other noise sources must be considered when assessing a barrier's ability to achieve substantial noise reduction. Safety and environmental impacts are important considerations in determining whether a barrier is feasible.

MassDOT Guideline:

The goal is to provide substantial protection for impacted receivers. Every effort should be made to attain a 10 dB (or higher) Insertion Loss (IL) at first-row receivers. However, for a barrier to be included in a Type I study, at least one first-row receiver should get a minimum of 7 dB IL. Safety factors that should be considered in the design of the barrier include maintaining a clear recovery zone, redirection of crash vehicles, adequate sight distance, and fire/emergency vehicle access. The design of the barrier should also consider environmental impacts such as wetland and animal migratory paths, etc.

3.) Reasonableness

Reasonableness implies that good judgement and common sense has been applied in arriving at a decision. Reasonableness should be based on a number of factors with regard to the individual specific needs of each project. The following criteria shall be used to determine the reasonableness of a barrier. ("Yes" means construction of a barrier is reasonable. "No" means construction of a barrier is not reasonable. "High" and "Low" indicate how the criteria should influence the overall decision to build a barrier.)

MassDOT Guideline:

I.) Cost Effectiveness

A Cost Effectiveness Index (CEI) should be calculated for each barrier. The units of CEI are: $/dBIL/unit.

Where:

$ = Total barrier cost.

dBIL = Average weighted insertion loss of protected dwelling units, in dBA

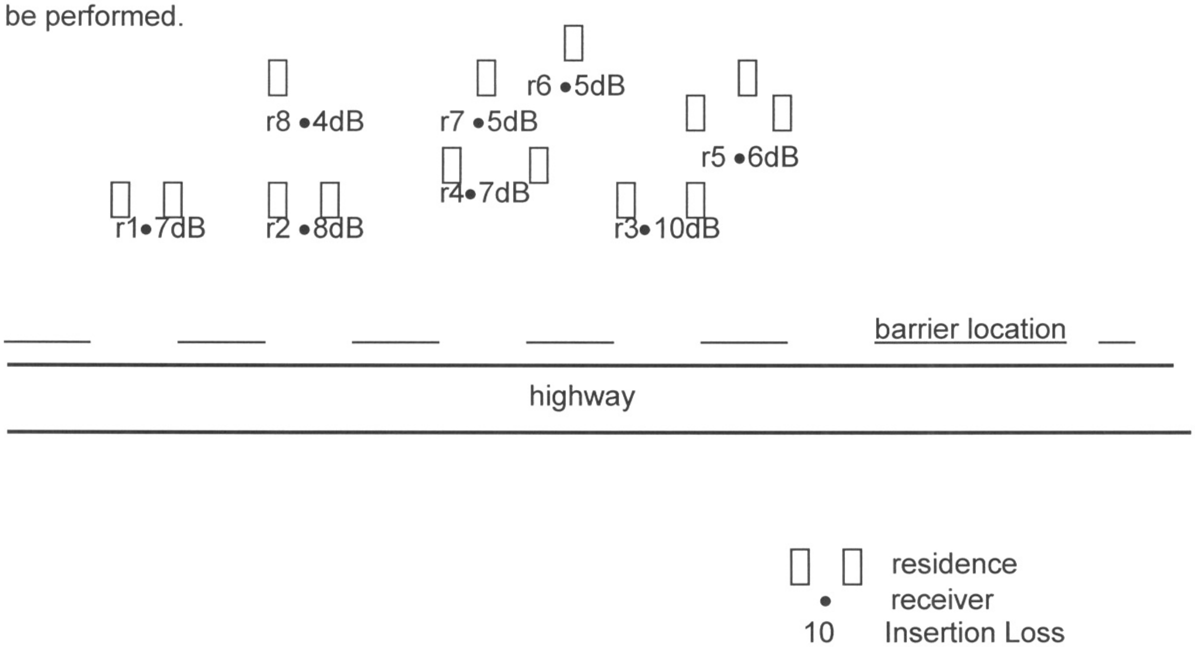
unit = Number of dwelling units protected in the study zone

The CEI shall be calculated based upon the noise reduction received at sensitive receptors in the study zone. The study zone is defined as the area 150 meters (500 ft.) back from the edge of the roadway directly behind the barrier. All receivers in the study zone attaining at least 5 dB IL will be counted as 'protected' and included in the cost effectiveness calculation. Receivers getting less than 5 dB of noise reduction should not be counted as protected. All noise barriers shall be designed to protect ground level exterior activity. In general, only the first floor dwellings of multi-family homes shall be included in a cost effectiveness calculation. However, If it can be clearly demonstrated that a multi-family dwelling provides ground level exterior activity for residents that occupy other levels of the structure, then those dwelling units may be included in the cost effectiveness calculation only after approval by the MassDOT Environmental Division.

For the purpose of developing the CEI, calculations shall be based on an average barrier material cost of $172.00 per square meter (Based on $16.00 per square foot. This figure is purely for developing the CEI. Actual costs will vary.) Every effort should be made to keep the barrier cost under $2,700 per dBIL per dwelling unit.

$ $/dBIL/unit	Reasonableness
< 2000	High Yes
2000 – 2700	Low Yes
2700 – 3400	Low No
> 3400	High No

The following figure shows an example of how the cost effectiveness calculation should be performed.



Barrier cost = $100,000.00
Residences studied = 14
Average Weighted Insertion Loss = dBIL

Receiver	Number of residences represented	Insertion Loss (dB)	Weighted Insertion Loss (dB)
R1	2	7	14
R2	2	8	16
R3	2	10	20
R4	2	7	14
R5	3	6	18
R6	1	5	5
R7	1	5	5
R8	(1) Not Protected	(4) Not Protected	Not Protected
Total = 13		Total = 92	

Average Weighted Insertion Loss = dBIL = 92/13 = 7 dBIL

Therefore: CEI = $100,000.00 / 7 dBIL / 13 residences protected
CEI = $1,190.48 / dBIL / Residence Protected

Appendix B DESCRIPTION OF NOISE METRICS

This Appendix describes the noise metrics used in this report.

B.1 A-weighted Sound Level, dBA

Loudness is a subjective quantity that enables a listener to order the magnitude of different sounds on a scale from soft to loud. Although the perceived loudness of a sound is based somewhat on its frequency and duration, chiefly it depends upon the sound pressure level. Sound pressure level is a measure of the sound pressure at a point relative to a standard reference value; sound pressure level is always expressed in decibels (dB), a logarithmic quantity.

People hear changes in sound level according to the following rules of thumb: 1) a change of 1 decibel or less in a given sound's level is generally not readily perceptible except in a laboratory setting; 2) a 5-dB change in a sound is considered to be generally noticeable in a community setting; and 3) it takes approximately a 10-dB change to be heard as a doubling or halving of a sound's loudness.

Another important characteristic of sound is its frequency, or "pitch." This is the rate of repetition of sound pressure oscillations as they reach our ears. Frequency is expressed in units known as Hertz (abbreviated "Hz" and equivalent to one cycle per second). Sounds heard in the environment usually consist of a range of frequencies. The distribution of sound energy as a function of frequency is termed the "frequency spectrum."

The human ear does not respond equally to identical noise levels at different frequencies. Although the normal frequency range of hearing for most people extends from a low of about 20 Hz to a high of 10,000 Hz to 20,000 Hz, people are most sensitive to sounds in the voice range, between about 500 Hz to 2,000 Hz. Therefore, to correlate the amplitude of a sound with its level as perceived by people, the sound energy spectrum is adjusted, or "weighted."

The weighting system most commonly used to correlate with people's response to noise is "A-weighting" (or the "A-filter") and the resultant noise level is called the "A-weighted noise level" (dBA). A-weighting significantly de-emphasizes those parts of the frequency spectrum from a noise source that occurs both at lower frequencies (those below about 500 Hz) and at very high frequencies (above 10,000 Hz) where we do not hear as well. The filter has very little effect, or is nearly "flat," in the middle range of frequencies between 500 and 10,000 Hz.

A-weighted sound levels are normally used to evaluate environmental noise because they have been found to correlate better than other weighting networks with human perception of "noisiness." One of the primary reasons for this is that the A-weighting network emphasizes the frequency range where human speech occurs. Noise interference with speech is the primary basis for the noise abatement programs supported by MassDOT and FHWA.

B.2 Equivalent Sound Level, Leq

The Equivalent Sound Level, abbreviated Leq, is a kind of average of the A-weighted sound levels over a particular period of interest -- for example, an hour, an 8-hour school day, nighttime, or a full 24-hour day. However, because the length of the period can be different depending on the time frame of interest, the applicable period should always be identified or clearly understood when discussing the metric. Such durations are often identified through a subscript, for example Leq(24).

Leq may be thought of as a constant sound level over the period of interest that contains as much sound energy as (is "equivalent" to) the actual time-varying sound level with its normal peaks and valleys.

These two signals (the constant one and the time-varying one), however, would sound very different from each other. The "average" sound level suggested by Leq is not an arithmetic value, but the average of the sound energy associated with the sound levels. Sound energy is the antilogarithm of the sound level, which as stated above, is a logarithmic quantity. Thus, the louder events in the noise environment, which have greater sound energy, will influence the Leq more than the quieter events. In the case of traffic noise, heavy trucks, which are louder than cars or medium trucks, can dominate the overall traffic noise Leq, but only if their percentage in the vehicle mix is more than about 5 or 10%.

The following figure is a graphic representation of the Leq noise metric. The shaded area in the figure represents the fluctuating A-weighted sound pressure levels for a typical one-minute interval period. The fluctuating sound pressure levels range from the low 50's to the mid 80's and are expressed in terms of A-weighted decibels. The bars in the figure represent the one-minute Leq that contains the same sound energy as the actual time-varying sound. For the one-minute period in the graph, the one-minute Leq is 76 dBA.

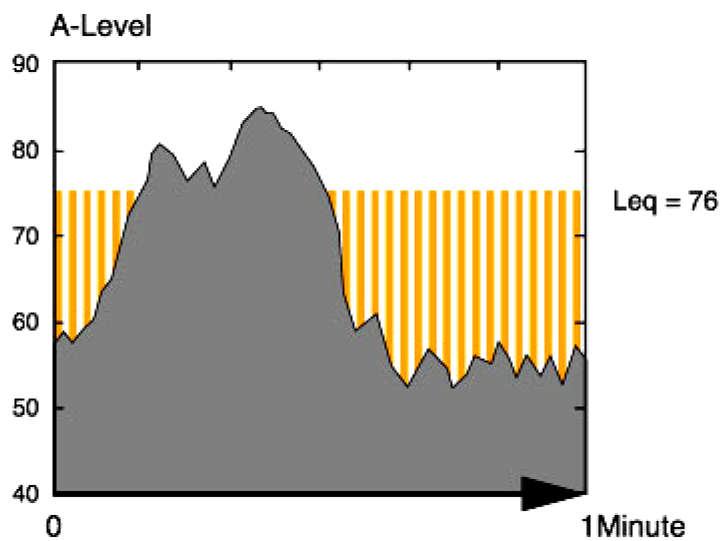


Figure B-1 Graphic Representation of the One-minute Equivalent Sound Pressure Level (L_{eq})

Appendix C TRAFFIC DATA USED IN NOISE MODELING

This appendix lists the traffic volumes and speeds used in the noise analysis modeling. The traffic volume data were provided by Massport (from CTPS) for the Existing case (2007) and the design-year (2020) Build scenarios.

Roadway	Speed (mph)	Existing Volumes			Build Volumes		
		Autos	Medium Trucks	Heavy Trucks	Autos	Medium Trucks	Heavy Trucks
Route 1A NB	45	1194	78	33	1341	88	37
Route 1A SB	45	1179	135	57	1324	152	64
Bennington Street EB - West of Neptune	30	433	17	0	940	21	5
Bennington Street WB - East of Route 1A	30	723	22	2	793	22	2
Bremen Street	20	60	0	0	57	0	0
Neptune Street - North of Bennington	15	377	48	10	390	25	5
Saratoga Street - West of Bremen	30	523	10	3	553	10	3
Chelsea Street - East of Saratoga	25	720	59	12	797	28	6
Haul Road NB	30	0	0	0	0	27	5
Haul Road SB	30	0	0	0	0	13	3
Neptune Street - South of Bennington	15	387	59	12	427	25	5
Bennington Street WB - Route 1A to Neptune	30	723	22	2	800	22	2
Bennington Street EB - East of Route 1A	30	850	19	5	477	17	0
Bennington Street WB - West of Neptune	30	397	19	5	440	21	5
Bennington Street EB - Neptune to Route 1A	30	850	19	5	407	11	3
Chelsea Street - West of Saratoga	25	953	47	9	1030	33	7
Saratoga Street - East of Bremen	30	383	8	3	410	8	3

Appendix C
Supplemental Transportation Information

1. **CTPS Model Methodology**
2. **Northern Terminus Traffic Analysis**
3. **Southern Terminus Traffic Analysis**

METHODOLOGY AND ASSUMPTIONS USED IN THE CTPS REGIONAL TRAVEL DEMAND MODEL SET FOR EAST BOSTON BYPASS ROAD STUDY

Central Transportation Planning Staff

State Transportation Building
Ten Park Plaza, Suite 2150
Boston, Massachusetts 02116

July 12, 2010

INTRODUCTION

The regional travel forecasting model set of the Central Transportation Planning Staff (CTPS) is based on procedures that have evolved over many years at CTPS. It follows the traditional four-step travel-modeling process of trip generation, trip distribution, mode choice, and trip assignment and is implemented in the EMME software package. This modeling process is employed to estimate present and future daily transit ridership (when applicable) and daily highway traffic volumes, primarily on the basis of demography and the characteristics of the transportation network. The model set simulates travel on the entire eastern Massachusetts transit and highway systems. When the model set is estimating future travel, the inputs include forecasts of demography and projections of transit and highway improvements.

This document gives a general description of the model set for the East Boston Bypass Road Study. The model set will be referred to as "the regional model," for simplicity's sake. The organization of this document is:

Description of the Regional Model

- Overview of the Four Steps
- Notable Features of the Regional Model
- Model Structures and Inputs
- Calibration of the Regional Model

The model set also incorporated the Logan Ground Access Mode Choice Model and the Tour-based Truck Travel Forecasting Model in this study. They will be described following the general description of the regional model.

DESCRIPTION OF THE REGIONAL MODEL

OVERVIEW OF THE FOUR STEPS

In the first step, the number of trips generated by residents of the CTPS Modeling Area (the 101 cities and towns that make up the Boston Region Metropolitan Planning Organization [MPO] area, together with 63 communities outside of the MPO area) is calculated using demographic and socioeconomic data. Similarly, the number of trips attracted to different types of land use, such as employment centers, schools, hospitals, shopping centers, etc., is estimated using land use data and trip generation rates obtained from household travel surveys. This information is produced at the level of disaggregated geographic areas known as transportation analysis zones (TAZs). All calculations are performed at the TAZ level.

In the second step, trip distribution, the model determines how the trips generated in each TAZ are distributed throughout the region. Trips are distributed based on transit and highway travel times, distances, and costs between TAZs and on the relative attractiveness of each TAZ, which is measured by the number of trips generated by that TAZ.

Once the number of trips of each purpose between each pair of TAZs is determined, the mode choice step of the model (step three) allocates the trips among the available modes of travel. The available modes of travel are walk, auto (single-occupancy vehicle [SOV] and carpool), and transit (subdivided by access mode: walking to transit or driving to transit). To determine the proportion of trips to allocate to each mode, the model takes into account the travel times and distances, number of transfers required, parking availability, and costs associated with each option. Other variables, such as auto ownership and household size, are also included in the model.

After estimating the number of trips by mode for each purpose for all possible TAZ combinations, the model assigns trips to their respective specific routes in trip assignment (the fourth and final step). This is necessary because there is often more than one highway route or transit path between two TAZs.

Various reports showing the transit ridership on different transit modes (including the specific ridership on each of the existing and proposed individual transit lines) and traffic volumes on the highway network are produced as needed. A schematic representation of the modeling process is shown in Figure 1.

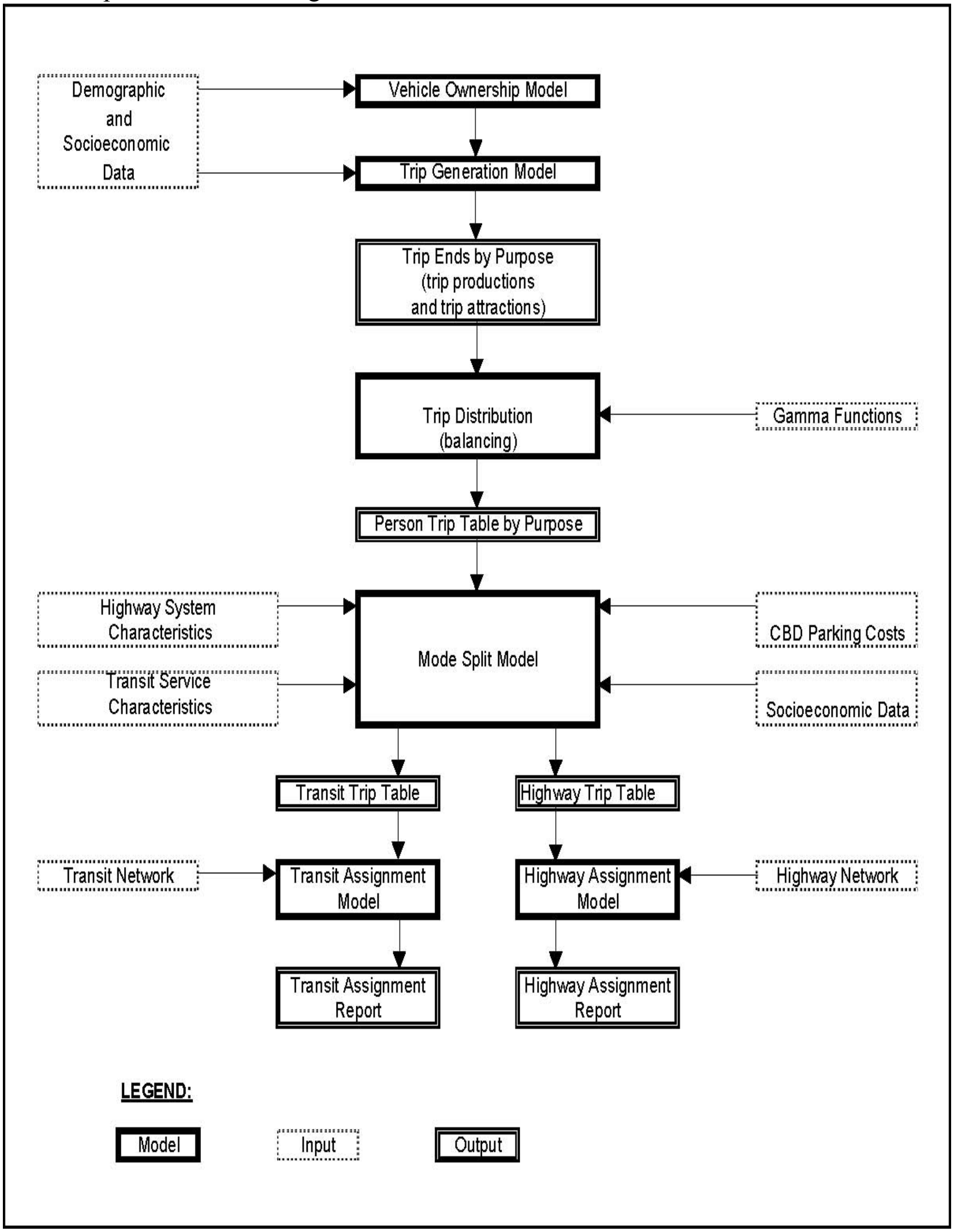
NOTABLE FEATURES OF THE REGIONAL MODEL

The model developed for the East Boston Bypass Road Study uses the best component models, networks, and input data available to CTPS at this time. Some of the notable features of the model are as follows:

- It incorporates both motorized and non-motorized trips.
- It simulates transit and highway travel during four time periods of a typical weekday.
- The trip generation, trip distribution, and mode choice components are well calibrated.
- EMME software used in implementing the model is capable of performing multi-class, multi-path assignment that is superior to the traditional all-or-nothing assignment.
- The procedure that estimates air quality benefits is sophisticated and well integrated within the main model.

FIGURE 1

The Four-Step Demand Modeling Process



MODEL STRUCTURES AND INPUTS

Modeled Area

The modeled area encompasses 164 cities and towns in eastern Massachusetts, which includes the 101 Boston Region MPO cities and towns and 63 additional communities, as shown in Figure 2.

Zone System

The modeled area is divided into 2,727 internal TAZs. There are 97 external stations around the periphery of the modeled area that allow for travel between the modeled area and adjacent areas of Massachusetts, New Hampshire, and Rhode Island.

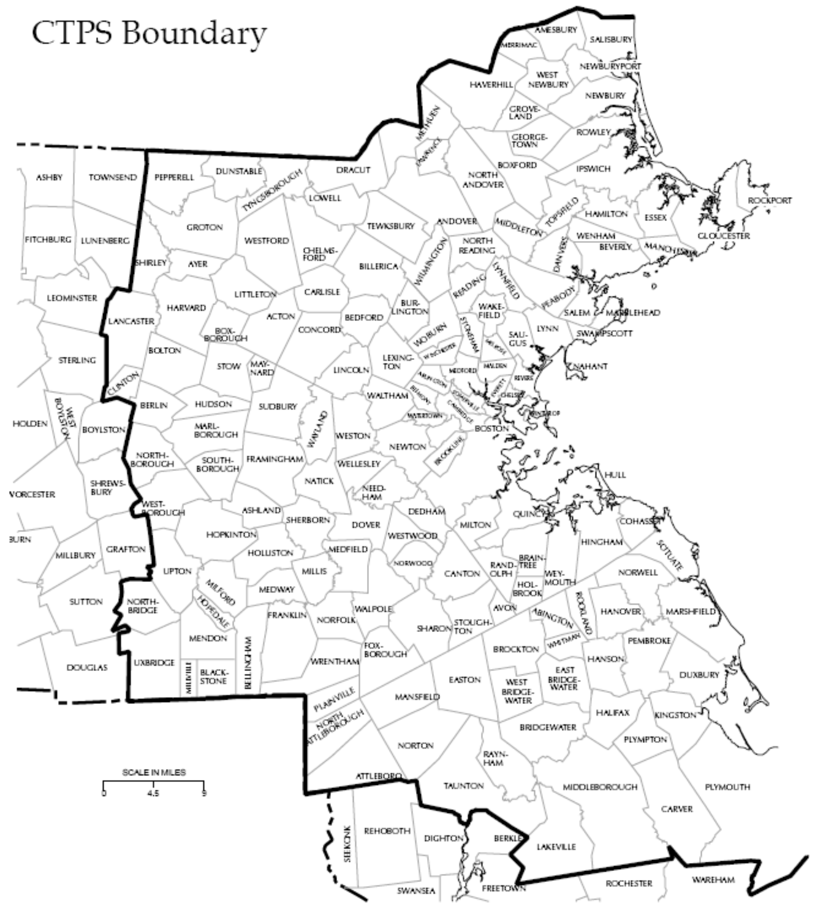
Transportation Networks

There are two types of network: transit and highway. Both are integrated in EMME. The highway network comprises express highways, principal and minor arterials, and local roadways. The transit network comprises commuter rail lines, rapid transit lines, bus lines (MBTA and private carriers), and boat lines. The model contains service frequency (i.e., how often trains and buses run), routing, travel time, and fares for all lines.

- *Highway Network*: The regional highway network contains almost 50,000 links and more than 21,000 nodes. It is fairly dense in the study area, although like any modeled network, it does not include some local and collector streets. Each link is coded with the appropriate free-flow speed, number of lanes, lane capacity and modes (e.g. SOV, HOV, hazardous truck, etc.). Functional class is coded onto the links as are various geographic flags useful for summarizing emissions.

- *Transit Network*: The transit network represents all regional transit agency bus and rail services in eastern Massachusetts, as well as private express buses and ferries. Most-likely travel paths are built through the network, skimmed, and the resulting impedances are input to the trip distribution and mode choice models. After mode choice, transit trip tables by time of day are assigned to the network travel paths.

FIGURE 2 CTPS Modeled Area



Major Data Inputs

CTPS's travel model underwent a major revision in 1993, and several important data sources were used in that revision. Those and other major data items underlying the model are as follows:

- *Household Travel Survey:* In 1991, CTPS conducted a household travel survey. The survey took the form of an activity-based travel diary that was filled out for one weekday. Approximately 4,000 households, generating some 39,000 weekday trips, were represented in the final database. The data were used to estimate new models for trip generation, auto ownership, trip distribution, and mode choice.

- *External Cordon Survey:* Also in 1991, a survey of automobile travelers bound for the modeled area from adjacent areas was performed. Survey results were used in trip generation and distribution to update estimates of external trips.

- *Site-Level Employment Database:* Employment estimates for 2000 were taken from a single, unified regional employment database based on employment data from the Department of Employment and Training and on extensive research by CTPS. Aggregate employment data for the year 2007 were used to update this database for use for the base-year analysis in the regional model version used for this study.

- *2000 U.S. Census:* Various census files were used in model estimation and calibration processes. In particular, Census Journey to Work information was incorporated into the model at several stages of model development.

- *Ground Counts:* Transit ridership and highway traffic volume data representing early 1990s conditions were amassed into a database and used to calibrate the components of the travel model. Updated counts and volumes have been used for model validation.

- *On Board Transit Survey:* CTPS surveyed passengers on all MBTA transit modes in an effort spanning the years 2008-2010. Data from this survey, specifically for transit service in the study area, were used to validate and calibrate components of trip distribution and mode choice for the model.

Analysis Year

The base year is 2007 and the forecast horizon year is 2020.

Time-of-Day Considerations

The mode choice and transit assignment steps of the modeling process are conducted on the basis of time periods. The four time periods modeled are an AM peak period (6:00 AM–9:00 AM), a midday period (9:00 AM–3:00 PM), a PM peak period (3:00 PM–6:00 PM), and a nighttime period (6:00 PM–6:00 AM). The trip generation model, however, is based on daily trips. The trip distribution model considers two time periods: peak (the AM peak and PM peak periods) and off-peak.

The trip volumes produced by the trip generation model are split into peak and off-peak period trips, the trip tables produced by the trip distribution model are split into the four time periods defined above, and the highway vehicle trips and transit person trips created by the mode choice model are converted from production/attraction format to an origin/destination format, based upon factors created from the data collected in the 1991 Household Travel Survey.

The final trip tables created for each time period reflect observed levels of congestion on the highway system. The results of the four assignments are summed to obtain daily (average weekday traffic [AWDT]) results.

Population, Household, and Employment Forecasts

All of the demographic assumptions, namely households, population, and employments came from the regional planning agencies (RPAs), which were covered by the CTPS regional travel demand model set and were used in the RPA's most current Long Range Transportation Plans.

Households and employment by type are major inputs to the travel model process: they are the variables upon which trip generation is performed. The forecasts for the region were developed by combining household and employment forecasts produced independently by the seven RPAs in eastern Massachusetts: the Central Massachusetts Regional Planning Commission (CMRPC), Merrimack Valley Planning Commission (MVPC), Metropolitan Area Planning Council (MAPC), Montachusett Regional Planning Commission (MRPC), Northern Middlesex Council of Governments (NMCOG), Old Colony Planning Council (OCPC), and Southeastern Regional Planning and Economic Development District (SRPEDD). Forecasts for the 101 cities and towns that make up the MAPC area (also the Boston Region MPO area) were developed by MAPC based on a scenario it has developed, known as the Metrofutures scenario, in which growth was targeted to communities' denser areas, with a focus on development around transit stations.

Employment base year estimates were developed in a different fashion than population and household estimates. CTPS examined the annual employment estimates produced by the state's Division of Employment and Training (DET). Differences in employment between 2000 and April 2008 were calculated at the town level for the region. These differences were then applied to the Boston Region MPO's year 2000 town level data and then distributed among each town's TAZ system according the year 2000 employment distribution. The realm of "basic" employment was refined according the extensive up-to-date manufacturing employment database maintained by CTPS. Thus, these sources were utilized to best reflect the reality of employment throughout the model area's geography in 2007. Future year (2020) employment projections for the region were taken from the Metrofutures scenario.

Forecasts for the 63 communities in the model belonging to RPAs other than MAPC were developed in a slightly different fashion. Each RPA independently maintains its own travel demand model, TAZ system, base-year estimates, and future-year forecasts. However, the Boston Region MPO's year 2000 data have long been accepted as the best possible and most refined and detailed demographics data set for the year 2000 for eastern Massachusetts, and significant faith has been invested in it.

For population, group quarters and households, estimates for the 2007 base year were calculated through interpolation of the 2000 estimates and 2010 forecasts. The changes between the 2010 and 2020 forecasts were calculated at each RPA's TAZ level and then, for the 63 communities outside of the Boston Region MPO, converted into the Boston Region MPO's TAZ system by use of a series of correspondence factors between the two sets of TAZs. The growth was then added to the year 2007 TAZ data for the future-year population and household forecasts.

2007 TAZ employment was estimated based upon 2000 TAZ employment estimates and the changes in town/city employment from 2000 to 2008. The absolute changes between the 2010 and 2030 forecasts were then added to these numbers to produce a new set of 2020 employment forecasts.

This combination of forecasts ensured the accuracy of the Boston Region MPO's widely accepted demographic data sets while still capturing and respecting much of the growth expressed and projected by the individual RPAs for the other 63 communities.

CALIBRATION OF THE REGIONAL MODEL

Calibration is the process in which model results or outputs are compared with observed data in order to assess the accuracy of a model. In winter 2005/2006 CTPS has made observations of traffic movement and volume on some key segments in the study area. And the information has helped CTPS to calibrate and provide reasonable forecast.

The model set used in the East Boston Bypass Road Study underwent an extensive calibration process. For the base year, the trip distribution, mode choice, and trip assignment models ran through an iterative feedback loop several times to estimate the most accurate model parameters possible. This process constitutes a feedback loop in that certain outputs from each model are in turn used as an input into another model. For instance, highway and transit skims are an output of the assignment model but are also an input into the trip distribution and mode choice models. An accurate model set can thus be obtained by iteratively running this chain of models until the products do not change significantly.

LOGAN GROUND ACCESS MODE CHOICE MODEL

The Logan Airport Passenger Ground Access Mode Choice Model was used to forecast the impact on the modal distribution of passenger travel to and from Logan Airport and the demand for parking at Logan Airport due to changes in the regional transportation system. This model was used because of the special transportation services in the regional network available for Logan passengers and because the factors that affect Logan modal choices are different from the factors affecting modal choices for other non-airport travel.

The current version of the Logan model was developed based upon the 2003 Logan passenger survey and has been validated to the 2007 Logan passenger survey data. This was accomplished by combining the survey data with travel time and cost data from the regional highway and transit networks along with Massport data on Logan services. The Logan model estimates the distribution of average weekday travel by sixteen market segments.

Since the Logan egress mode selection process is thought to differ significantly from the Logan access mode selection process, survey information on the relationship between the access and egress modes (not the access mode choice model) is used to forecast egress mode travel.

The results of the Logan Ground Access Mode Choice Model are added to the trip tables produced by mode choice step of the regional model.

TOUR-BASED TRUCK TRAVEL FORECASTING MODEL

The tour-based truck travel forecasting model includes its own trip generation and trip distribution processes. The results of these truck trip generation and distribution steps are then added to the trip tables produced in the mode choice step of the regional model. A separate model is used to estimate truck demand because truck trip making has fundamentally different characteristics from home based work, home based other, non-home based and home based school trip making.

The truck travel forecasting model was constructed so that it could forecast truck demand based on changes in demographics, tolls and infrastructure characteristics of the regional transportation system. The survey data used to estimate the truck model and truck trip ends included truck ownership information, truck/vehicle inventories and use surveys, surveys of local businesses, field observations of trucks, vehicle classification counts and information about truck travel by industrial sector, etc. Once truck trip ends are estimated the truck model then uses estimated trip ends and gamma functions to match regional trip length frequencies based on observed truck trip length frequencies. The resulting trip tables are created for three truck vehicle classes: commercial pickup trucks/vans, big trucks (including the seven U.S. DOT use categories) and tankers.

2. Northern Terminus Traffic Analysis

TRAFFIC ANALYSIS

Proposed Haul Road

East Boston, Massachusetts

Prepared for
Massachusetts Port Authority

Prepared by

ENGINEERS FST Since 1914

Fay, Spofford & Thorndike, LLC
Engineers ● Planners ● Scientists
Burlington, Massachusetts

August 2010

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1.0 INTRODUCTION

1.1 Overview

Fay, Spofford & Thorndike (FST) has been retained by MassPort to develop Preliminary Design Documents for construction of a new truck route from Frankfort Street to Chelsea Street in East Boston. The proposed Haul Road will run along an abandoned rail corridor and is intended to provide a more direct connection between the airport services and industrial facilities and parking lots in Chelsea. The new Haul Road will benefit the area by reducing the volume of trucks and buses that currently travel on Curtis Street toward the airport and on Neptune Road when leaving the airport. There are currently two separate locations where the Haul Road may intersect Chelsea Street. Location 1 would intersect approximately 400 feet north of Curtis Street (295 feet south of the Chelsea Street Bridge), while Location 2 is a former spur rail line intersecting approximately south of Curtis Street and is currently gated. At Location 2, the northbound approach to Chelsea Street intersects 180 feet south of Curtis Street, while the southbound departure utilizes Beck Street and intersects 410 feet south of Curtis Street

This memorandum provides an assessment of the traffic operations at both potential intersections of the proposed Haul Road with Chelsea Street. The study area for this project includes the proposed intersection of Chelsea Street with the proposed Haul Road and the adjacent intersection of Chelsea Street/Curtis Street, in East Boston, Massachusetts.

Due to the proximity to the intersection of Chelsea Street/ Curtis Street, in addition to the proximity to the Chelsea Street Bridge, consideration of vehicle queues is crucial in this area to ensure that vehicles will not block adjacent intersections and will not queue on the drawbridge.

2.0 EXISTING CONDITIONS

2.1 Existing Conditions

Chelsea Street is an urban minor arterial under City of Boston jurisdiction with a north-south orientation. Chelsea Street has a paved width of 48 feet and a Right-of-Way (ROW) width of 70 feet. The roadway and the Chelsea Street Bridge provide a connection between East Boston and the City of Chelsea. Sidewalks are located on both sides of the roadway. Curtis Street intersects Chelsea Street from the east to form a three-legged T-type intersection. Although there is no Stop sign or stop line on Curtis Street, Curtis Street acts as the minor roadway and stops while Chelsea Street operates as free flow. The proposed Haul Road will intersect Chelsea Street from the east, and will follow an existing abandoned rail corridor.

Chelsea Street at Curtis Street

3.0 TRAFFIC

3.1 Data Collection and Existing Traffic Volumes

In order to evaluate traffic operations, available traffic counts were researched. The Chelsea Street Bridge is currently under construction. Starting April 17, 2010 closures and detours were put into effect. Turning movement counts (TMCs) that were collected in October 2009 were obtained from MassPort for the intersection of Chelsea Street/ Curtis Street during the 4:00 - 6:00 PM peak traffic period.

In addition to manual counts, automatic traffic recorder (ATR) counts on Chelsea Street were obtained from MassDOT. The ATR data was collected on Chelsea Street in February 2010. This was supplemented with field observed turning movements to develop the morning peak hour volumes. These traffic counts are included in the Appendix of this document. A summary of the ATR traffic data is presented in Table 1.

Based on a review of the ATR data, traffic volumes on Chelsea Street are 48% higher during the weekday evening peak hour than during the morning peak hour. Therefore, the weekday evening peak hour represents the critical time period.

Table 1 – Existing (2009) Traffic Volumes

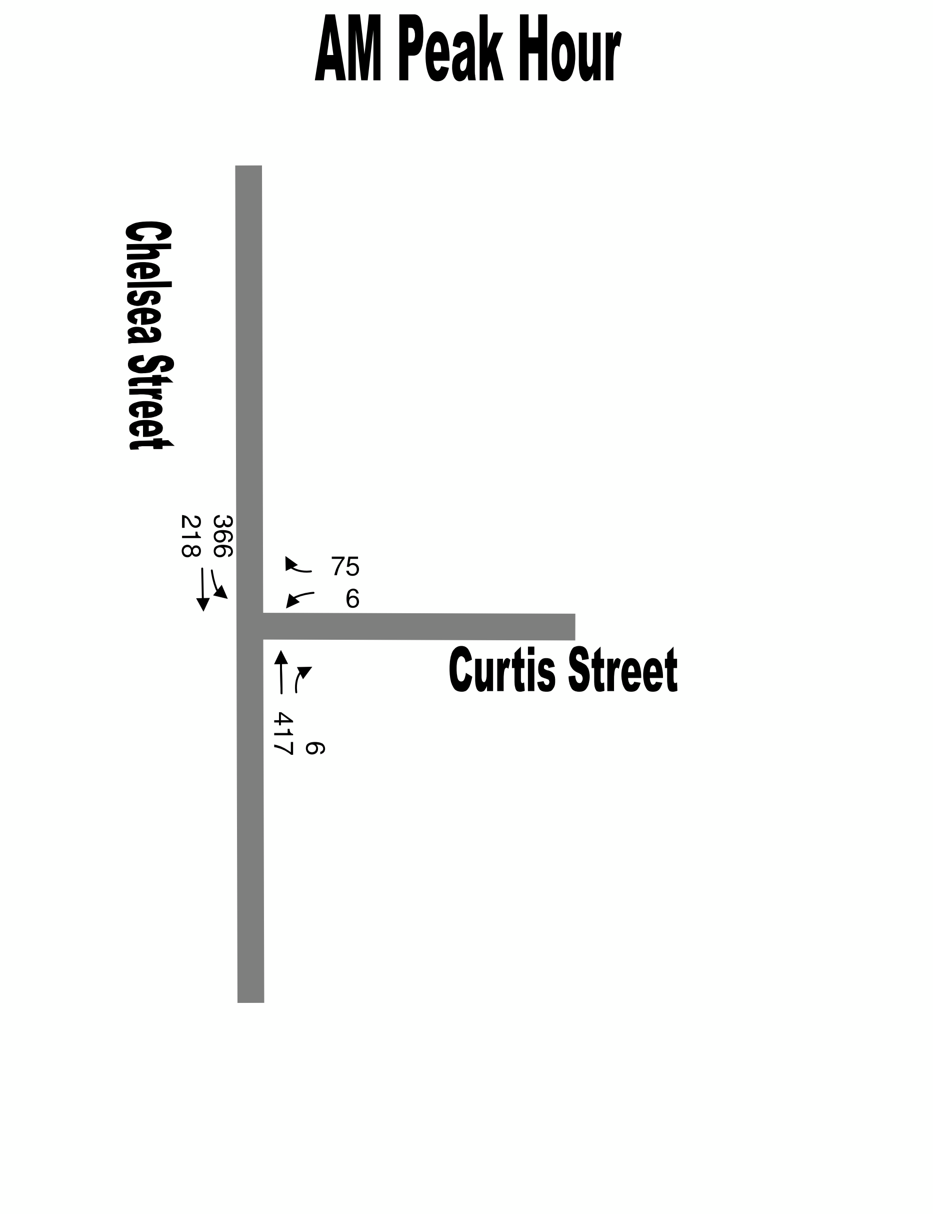
		AM Peak Hour		PM Peak Hour	
Location	Daily Volume [a]	Peak Hour Volume [b]	K [c]	Peak Hour Volume	K
Chelsea Street (north of Curtis Street)	20,200	1,020	5.0	1,505	7.4

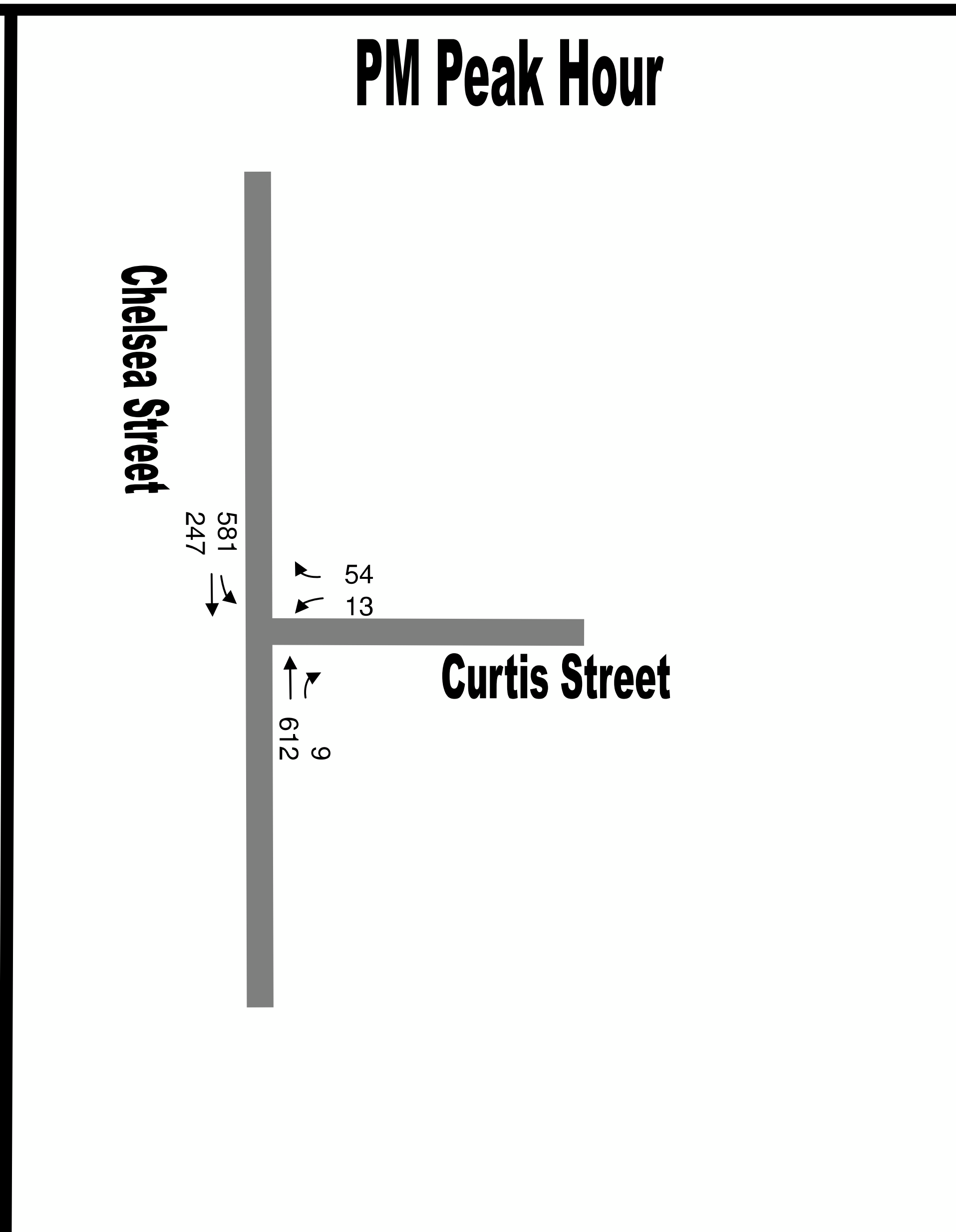
a daily traffic expressed in vehicles per day
b peak hour volumes expressed in vehicles per hour
c percent of daily traffic that occurs during the peak hour

3.2 Future Traffic Volumes

In order to evaluate the ability of Chelsea Street to accommodate the anticipated traffic growth in the area, future traffic demand volumes were developed. Recent traffic counts on Chelsea Street indicate that traffic volumes have decreased between 2004 and 2010. For this project a 10-year planning horizon was chosen based on the anticipated level of improvements. The future traffic volumes (2020) were developed by applying an annual background growth rate of 0.5% per year to current volumes to account for general traffic growth in the region.

The projected traffic volumes on the new Haul Road were obtained from the 2010 Final Environmental Impact Report for the MassPort Southwest Service Area Redevelopment Program. The proposed Haul Road will benefit the area by reducing the volume of trucks and buses that currently travel on Curtis Street toward the airport and on Neptune Road when leaving the airport. The 2020 No Build traffic volumes are shown in Figure 1. The 2020 Build traffic volumes for the potential Haul Road Location 1 condition are shown in Figure 2. The 2020 Build traffic volumes for the potential Haul Road Location 2 condition are shown in Figure 3.





Schematic Diagram: Not to Scale

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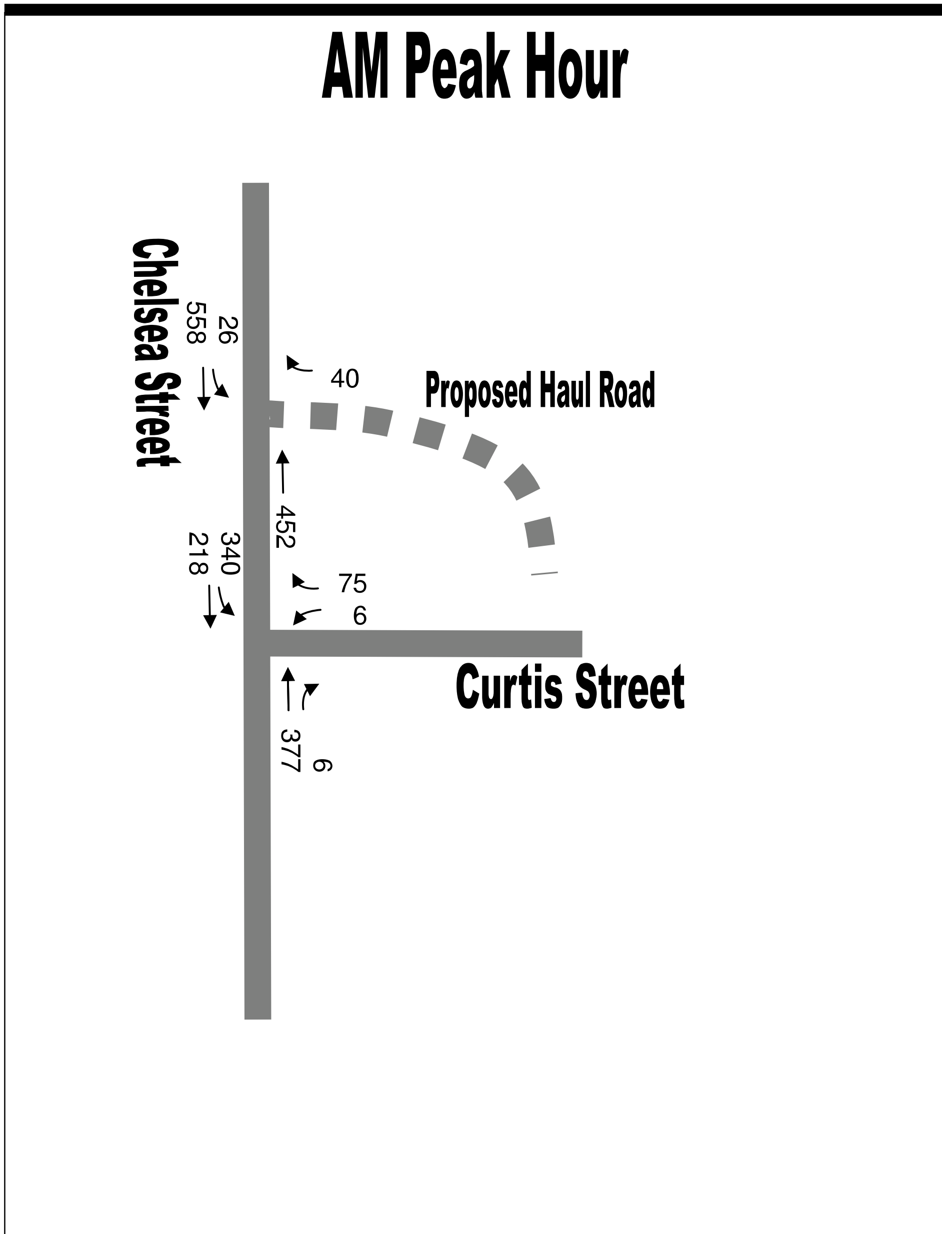
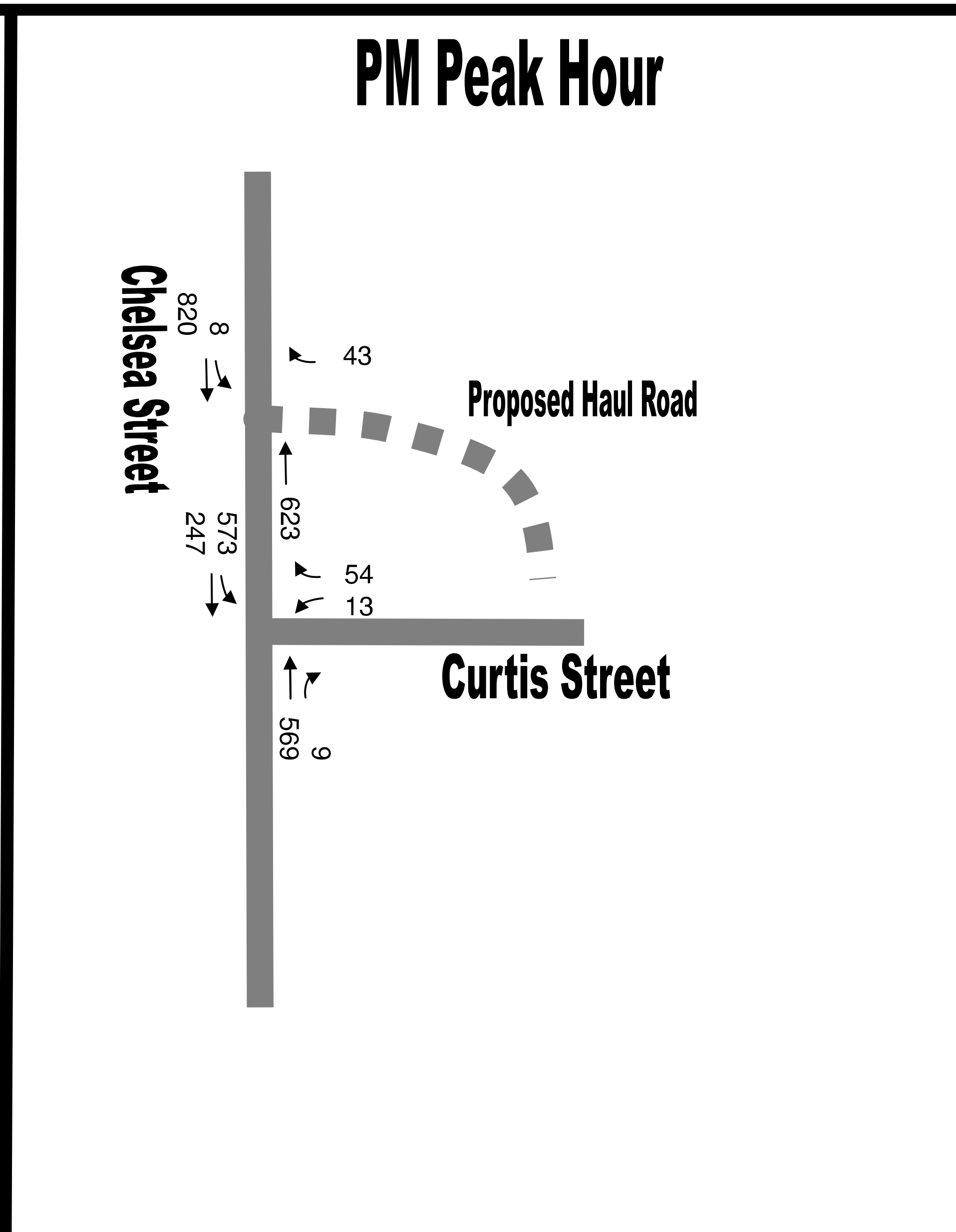
2020 No Build AM and PM Peak Hour Traffic Volumes

Proposed Haul Road
East Boston, Massachusetts

Figure 1





Schematic Diagram: Not to Scale

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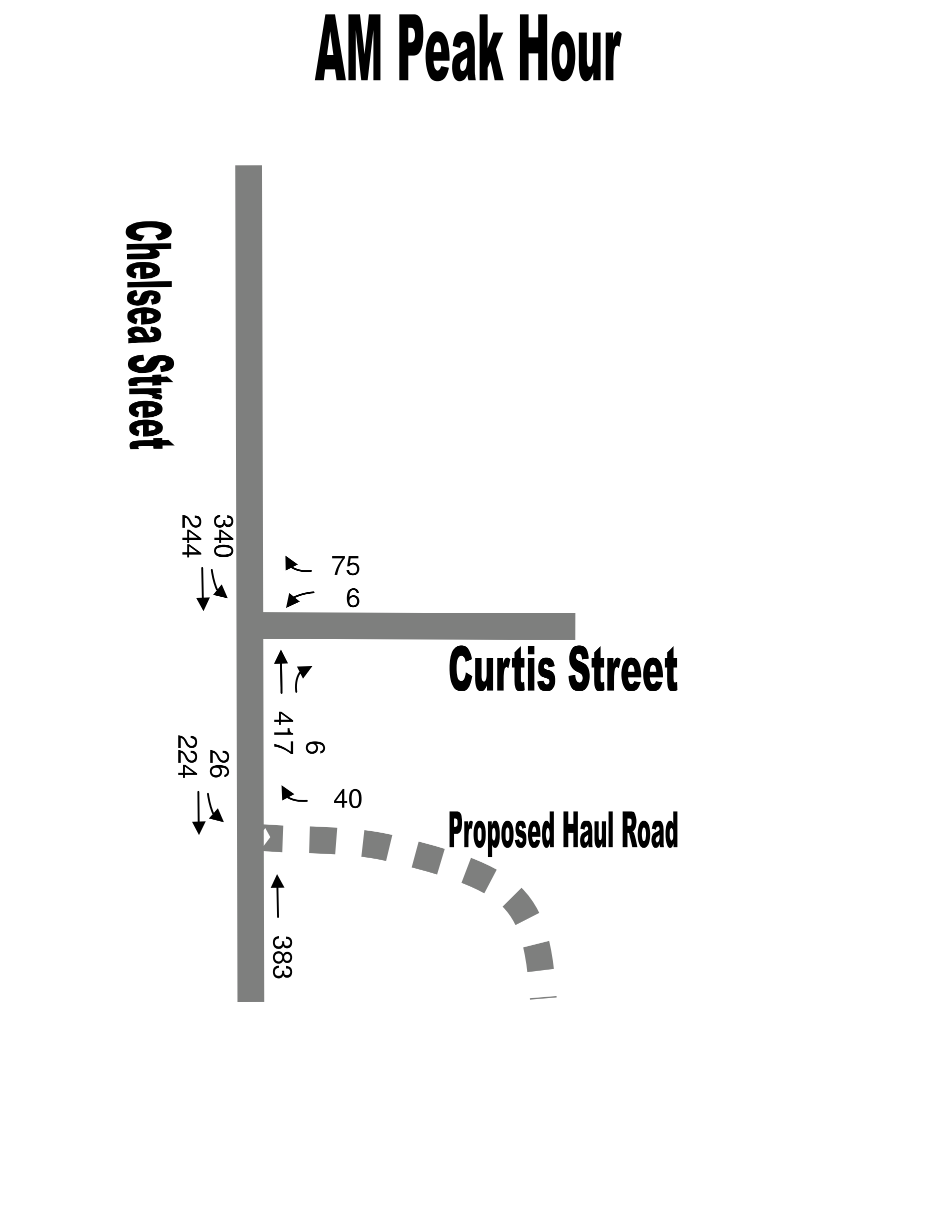
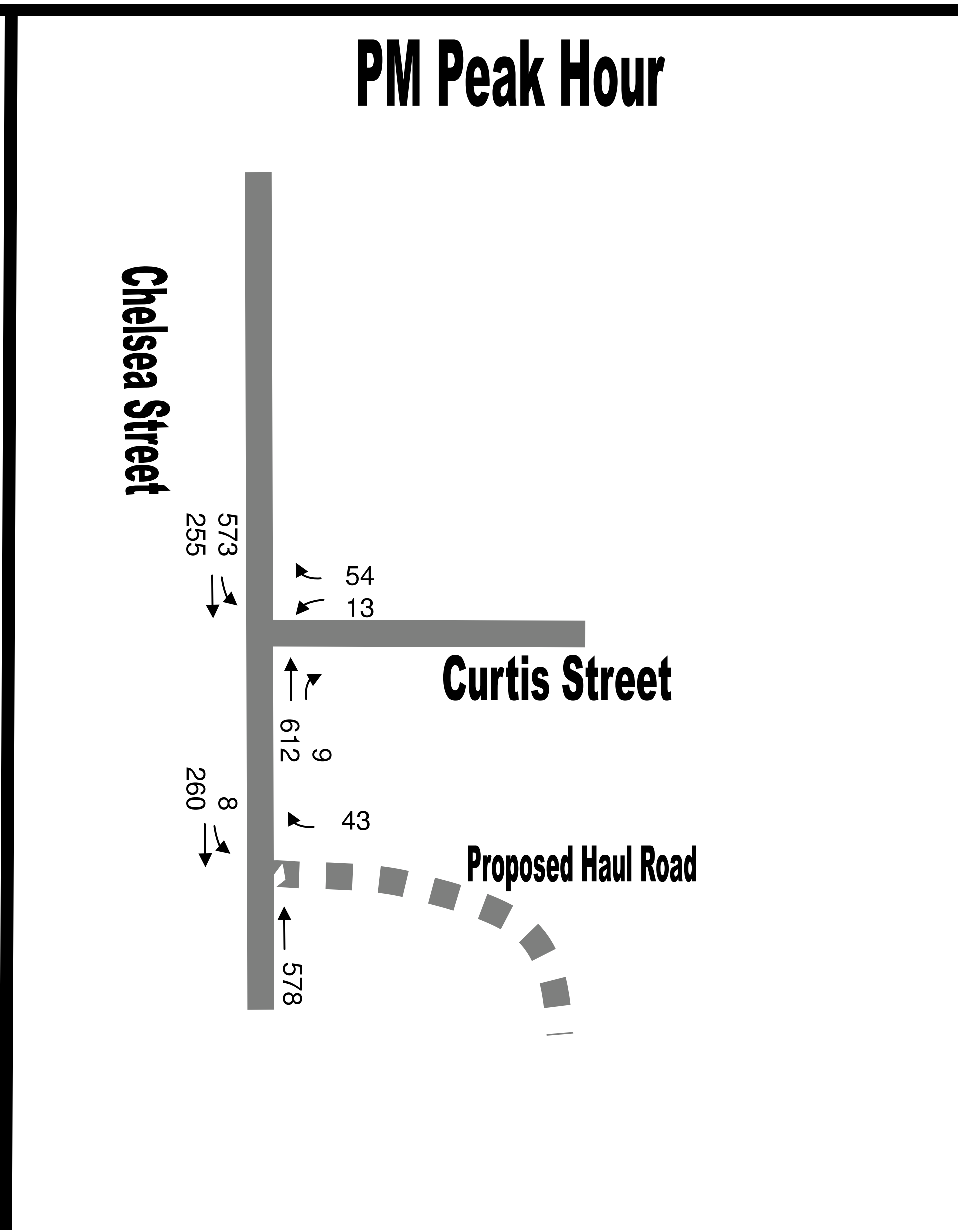
2020 Build AM and PM Peak Hour Traffic Volumes Location 1

Proposed Haul Road East Boston, Massachusetts

Figure 2





Schematic
Diagram:
Not to Scale

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2020 Build AM and PM Peak Hour Traffic Volumes Location 2

Proposed Haul Road
East Boston, Massachusetts

Figure 3

3.3 Safety Analysis

MassDOT crash history data for this location were reviewed for the 3-year period from 2006 through 2008. At the Chelsea Street/ Curtis Street intersection, 5 crashes were reported during the three-year period, an average of 1.67 accidents per year. The data indicates that this is not a high accident location.

Although the number of accidents alone is important, the actual exposure or potential for an individual driver being involved in an accident is reflected in the crash rate. The crash rate is defined as the number of accidents per million entering vehicles at an intersection. Using MassDOT's Crash Rate Worksheet, the intersection of Chelsea Street/ Curtis Street was found to have 0.24 crashes for every million vehicles entering the intersection. This is lower than the MassDOT average crash rate of 0.59 crashes per million vehicles for unsignalized intersections in MassDOT District 4, and supports the initial assessment that this is not a high accident location.

Table 2 - Crash Summary

Year	
2006	2
2007	1
2008	2
Total	5
Average per year	1.7
Crash Rate	0.24
Severity	
Property Damage Only	1
Non-Fatal Injury	1
Fatal Injury	0
Not Reported	3
Total	5
Type of Accident	
Angle	0
Rear-End	3
Not Reported	2
Total	5

Note: Crash rate expressed as crashes per million entering vehicles (mev)

3.4 Traffic Signal Warrant Analysis

The Manual on Uniform Traffic Control Devices (MUTCD) contains 9 warrants for the installation of traffic signals. These warrants, which consider vehicular and pedestrian volumes, delay, and crash history, are listed below.

Warrant 1. Eight-Hour Vehicular Volume
Warrant 2. Four-Hour Vehicular Volume
Warrant 3. Peak Hour
Warrant 4. Pedestrian Volume
Warrant 5. School Crossing
Warrant 6. Coordinated Signal System
Warrant 7. Crash Experience
Warrant 8. Roadway Network
Warrant 9. Intersection Near a Grade Crossing

An intersection need satisfy only one of these warrants to support the installation of a traffic signal. However, satisfying one or more of these warrants does not require in itself either the installation or the continued operation of a traffic signal. Furthermore, per the Massachusetts Amendments to MUTCD regarding the factors for justifying traffic control signals, MassDOT views the satisfaction of Warrant 1 (Eight- Hour Vehicular Volume) as paramount when justifying a traffic control signal based on vehicular traffic flow.

An analysis of the signal warrants was conducted for the two intersections, and it was determined that three warrants are satisfied at the intersection of Chelsea Street/ Curtis Street. However, no warrants are met at the proposed Haul Road at either proposed location. Therefore, a signal could be installed at the intersection of Chelsea Street/ Curtis Street. The warrants are based on the heavy Chelsea Street southbound left turn volumes conflicting with the northbound through movement. The following are the traffic signal warrants that are met.

<u>Chelsea Street at Curtis Street</u>

Warrant 1. Eight-Hour Vehicular Volume
Warrant 2. Four-Hour Vehicular Volume
Warrant 3. Peak Hour

4.0 IMPROVEMENTS

4.1 Alternatives

With the objective of reducing the volume of trucks and buses that currently travel on Curtis Street toward the airport and on Neptune Road when leaving the airport, a new roadway is proposed. The Haul Road will follow an abandoned rail line between Frankfort Street and Chelsea Street. There are currently two separate locations where the Haul Road may intersect Chelsea Street. Location 1 would intersect approximately 400 north of Curtis Street (295 feet south of the Chelsea Street Bridge), while Location 2 is a former spur rail line intersecting south of Curtis Street, which is currently gated. At Location 2, the northbound approach to Chelsea Street intersects 180 feet south of Curtis Street, while the southbound departure utilizes Beck Street and intersects 410 feet south of Curtis Street.

Chelsea Street northbound near Location 1 (approaching Chelsea Street Bridge)

For both locations, two Alternatives considered for each location. Therefore, the following four Alternatives were analyzed.

- Alternative 1A – Intersection at Location 1 - No Signalization
- Alternative 1B – Intersection at Location 1 - Traffic Signal at Curtis Street
- Alternative 2A – Intersection at Location 2 - No Signalization
- Alternative 2B – Intersection at Location 2 - Traffic Signal at Curtis Street

4.2 Level of Service Criteria

Level of Service (LOS), an expression of traffic flow, is a commonly used and accepted measure of effectiveness of peak-hour traffic operating conditions. It takes into account such factors as automobile and truck volumes, roadway width, speed, grades, parking restrictions, pedestrian activity, and traffic control devices.

LOS is designated in a range from Level "A", which is the optimal condition where a roadway's operating conditions are at their best, to Level "F", which indicates traffic jam conditions. Levels "A" through "D" are typically associated with acceptable levels of peak-hour traffic operation within urban areas, with LOS "D" marking the boundary between acceptable and unacceptable traffic conditions. At Level "E", the ratio of the approach volume to capacity, or v/c ratio, of an intersection is between 90 and 100 percent of its theoretical capacity. Traffic congestion is considered to be unacceptable at LOS "E" or "F".

All capacity analysis for this study was performed in accordance with the methodologies set forth in the *Highway Capacity Manual 2000* (HCM). As defined in the HCM, LOS for unsignalized and signalized intersections is defined in terms of the average control delay in seconds per vehicle approaching the intersection for the peak 15-minute analysis period of a peak hour. The delay criteria and their associated LOS rankings are given in Tables 3 and 4.

Table 3 – Level of Service Criteria for Unsignalized Intersections

Level of Service	Total Delay (sec/veh)
A	≤10.0
B	10.1 to 15.0
C	15.1 to 25.0
D	25.1 to 35.0
E	35.1 to 50.0
F	> 50.0

Source:*Highway Capacity Manual 2000*, TRB

Table 4 – Level of Service Criteria for Signalized Intersections

Level of Service	Control Delay (sec/veh)
A	≤ 10.0
B	10.1 to 20.0
C	20.1 to 35.0
D	35.1 to 55.0
E	55.1 to 80.0
F	> 80.0

Source:*Highway Capacity Manual 2000*, TRB

4.3 Traffic Operations

The projected (2020) peak hour traffic volumes were used in the capacity analysis conducted on the study area intersections. For this analysis, two locations were considered, with two Alternatives considered for each location. Location 1 involves intersecting Haul Road with Chelsea Street north of Curtis Street while Location 2 involved intersecting Haul Road with Chelsea Street south of Curtis Street. The two alternatives consisted of a signalized alternative and an unsignalized alternative. Capacity Analysis was conducted for the following four Alternatives:

- Alternative 1A – Intersection at Location 1 - No Signalization
- Alternative 1B – Intersection at Location 1 - Traffic Signal at Curtis Street
- Alternative 2A – Intersection at Location 2 - No Signalization
- Alternative 2B – Intersection at Location 2 - Traffic Signal at Curtis Street

Since the location of the Haul Road will impact traffic volumes at each intersection, analysis was conducted separately for each location and is presented in separate tables. Table 5 shows AM and PM peak hour traffic operations for the study area intersections assuming Location 1, while Table 6 shows traffic operations for the study area intersections assuming Location 2. For unsignalized analysis, delays and queues are calculated only for the minor street movements and mainline left turns. For signalized analysis, delays and queues are calculated for each lane group.

Location 1

For the Location 1 scenario, the results of the analysis are summarized in Table 5. This analysis indicates that under Alternative 1A, which does not involve signalization, operations at the intersection of Chelsea Street/ Curtis Street will improve slightly from No Build Conditions due to the relocation of trucks and buses away from the intersection. The critical Chelsea Street southbound queue (95th percentile) is projected to be 164 feet during the weekday evening peak hour. The projected queue turning left onto the Haul Road or taking a right exiting the Haul Road is projected to be limited to less than one vehicle.

Under Alternative 1B, which includes signalization, operations at the intersection of Chelsea Street/ Curtis Street will improve significantly for the Curtis Street approach, but will result in increased delay and queues on Chelsea Street. The critical Chelsea Street southbound queue (95th percentile) is projected to be 374 feet during the weekday evening peak hour. The projected queue turning left onto the Haul Road or taking a right exiting the Haul Road is projected to be less than one vehicle.

Since southbound left turn and northbound through queues will increase under the signalized alternative (Alternative 1B), the benefit of signalization is minimal and limited to improving the Curtis Street approach. Therefore, we do not recommend signalization.

Table 5– Location 1 - Peak Hour Traffic Operations

	AM Peak Hour					PM Peak Hour				
				Queue[3]					Queue	
Alternative/ Movement	v/c[1]	Delay[2]	LOS	50%	95%	v/c	Delay	LOS	50%	95%
No Build Conditions – (Unsignalized)										
Curtis Street WB LR	0.27	19.8	C		29	1.37	377.2	F		185
Chelsea Street SB L	0.39	10.8	B		53	0.74	19.9	C		189
Haul Road WB R			N/A					N/A		
Chelsea Street SB L			N/A					N/A		
Alternative 1A – (Unsignalized)										
Curtis Street WB LR	0.23	17.4	C		25	1.10	249.7	F		159
Chelsea Street SB L	0.35	10.2	B		44	0.70	17.7	C		164
Haul Road WB R	0.10	14.5	B		10	0.15	18.2	C		14
Chelsea Street SB L	0.04	10.3	B		3	0.01	11.2	B		1
Alternative 1B – (Signalized)										
Curtis Street WB LR	0.14	20.5	C	2	43	0.27	27.5	C	6	49
Chelsea Street NB TR	0.64	13.5	B	96	220	0.93	37.2	D	303	505
Chelsea Street SB L	0.61	5.5	A	31	78	0.94	33.3	C	160	374
Chelsea Street SB T	0.18	2.0	A	17	31	0.19	1.7	A	20	35
OVERALL	**0.55**	**8.9**	**A**			**0.86**	**29.3**	**C**		
Haul Road WB R	0.09	13.2	B		8	0.12	15.7	C		12
Chelsea Street SB L	0.04	10.1	B		3	0.01	11.2	B		1

1. volume-to-capacity ratio.
2. delay in seconds per vehicle.
3. Queue in feet per lane (based on 28 feet/vehicle)

50% Queue Length not calculated for unsignalized intersections
N/A = Haul Road does not exist under No Build Conditions

Location 2

For the Location 2 scenario, the results of the analysis are summarized in Table 6. This analysis indicates that under Alternative 2A, which does not involve signalization, operations at the intersection of Chelsea Street/ Curtis Street will remain approximately the same as No Build Conditions. Since the Haul Road would be south of Curtis Street, the total volume at the intersection of Chelsea Street/ Curtis Street will not change. The critical Chelsea Street southbound queue (95th percentile) is projected to be 180 feet during the weekday evening peak hour. The projected queue turning left onto the Haul Road or taking a right exiting the Haul Road is projected to be limited to less than one vehicle.

Under Alternative 2B, which includes signalization, operations at the intersection of Chelsea Street/ Curtis Street will improve significantly for the Curtis Street approach, but will result in increased delay and queues on Chelsea Street. The critical Chelsea Street southbound queue (95th percentile) is projected to be 393 feet during the weekday evening peak hour. The Chelsea Street northbound queue (95th percentile) is projected to be 537 feet during the weekday evening peak hour, which will block the intersection with the proposed Haul Road. The projected queue turning left onto the Haul Road or taking a right exiting the Haul Road is projected to be less than one vehicle.

Since southbound left turn and northbound through queues will increase under the signalized alternative (Alternative 2B), the benefit of signalization is minimal and limited to improving the Curtis Street approach. Therefore, we do not recommend signalization.

Table 6– Location 2 - Peak Hour Traffic Operations

Alternative/ Movement	AM Peak Hour v/c[1]	Delay[2]	LOS	Queue[3] 50%	95%	PM Peak Hour v/c	Delay	LOS	Queue 50%	95%
No Build Conditions – (Unsignalized)										
Curtis Street WB LR	0.27	19.8	C		29	1.37	377.2	F		185
Chelsea Street SB L	0.39	10.8	B		53	0.74	19.9	C		189
Haul Road WB R			N/A					N/A		
Chelsea Street SB L			N/A					N/A		
Alternative 2A – (Unsignalized)										
Curtis Street WB LR	0.26	19.0	C		28	1.30	339.7	F		178
Chelsea Street SB L	0.36	10.5	B		47	0.72	19.2	C		180
Haul Road WB R	0.09	13.4	B		9	0.14	17.1	C		13
Chelsea Street SB L	0.04	9.9	A		3	0.01	10.9	B		1
Alternative 2B – (Signalized)										
Curtis Street WB LR	0.15	22.1	C	2	45	0.28	28.5	C	6	49
Chelsea Street NB TR	0.65	13.7	B	111	299	1.00	53.4	D	329	537
Chelsea Street SB L	0.62	6.0	A	31	85	0.96	38.0	D	173	393
Chelsea Street SB T	0.22	2.0	A	20	36	0.20	1.6	A	21	37
OVERALL	**0.57**	**9.3**	**A**			**0.88**	**37.8**	**D**		
Haul Road WB R	0.09	13.4	B		9	0.14	17.1	C		13
Chelsea Street SB L	0.04	10.1	B		3	0.01	10.2	B		1

1. volume-to-capacity ratio.
2. delay in seconds per vehicle.
3. Queue in feet per lane (based on 28 feet/vehicle)
50% Queue Length not calculated for unsignalized intersections
N/A = Haul Road does not exist under No Build Conditions

When comparing the relative benefits of Location 1 and Location 2, it can be seen that the construction of the Haul Road at Location 1 will have a greater improvement on the operations at Chelsea Street/ Curtis Street due to its ability to remove vehicles from this intersection. The operations at the intersection of Chelsea Street/ Haul Road would not vary significantly under either Location scenario. Both locations would remove truck and bus traffic from Neptune Road and Day Square equally due to the relocated traffic that exits the airport.

5.0 SUMMARY

The proposed Haul Road will result in relocating trucks and buses away from Curtis Street and Day Square and onto the new Haul Road directly into the airport roadway system. Two locations for the Haul Road intersections were evaluated, each with two alternatives. Location 1 involves intersecting Chelsea Street north of Curtis Street while Location 2 involves intersecting Chelsea Street south of Curtis Street.

Alternatives 1A and 2A involved constructing the proposed Haul Road but does not involve signalizing the Chelsea Street/ Curtis Street intersection. Alternatives 1B and 2B involved constructing the proposed Haul Road and also includes signalizing the Chelsea Street/ Curtis Street intersection.

A summary of the advantages and disadvantages for each of the alternatives is discussed below.

The two alternatives consisted of a signalized alternative and an unsignalized alternative. Capacity Analysis was conducted for the following four Alternatives:

- Alternative 1A – Intersection at Location 1 - No Signalization
- Alternative 1B – Intersection at Location 1 – Traffic Signal at Curtis Street
- Alternative 2A – Intersection at Location 2 - No Signalization
- Alternative 2B – Intersection at Location 2 - Traffic Signal at Curtis Street

Alternative 1A – Intersection at Location 1 - No Signalization
Advantages – Will remove trucks and buses from Curtis Street and Neptune Road.
Slight improvement at the intersection of Chelsea Street/ Curtis Street.
The operations at the Chelsea Street/ Haul Road intersection are projected to operate adequately. The construction of the Haul Road at Location 1 will remove vehicles from the intersection of Curtis Street.

Disadvantages – Due to proximity to the Chelsea Street Bridge, managing southbound vehicle queues will critical.

Alternative 1B – Intersection at Location 1 – Traffic Signal at Curtis Street
Advantages – Will remove trucks and buses from Curtis Street and Neptune Road.
The operations at the Chelsea Street/ Haul Road intersection are projected to operate adequately. The construction of the Haul Road at Location 1 will remove vehicles from the intersection of Curtis Street.

Disadvantages – Signalization will negatively impact the Chelsea Street operations. Southbound left turning vehicles at Curtis Street are projected to occasionally queue into the proposed Haul

Road intersection. Due to proximity to the Chelsea Street Bridge, managing southbound vehicle queues will critical.

Alternative 2A – Intersection at Location 2 - No Signalization
Advantages – Will remove trucks and buses from Curtis Street and Neptune Road. The operations at the Chelsea Street/ Haul Road intersection are projected to operate adequately

Disadvantages – Will not remove traffic from the intersection of Chelsea Street/ Curtis Street.

Alternative 2B – Intersection at Location 2 – Traffic Signal at Curtis Street
Advantages – Will remove trucks and buses from Curtis Street and Neptune Road. The operations at the Chelsea Street/ Haul Road intersection are projected to operate adequately.

Disadvantages – Signalization will negatively impact the Chelsea Street operations. Northbound Chelsea Street vehicles at Curtis Street are projected to queue into the proposed Haul Road intersection. Will not remove traffic from the intersection of Chelsea Street/ Curtis Street.

Since the Chelsea Street delay and queues will increase under the signalized alternatives (Alternatives 1B and 2B), the benefit of signalization is minimal and limited to improving the Curtis Street approach. Therefore, we do not recommend signalization.

Based on the projected traffic volumes and capacity results, operations at the proposed intersection of Chelsea Street at both Location 1 and Location 2 both are adequate. When comparing the relative benefits of Location 1 and Location 2, it can be seen that the construction of the Haul Road at Location 1 will have a greater improvement on the operations at Chelsea Street/ Curtis Street due to its ability to remove vehicles from this intersection. This report does not address construction costs of either alternative or impacts to adjacent property.

ATTACHMENTS

Turning Movement Counts, Chelsea Street at Curtis Street
Thursday, Oct. 29, 2009
Data collected by Stephen L.

Car: Cars and Lt. Vehicles
Truck: Trucks, Bus, Heavy Vehicles

000000000001 Chelsea-Curt 01 1446 102909 1645 102909 0015 00 6 100 14000

		North				East				South				West						
		Chelsea St Southbound				Curtis Street (Westbound)				Chelsea St Northbound				n/a						
	Time	Straight (Car)	Straight (Truck)	Left (Car)	Left (Truck)	Right (Truck)	Right (Car)	Left (Truck)	Left (Car)	Right (Truck)	Right (Car)	Straight (Truck)	Straight (Car)	**Ped**	**Right**	**Thru**	**Left**	**Total**	**Date**	**Day**
0 0 1	1500	65	7	139	20	4	8	0	0	2	0	11	107	0	0	0	0	**363**	10/29/2009	Thurs
0 0 1	1515	56	1	120	23	5	8	0	4	0	0	12	162	0	0	0	0	**391**	10/29/2009	Thurs
0 0 1	1530	46	2	109	12	2	12	2	3	2	2	12	136	0	0	0	0	**340**	10/29/2009	Thurs
0 0 1	1545	55	2	101	26	2	10	0	1	1	2	7	132	0	0	0	0	**339**	10/29/2009	Thurs
0 0 1	1600	47	4	68	11	6	17	1	0	0	2	4	142	0	0	0	0	**302**	10/29/2009	Thurs
0 0 1	1615	51	2	68	10	3	11	1	1	0	0	5	176	0	0	0	0	**328**	10/29/2009	Thurs
0 0 1	1630	55	1	67	14	5	16	1	3	1	1	7	177	0	0	0	0	**348**	10/29/2009	Thurs
0 0 1	*1645*	*49*	*5*	*55*	*9*	*3*	*8*	*1*	*0*	*0*	*1*	*5*	*146*	*0*	*0*	*0*	*0*	***282***	10/29/2009	Thurs
1 Hour Summary																				
Period begin																		**Total**		
	1500	222	12	469	81	13	38	2	8	5	4	42	537	0	0	0	0	**1433**	10/29/2009	Thu
	1600	202	12	258	44	17	52	4	4	1	4	21	641	0	0	0	0	**1260**	10/29/2009	Thu
	1700																	**0**	10/29/2009	Thu
	1800																	**0**	10/29/2009	Thu
	hour	424	24	727	125	30	90	6	12	6	8	63	1178	0	0	0	0	**2,693**		
	total (cl	424	24	727	125	30	90	6	12	6	8	63	1178					2693		
	avg.	212	12	364	63	15	45	3	6	3	4	32	589					673	hour	
	avg.	53	3	91	16	4	11	1	2	1	1	8	147					337	15-min	
		95%	5%	85%	15%	25%	75%	33%	67%	43%	57%	5%	95%							
	car vs. truck			89%	11%			26%	74%			5%	95%							
	movement		34%	66%			87%	13%			1%	99%								

Mass Highway Department
WEEKLY SUMMARY FOR LANE 1
Starting: 2/5/2010

Site Reference: 000000000101
Site ID: 010160000738
Location: CHELSEA ST NB, N. OF CURTIS ST.
Direction: NORTH

File: 101.prn
City: BOSTON (E. BOSTON)
County: CLASS

TIME	MON 8	TUE 9	WED	THU	FRI 5	WKDAY AVG	SAT 6	SUN 7	WEEK AVG	TOTAL
01:00	142	120				131	196	208	166	666
02:00	93	95				94	182	169	134	539
03:00	102	100				101	174	156	133	532
04:00	185	186				185	187	175	183	733
05:00	247	241				244	221	213	230	922
06:00	291	284				287	201	175	237	951
07:00	411	418				414	266	166	315	1261
08:00	488	473				480	299	164	356	1424
09:00	438	465				451	369	261	383	1533
10:00	479	471			532	494	425	326	446	2233
11:00	489				498	493	439	379	451	1805
12:00	586				562	574	599	459	551	2206
13:00	597				658	627	594	485	583	2334
14:00	590				672	631	515	545	580	2322
15:00	662				528	595	538	582	577	2310
16:00	706				688	697	512	510	604	2416
17:00	791				869	830	491	475	656	2626
18:00	736				807	771	466	459	617	2468
19:00	511				503	507	402	368	446	1784
20:00	416				467	441	376	317	394	1576
21:00	343				399	371	342	411	373	1495
22:00	304				337	320	345	271	314	1257
23:00	256				304	280	306	358	306	1224
24:00	187				328	257	252	207	243	974
TOTALS	10050	2853	0	0	8152	10275	8697	7839	9278	37591
% AVG WKDY	97.8	27.7			79.3		84.6	76.2		
% AVG WEEK	108.3	30.7			87.8		93.7	84.4		
AM Times	12:00	08:00			12:00	12:00	12:00	12:00	12:00	
AM Peaks	586	473			562	574	599	459	551	
PM Times	17:00				17:00	17:00	13:00	15:00	17:00	
PM Peaks	791				869	830	594	582	656	

K = 7%
D = 55%
Tph = 7%
Tad = 9%

U5

NB 10275
SB 9972
COMB AWD 20247
FAC .99
COMB ADT 20,000

Mass Highway Department
WEEKLY SUMMARY FOR LANE 1
Starting: 2/5/2010

Site Reference: 000000000102
Site ID: 010160000791
Location: CHELSEA ST SB, N. OF CURTIS ST.
Direction: SOUTH

File: 102.prn
City: BOSTON (E. BOSTON)
County: CLASS

TIME	MON 8	TUE 9	WED	THU	FRI 5	WKDAY AVG	SAT 6	SUN 7	WEEK AVG	TOTAL
01:00	153	140				146	260	198	187	751
02:00	129	101				115	205	205	160	640
03:00	81	82				81	135	120	104	418
04:00	97	118				107	141	105	115	461
05:00	162	134				148	147	150	148	593
06:00	195	191				193	155	125	166	666
07:00	387	365				376	189	140	270	1081
08:00	555	525				540	240	126	361	1446
09:00	685	744				714	355	235	504	2019
10:00	564	544			555	554	417	301	476	2381
11:00	543				500	521	461	298	450	1802
12:00	542				569	555	523	408	510	2042
13:00	583				614	598	565	481	560	2243
14:00	531				602	566	537	520	547	2190
15:00	628				569	598	526	465	547	2188
16:00	728				690	709	501	470	597	2389
17:00	678				673	675	491	473	578	2315
18:00	585				626	605	455	467	533	2133
19:00	536				526	531	474	418	488	1954
20:00	422				416	419	397	358	398	1593
21:00	371				430	400	399	490	422	1690
22:00	288				386	337	336	300	327	1310
23:00	232				244	238	272	278	256	1026
24:00	169				323	246	233	228	238	953
TOTALS	9844	2944	0	0	7723	9972	8414	7359	8942	36284
% AVG WKDY	98.7	29.5			77.4		84.3	73.7		
% AVG WEEK	110	32.9			86.3		94	82.2		
AM Times	09:00	09:00			12:00	09:00	12:00	12:00	12:00	
AM Peaks	685	744			569	714	523	408	510	
PM Times	16:00				16:00	16:00	13:00	14:00	16:00	
PM Peaks	728				690	709	565	520	597	

MassHighway

CRASH RATE WORKSHEET

CITY/TOWN : **East Boston** COUNT DATE : 2010 | *MHD USE ONLY*

DISTRICT : **4** UNSIGNALIZED : **x** SIGNALIZED : | Source #

~ INTERSECTION DATA ~

MAJOR STREET : **Chelsea Street** | RIN #

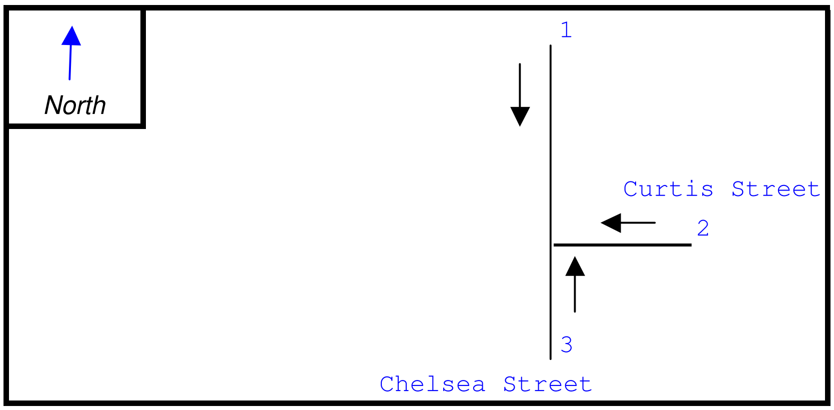
MINOR STREET(S) : **Curtis Street** | RIN #

RIN #

RIN #

RIN #

INTERSECTION DIAGRAM (Label Approaches)



INTERSECTION REF #

Peak Hour Volumes *(PM)*

APPROACH :	**1**	**2**	**3**	**4**	**5**	**6**
DIRECTION :	SB	WB	NB			
VOLUMES (PM) :	784	63	588			

" K " FACTOR : 0.074 APPROACH ADT : 19,392 **ADT** = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 5 # OF YEARS : 3 AVERAGE # OF ACCIDENTS (**A**) : 1.67

CRASH RATE CALCULATION : 0.235

$$\text{RATE} = \frac{(A \times 1{,}000{,}000)}{(ADT \times 365)}$$

Comments :

massDOT **#REF!**

Crash Number	City/Town Name	Crash Date	Crash Time	Crash Severity	Number of Vehicles	Total Nonfatal Injuries	Total Fatal Injuries	Manner of Collision	Vehicle Action Prior to Crash	Vehicle Travel Directions	Most Harmful Events	Vehicle Configuration	Road Surface Condition	Ambient Light	Weather Condition	At Roadway Intersection	Distance from Nearest Roadway Intersection	anc e fro	nce from Near	Distance from Nearest Landmark	Non Motorist Type	X Coordinate	Y Coordinate
2512360	BOSTON (EAST BOSTON)	15-Jun-2008	10:20 PM	Property damage only (none injured)	2	0	0	Rear-end	V1: Travelling straight ahead / V2:Travelling straight ahead	V1:Southbound / V2:Southbound	V1: Not reported / V2: Not reported	V1: Passenger car / V2:Not reported	Dry	Dark - lighted roadway	Cloudy		CURTIS STREET / CHELSEA STREET					239307.6408	903822.0623
2488502	BOSTON (EAST BOSTON)	16-Jan-2008	2:00 AM	Not Reported	2	0	0	Rear-end	V1: Travelling straight ahead / V2:Turning left	V1:Northbound / V2:Westbound	V1: Not reported / V2: Not reported	V1: Passenger car / V2:Passenger car	Dry	Daylight	Clear	CHELSEA STREET / CURTIS STREET						239307.6408	903822.0623
2269654	BOSTON (EAST BOSTON)	02-Jan-2007	3:00 AM	Non-fatal injury	2	1	0	Rear-end	V1: Slowing or stopped in traffic / V2:Travelling straight ahead	V1:Northbound / V2:Not reported	V1: Not reported / V2: Not reported	V1: Passenger car / V2:Not reported	Dry	Daylight	Clear	CHELSEA STREET / CURTIS STREET						239307.640789852	903822.062322687
2101952	BOSTON (EAST BOSTON)	09-Mar-2006	11:45 AM	Not Reported	2	0	0	Not reported	V1:Not reported / V2:Eastbound	V1: Not reported / V2: Not reported	Dry	Daylight	Clear		CHELSEA STREET / CURTIS STREET					239307.640789847	903822.062322683		
2088805	BOSTON (EAST BOSTON)	06-Apr-2006	2:20 AM	Not Reported	2	0	0	Not reported	V1:Not reported / V2:Not reported	V1: Not reported / V2: Not reported	Dry	Daylight	Clear	CHELSEA STREET / CURTIS STREET						239307.640789847	903822.062322683		

HCS+: MUTCD Signal Warrants Release 5.2

Analyst: atc
Agency: FST
Project ID: Minor Street = Southbound leftysis Year: 2010
EW Street: Curtis Street

Intersection: Chelsea Street/ Curtis Street
Jurisdiction:
NS Street: Chelsea Street

General Information

Major St. Speed (mph): 0
Nearest Signal (ft): 0
Crashes per Yr: 0

Population: Not less than 10000
Coordinated Signal System: N

School Crossing

Students in Highest Hour: 0
Adequate Gaps in Period: 0
Minutes in Period: 0

Roadway Network

Two Major Routes: 0
Weekend Count: 0
5-yr Growth Factor: 0

Geometry and Traffic

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	0	0	1	0	0	0	1	0	0	0	0
LaneUsage				L				T				

Results

Warrant 1: Eight-Hour Vehicular Volume [X]
1 A. Minimum Vehicular Volumes [X]
1 B. Interruption of Continuous Traffic [ ]
1 80% Vehicular --and-- Interruption Volumes [ ]

Warrant 2: Four-Hour Vehicular Volume
2 A. Four-Hour Vehicular Volumes [X]

Warrant 3: Peak Hour [X]
3 A. Peak-Hour Conditions [ ]
3 B. Peak-Hour Vehicular Volume Hours Met [X]

Warrant 4: Pedestrian Volume [ ]
4 A. Pedestrian Volumes [ ]
4 B. Gaps Same Period [ ]

Warrant 5: School Crossing [ ]
5 A. Student Volumes [ ]
5 B. Gaps Same Period [ ]

Warrant 6: Coordinated Signal System
6 Degree of Platooning [ ]

Warrant 7: Crash Experience [ ]
7 A. Adequate trials of alternatives [ ]
7 B. Reported crashes [ ]
7 80% Volumes for Warrants 1A, 1B --or-- 4 [X]

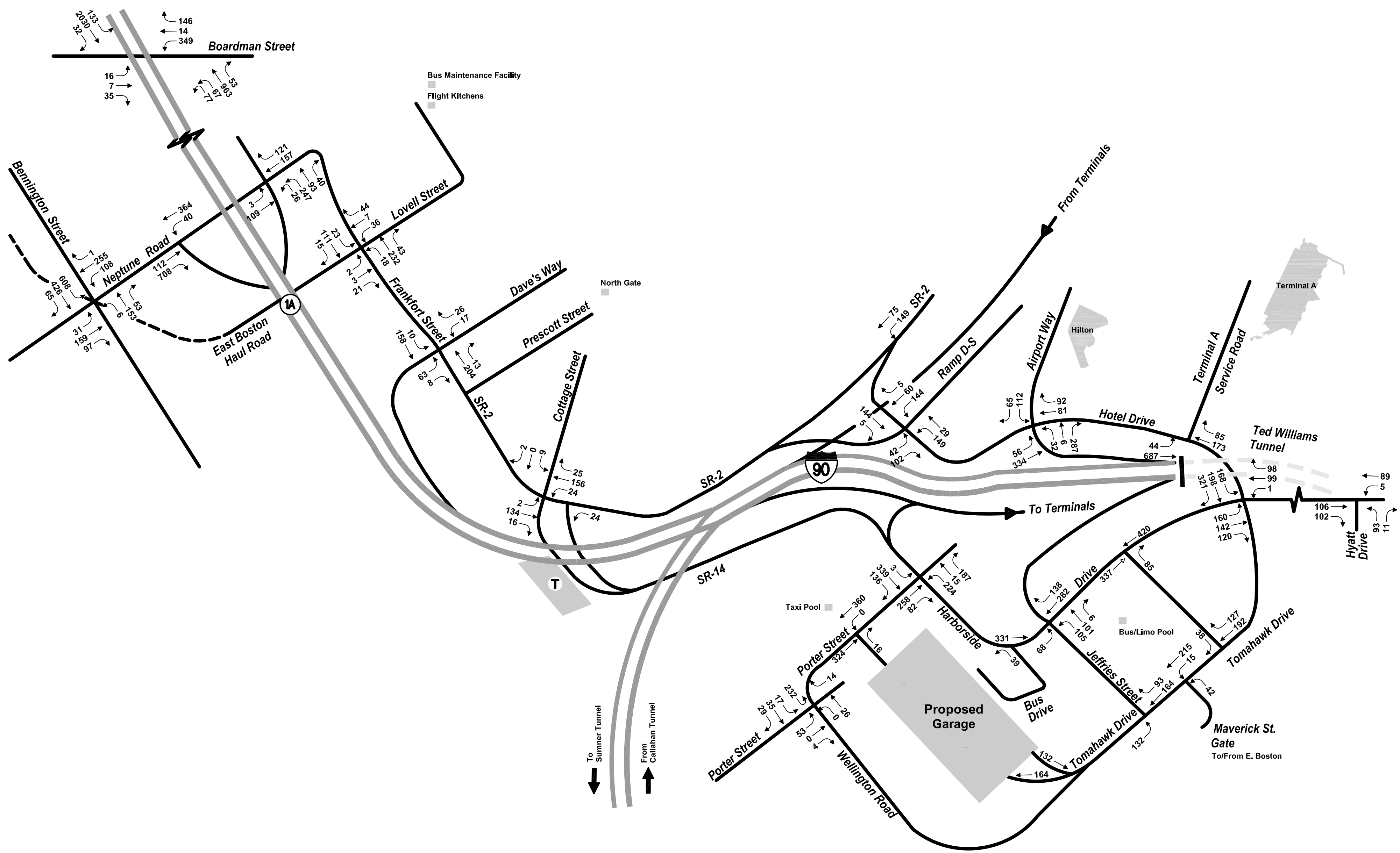
Warrant 8: Roadway Network [ ]
8 A. Weekday Volume [ ]
8 B. Weekend Volume [ ]

Summary

Hours	Major Volume	Minor Volume	Total Volume	Delay (Veh-hr)	1A 100%	1A 80%	1B 100%	1B 80%	2 100%	3A 100%	3B 100%
12-13	588	352	940	0.0	Yes	Yes	No	No	Yes	No	No
13-14	597	388	985	0.0	Yes	Yes	No	No	Yes	No	Yes
14-15	590	384	974	0.0	Yes	Yes	No	No	Yes	No	Yes
15-16	662	430	1092	0.0	Yes	Yes	No	Yes	Yes	No	Yes
16-17	706	459	1165	0.0	Yes	Yes	No	Yes	Yes	No	Yes
17-18	791	441	1232	0.0	Yes	Yes	Yes	Yes	Yes	No	Yes
18-19	736	380	1116	0.0	Yes	Yes	No	Yes	Yes	No	Yes
19-20	511	332	843	0.0	Yes	Yes	No	No	Yes	No	No
20-21	0	0	0	0.0	No	No	No	No	No	No	No
21-22	0	0	0	0.0	No	No	No	No	No	No	No
22-23	0	0	0	0.0	No	No	No	No	No	No	No
23-00	0	0	0	0.0	No	No	No	No	No	No	No
Total	5181	3166	8347		8	8	1	4	8	0	6

Traffic Volumes (vph)

Eastbound			Westbound			Northbound			Southbound		
L	T	R	L	T	R	L	T	R	L	T	R
0	0	0	352	0	0	0	588	0	0	0	0
0	0	0	388	0	0	0	597	0	0	0	0
0	0	0	384	0	0	0	590	0	0	0	0
0	0	0	430	0	0	0	662	0	0	0	0
0	0	0	459	0	0	0	706	0	0	0	0
0	0	0	441	0	0	0	791	0	0	0	0
0	0	0	380	0	0	0	736	0	0	0	0
0	0	0	332	0	0	0	511	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0



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massport

Southwest Service Area Redevelopment Program

Logan International Airport
East Boston, Massachusetts

PGAL | PB planning collaborative

VHB Vanasse Hangen Brustlin, Inc.

Figure 3.23

2018 Build Condition
Weekday AM Peak Hour Traffic Volumes

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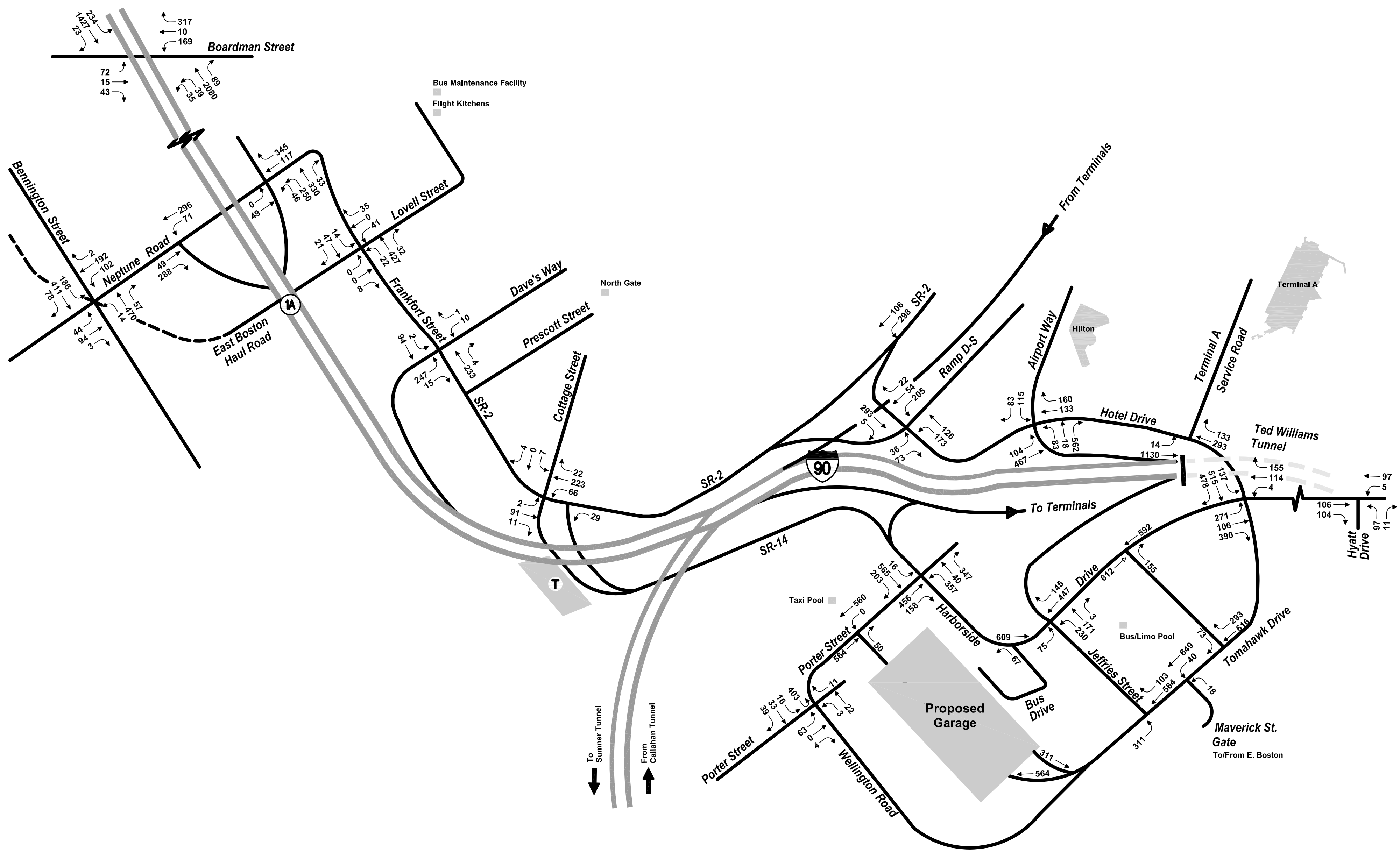

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Southwest Service Area Redevelopment Program

Logan International Airport
East Boston, Massachusetts

PGAL | PB planning collaborative

Vanasse Hangen Brustlin, Inc.

Figure 3.24

2018 Build Condition
Weekday PM Peak Hour Traffic Volumes

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	6	75	417	6	366	218
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	82	453	7	398	237
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1489	457			460	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1489	457			460	
tC, single (s)	7.4	6.3			4.3	
tC, 2 stage (s)						
tF (s)	4.4	3.4			2.4	
p0 queue free %	87	86			61	
cM capacity (veh/h)	51	592			1017	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	88	460	398	237
Volume Left	7	0	398	0
Volume Right	82	7	0	0
cSH	330	1700	1017	1700
Volume to Capacity	0.27	0.27	0.39	0.14
Queue Length 95th (ft)	29	0	53	0
Control Delay (s)	19.8	0.0	10.8	0.0
Lane LOS	C		B	
Approach Delay (s)	19.8	0.0	6.8	
Approach LOS	C			

Intersection Summary			
Average Delay	5.1		
Intersection Capacity Utilization	57.6%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	13	54	612	9	581	247
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	14	59	665	10	632	268
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2202	670			675	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2202	670			675	
tC, single (s)	6.6	6.4			4.2	
tC, 2 stage (s)						
tF (s)	3.7	3.5			2.3	
p0 queue free %	0	86			26	
cM capacity (veh/h)	11	419			858	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	73	675	632	268
Volume Left	14	0	632	0
Volume Right	59	10	0	0
cSH	53	1700	858	1700
Volume to Capacity	1.37	0.40	0.74	0.16
Queue Length 95th (ft)	185	0	189	0
Control Delay (s)	377.2	0.0	19.9	0.0
Lane LOS	F		C	
Approach Delay (s)	377.2	0.0	14.0	
Approach LOS	F			

Intersection Summary			
Average Delay	24.3		
Intersection Capacity Utilization	79.0%	ICU Level of Service	D
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
3: Curtis Street & Chelsea Street

4/20/2010

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	6	75	377	6	340	218
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	82	410	7	370	237
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1389	413			416	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1389	413			416	
tC, single (s)	7.4	6.3			4.3	
tC, 2 stage (s)						
tF (s)	4.4	3.4			2.4	
p0 queue free %	90	87			65	
cM capacity (veh/h)	64	626			1057	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	88	416	370	237
Volume Left	7	0	370	0
Volume Right	82	7	0	0
cSH	378	1700	1057	1700
Volume to Capacity	0.23	0.24	0.35	0.14
Queue Length 95th (ft)	25	0	44	0
Control Delay (s)	17.4	0.0	10.2	0.0
Lane LOS	C		B	
Approach Delay (s)	17.4	0.0	6.2	
Approach LOS	C			

Intersection Summary			
Average Delay	4.8		
Intersection Capacity Utilization	54.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↱	↑		↰	↑
Volume (veh/h)	0	40	452	0	26	558
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	43	491	0	28	607
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1154	491			491	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1154	491			491	
tC, single (s)	6.4	7.2			5.1	
tC, 2 stage (s)						
tF (s)	3.5	4.2			3.1	
p0 queue free %	100	90			96	
cM capacity (veh/h)	209	422			710	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	43	491	28	607
Volume Left	0	0	28	0
Volume Right	43	0	0	0
cSH	422	1700	710	1700
Volume to Capacity	0.10	0.29	0.04	0.36
Queue Length 95th (ft)	10	0	3	0
Control Delay (s)	14.5	0.0	10.3	0.0
Lane LOS	B		B	
Approach Delay (s)	14.5	0.0	0.5	
Approach LOS	B			

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	33.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	13	54	569	9	573	247
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	14	59	618	10	623	268
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2138	623			628	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2138	623			628	
tC, single (s)	6.6	6.4			4.2	
tC, 2 stage (s)						
tF (s)	3.7	3.5			2.3	
p0 queue free %	3	87			30	
cM capacity (veh/h)	15	447			894	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	73	628	623	268
Volume Left	14	0	623	0
Volume Right	59	10	0	0
cSH	66	1700	894	1700
Volume to Capacity	1.10	0.37	0.70	0.16
Queue Length 95th (ft)	159	0	164	0
Control Delay (s)	249.7	0.0	17.7	0.0
Lane LOS	F		C	
Approach Delay (s)	249.7	0.0	12.4	
Approach LOS	F			

Intersection Summary			
Average Delay	18.3		
Intersection Capacity Utilization	76.3%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	0	43	623	0	8	820
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	47	677	0	9	891
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1586	677			677	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1586	677			677	
tC, single (s)	6.4	7.2			5.1	
tC, 2 stage (s)						
tF (s)	3.5	4.2			3.1	
p0 queue free %	100	85			99	
cM capacity (veh/h)	117	320			587	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	47	677	9	891
Volume Left	0	0	9	0
Volume Right	47	0	0	0
cSH	320	1700	587	1700
Volume to Capacity	0.15	0.40	0.01	0.52
Queue Length 95th (ft)	14	0	1	0
Control Delay (s)	18.2	0.0	11.2	0.0
Lane LOS	C		B	
Approach Delay (s)	18.2	0.0	0.1	
Approach LOS	C			

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	46.5%	ICU Level of Service	A
Analysis Period (min)	15		

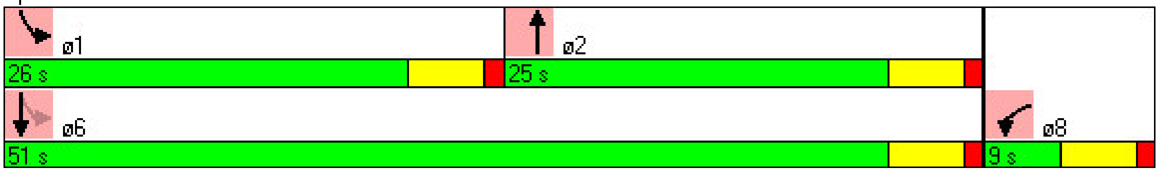
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	6	75	377	6	340	218
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	12	16	12	12	12
Right Turn on Red		Yes		Yes		
Link Speed (mph)	30		30			30
Link Distance (ft)	314		412			224
Travel Time (s)	7.1		9.4			5.1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	100%	8%	18%	0%	19%	2%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	89	0	417	0	370	237
Turn Type					pm+pt	
Protected Phases	8		2		1	6
Permitted Phases					6	
Detector Phase	8		2		1	6
Switch Phase						
Minimum Initial (s)	4.0		4.0		4.0	4.0
Minimum Split (s)	9.0		21.0		9.0	21.0
Total Split (s)	9.0	0.0	25.0	0.0	26.0	51.0
Total Split (%)	15.0%	0.0%	41.7%	0.0%	43.3%	85.0%
Yellow Time (s)	4.0		4.0		4.0	4.0
All-Red Time (s)	1.0		1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	4.0	5.0	4.0	5.0	5.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None		Min		Min	Min
v/c Ratio	0.36		0.63		0.58	0.15
Control Delay	12.7		17.3		6.8	2.1
Queue Delay	0.0		0.0		0.0	0.0
Total Delay	12.7		17.3		6.8	2.1
Queue Length 50th (ft)	2		96		31	17
Queue Length 95th (ft)	#43		220		78	31
Internal Link Dist (ft)	234		332			144
Turn Bay Length (ft)						
Base Capacity (vph)	249		988		963	1765
Starvation Cap Reductn	0		0		0	0
Spillback Cap Reductn	0		0		0	0
Storage Cap Reductn	0		0		0	0
Reduced v/c Ratio	0.36		0.42		0.38	0.13

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 41
Natural Cycle: 55
Control Type: Actuated-Uncoordinated
95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 3: Curtis Street & Chelsea Street



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	6	75	377	6	340	218
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	16	12	16	12	12	12
Total Lost time (s)	5.0		5.0		5.0	5.0
Lane Util. Factor	1.00		1.00		1.00	1.00
Frt	0.88		1.00		1.00	1.00
Flt Protected	1.00		1.00		0.95	1.00
Satd. Flow (prot)	1630		1825		1517	1863
Flt Permitted	1.00		1.00		0.31	1.00
Satd. Flow (perm)	1630		1825		490	1863
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	7	82	410	7	370	237
RTOR Reduction (vph)	78	0	1	0	0	0
Lane Group Flow (vph)	11	0	416	0	370	237
Heavy Vehicles (%)	100%	8%	18%	0%	19%	2%
Turn Type					pm+pt	
Protected Phases	8		2		1	6
Permitted Phases					6	
Actuated Green, G (s)	2.0		15.4		31.0	31.0
Effective Green, g (s)	2.0		15.4		31.0	31.0
Actuated g/C Ratio	0.05		0.36		0.72	0.72
Clearance Time (s)	5.0		5.0		5.0	5.0
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Lane Grp Cap (vph)	76		654		606	1343
v/s Ratio Prot	c0.01		0.23		c0.15	0.13
v/s Ratio Perm					c0.29	
v/c Ratio	0.14		0.64		0.61	0.18
Uniform Delay, d1	19.7		11.5		3.7	1.9
Progression Factor	1.00		1.00		1.00	1.00
Incremental Delay, d2	0.9		2.0		1.8	0.1
Delay (s)	20.5		13.5		5.5	2.0
Level of Service	C		B		A	A
Approach Delay (s)	20.5		13.5			4.1
Approach LOS	C		B			A

Intersection Summary			
HCM Average Control Delay	8.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	43.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	56.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	0	40	452	0	26	558
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	43	491	0	28	607
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			224			
pX, platoon unblocked	0.81	0.81			0.81	
vC, conflicting volume	1154	491			491	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1073	255			255	
tC, single (s)	6.4	7.2			5.1	
tC, 2 stage (s)						
tF (s)	3.5	4.2			3.1	
p0 queue free %	100	91			96	
cM capacity (veh/h)	190	482			730	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	43	491	28	607
Volume Left	0	0	28	0
Volume Right	43	0	0	0
cSH	482	1700	730	1700
Volume to Capacity	0.09	0.29	0.04	0.36
Queue Length 95th (ft)	8	0	3	0
Control Delay (s)	13.2	0.0	10.1	0.0
Lane LOS	B		B	
Approach Delay (s)	13.2	0.0	0.5	
Approach LOS	B			

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	33.8%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	13	54	569	9	573	247
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	12	16	12	12	12
Right Turn on Red		Yes		Yes		
Link Speed (mph)	30		30			30
Link Distance (ft)	314		412			224
Travel Time (s)	7.1		9.4			5.1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	20%	25%	7%	55%	15%	5%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	73	0	628	0	623	268
Turn Type					pm+pt	
Protected Phases	8		2		1	6
Permitted Phases					6	
Detector Phase	8		2		1	6
Switch Phase						
Minimum Initial (s)	4.0		4.0		4.0	4.0
Minimum Split (s)	9.0		21.0		9.0	21.0
Total Split (s)	9.0	0.0	22.0	0.0	29.0	51.0
Total Split (%)	15.0%	0.0%	36.7%	0.0%	48.3%	85.0%
Yellow Time (s)	4.0		4.0		4.0	4.0
All-Red Time (s)	1.0		1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	4.0	5.0	4.0	5.0	5.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None		Min		Min	Min
v/c Ratio	0.41		0.91		0.90	0.17
Control Delay	18.9		42.4		28.9	1.9
Queue Delay	0.0		0.0		0.0	0.0
Total Delay	18.9		42.4		28.9	1.9
Queue Length 50th (ft)	6		~303		160	20
Queue Length 95th (ft)	#49		#505		#374	35
Internal Link Dist (ft)	234		332			144
Turn Bay Length (ft)						
Base Capacity (vph)	179		692		860	1557
Starvation Cap Reductn	0		0		0	0
Spillback Cap Reductn	0		0		0	0
Storage Cap Reductn	0		0		0	0
Reduced v/c Ratio	0.41		0.91		0.72	0.17

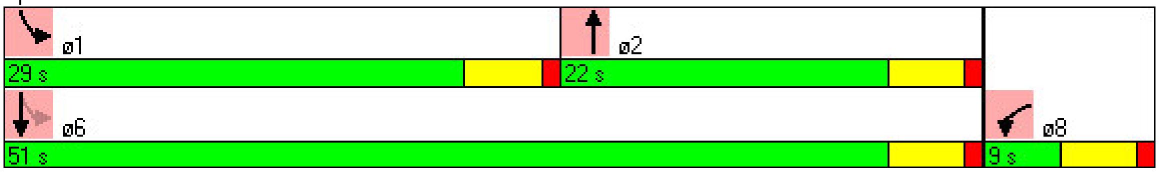
Intersection Summary	
Area Type:	Other
Cycle Length: 60	
Actuated Cycle Length: 51.4	
Natural Cycle: 80	
Control Type: Actuated-Uncoordinated	
~ Volume exceeds capacity, queue is theoretically infinite.	

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 3: Curtis Street & Chelsea Street



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	13	54	569	9	573	247
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	16	12	16	12	12	12
Total Lost time (s)	5.0		5.0		5.0	5.0
Lane Util. Factor	1.00		1.00		1.00	1.00
Frt	0.89		1.00		1.00	1.00
Flt Protected	0.99		1.00		0.95	1.00
Satd. Flow (prot)	1532		1994		1570	1810
Flt Permitted	0.99		1.00		0.17	1.00
Satd. Flow (perm)	1532		1994		286	1810
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	14	59	618	10	623	268
RTOR Reduction (vph)	57	0	1	0	0	0
Lane Group Flow (vph)	16	0	627	0	623	268
Heavy Vehicles (%)	20%	25%	7%	55%	15%	5%
Turn Type					pm+pt	
Protected Phases	8		2		1	6
Permitted Phases					6	
Actuated Green, G (s)	2.1		18.1		41.6	41.6
Effective Green, g (s)	2.1		18.1		41.6	41.6
Actuated g/C Ratio	0.04		0.34		0.77	0.77
Clearance Time (s)	5.0		5.0		5.0	5.0
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Lane Grp Cap (vph)	60		672		664	1402
v/s Ratio Prot	c0.01		0.31		c0.32	0.15
v/s Ratio Perm					c0.40	
v/c Ratio	0.27		0.93		0.94	0.19
Uniform Delay, d1	25.1		17.2		12.5	1.6
Progression Factor	1.00		1.00		1.00	1.00
Incremental Delay, d2	2.4		20.0		20.9	0.1
Delay (s)	27.5		37.2		33.3	1.7
Level of Service	C		D		C	A
Approach Delay (s)	27.5		37.2			23.8
Approach LOS	C		D			C

Intersection Summary			
HCM Average Control Delay	29.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	53.7	Sum of lost time (s)	10.0
Intersection Capacity Utilization	78.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	0	43	623	0	8	820
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	47	677	0	9	891
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			224			
pX, platoon unblocked	0.68	0.68			0.68	
vC, conflicting volume	1586	677			677	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1626	297			297	
tC, single (s)	6.4	7.2			5.1	
tC, 2 stage (s)						
tF (s)	3.5	4.2			3.1	
p0 queue free %	100	88			99	
cM capacity (veh/h)	76	383			591	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	47	677	9	891
Volume Left	0	0	9	0
Volume Right	47	0	0	0
cSH	383	1700	591	1700
Volume to Capacity	0.12	0.40	0.01	0.52
Queue Length 95th (ft)	12	0	1	0
Control Delay (s)	15.7	0.0	11.2	0.0
Lane LOS	C		B	
Approach Delay (s)	15.7	0.0	0.1	
Approach LOS	C			

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	46.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	6	75	417	6	340	244
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	82	453	7	370	265
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1461	457			460	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1461	457			460	
tC, single (s)	7.4	6.3			4.3	
tC, 2 stage (s)						
tF (s)	4.4	3.4			2.4	
p0 queue free %	88	86			64	
cM capacity (veh/h)	55	592			1017	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	88	460	370	265
Volume Left	7	0	370	0
Volume Right	82	7	0	0
cSH	345	1700	1017	1700
Volume to Capacity	0.26	0.27	0.36	0.16
Queue Length 95th (ft)	28	0	47	0
Control Delay (s)	19.0	0.0	10.5	0.0
Lane LOS	C		B	
Approach Delay (s)	19.0	0.0	6.1	
Approach LOS	C			

Intersection Summary			
Average Delay	4.7		
Intersection Capacity Utilization	56.1%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↱	↑		↰	↑
Volume (veh/h)	0	40	383	0	26	224
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	43	416	0	28	243
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	716	416			416	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	716	416			416	
tC, single (s)	6.4	7.2			5.1	
tC, 2 stage (s)						
tF (s)	3.5	4.2			3.1	
p0 queue free %	100	91			96	
cM capacity (veh/h)	382	471			766	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	43	416	28	243
Volume Left	0	0	28	0
Volume Right	43	0	0	0
cSH	471	1700	766	1700
Volume to Capacity	0.09	0.24	0.04	0.14
Queue Length 95th (ft)	9	0	3	0
Control Delay (s)	13.4	0.0	9.9	0.0
Lane LOS	B		A	
Approach Delay (s)	13.4	0.0	1.0	
Approach LOS	B			

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	30.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	13	54	612	9	573	255
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	14	59	665	10	623	277
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2193	670			675	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2193	670			675	
tC, single (s)	6.6	6.4			4.2	
tC, 2 stage (s)						
tF (s)	3.7	3.5			2.3	
p0 queue free %	0	86			28	
cM capacity (veh/h)	12	419			862	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	73	675	623	277
Volume Left	14	0	623	0
Volume Right	59	10	0	0
cSH	56	1700	862	1700
Volume to Capacity	1.30	0.40	0.72	0.16
Queue Length 95th (ft)	178	0	180	0
Control Delay (s)	339.7	0.0	19.2	0.0
Lane LOS	F		C	
Approach Delay (s)	339.7	0.0	13.3	
Approach LOS	F			

Intersection Summary			
Average Delay	22.3		
Intersection Capacity Utilization	78.6%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	0	43	578	0	8	260
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	47	628	0	9	283
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	928	628			628	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	928	628			628	
tC, single (s)	6.4	7.2			5.1	
tC, 2 stage (s)						
tF (s)	3.5	4.2			3.1	
p0 queue free %	100	86			99	
cM capacity (veh/h)	293	344			617	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	47	628	9	283
Volume Left	0	0	9	0
Volume Right	47	0	0	0
cSH	344	1700	617	1700
Volume to Capacity	0.14	0.37	0.01	0.17
Queue Length 95th (ft)	13	0	1	0
Control Delay (s)	17.1	0.0	10.9	0.0
Lane LOS	C		B	
Approach Delay (s)	17.1	0.0	0.3	
Approach LOS	C			

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	40.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	6	75	417	6	340	244
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	12	16	12	12	12
Right Turn on Red		Yes		Yes		
Link Speed (mph)	30		30			30
Link Distance (ft)	314		189			224
Travel Time (s)	7.1		4.3			5.1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	100%	8%	18%	0%	19%	14%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	89	0	460	0	370	265
Turn Type					pm+pt	
Protected Phases	8		2		1	6
Permitted Phases					6	
Detector Phase	8		2		1	6
Switch Phase						
Minimum Initial (s)	4.0		4.0		4.0	4.0
Minimum Split (s)	9.0		9.0		9.0	9.0
Total Split (s)	9.0	0.0	25.0	0.0	26.0	51.0
Total Split (%)	15.0%	0.0%	41.7%	0.0%	43.3%	85.0%
Yellow Time (s)	4.0		4.0		4.0	4.0
All-Red Time (s)	1.0		1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	4.0	5.0	4.0	5.0	5.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None		Min		None	Min
v/c Ratio	0.38		0.64		0.59	0.19
Control Delay	13.6		18.6		7.2	2.2
Queue Delay	0.0		0.0		0.0	0.0
Total Delay	13.6		18.6		7.2	2.2
Queue Length 50th (ft)	2		111		31	20
Queue Length 95th (ft)	#45		#299		85	36
Internal Link Dist (ft)	234		109			144
Turn Bay Length (ft)						
Base Capacity (vph)	234		899		901	1554
Starvation Cap Reductn	0		0		0	0
Spillback Cap Reductn	0		0		0	0
Storage Cap Reductn	0		0		0	0
Reduced v/c Ratio	0.38		0.51		0.41	0.17

Intersection Summary

Area Type: Other

Cycle Length: 60

Actuated Cycle Length: 43.7

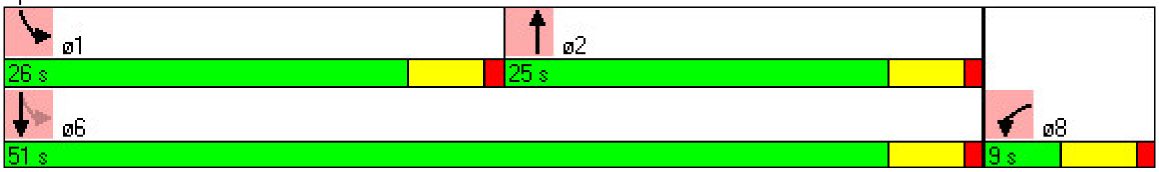
Natural Cycle: 60

Control Type: Actuated-Uncoordinated

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 3: Curtis Street & Chelsea Street



HCM Signalized Intersection Capacity Analysis
3: Curtis Street & Chelsea Street

4/20/2010

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	6	75	417	6	340	244
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	16	12	16	12	12	12
Total Lost time (s)	5.0		5.0		5.0	5.0
Lane Util. Factor	1.00		1.00		1.00	1.00
Frt	0.88		1.00		1.00	1.00
Flt Protected	1.00		1.00		0.95	1.00
Satd. Flow (prot)	1630		1825		1517	1667
Flt Permitted	1.00		1.00		0.29	1.00
Satd. Flow (perm)	1630		1825		457	1667
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	7	82	453	7	370	265
RTOR Reduction (vph)	78	0	1	0	0	0
Lane Group Flow (vph)	11	0	459	0	370	265
Heavy Vehicles (%)	100%	8%	18%	0%	19%	14%
Turn Type					pm+pt	
Protected Phases	8		2		1	6
Permitted Phases					6	
Actuated Green, G (s)	2.0		17.7		33.8	33.8
Effective Green, g (s)	2.0		17.7		33.8	33.8
Actuated g/C Ratio	0.04		0.39		0.74	0.74
Clearance Time (s)	5.0		5.0		5.0	5.0
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Lane Grp Cap (vph)	71		705		594	1230
v/s Ratio Prot	c0.01		0.25		c0.15	0.16
v/s Ratio Perm					c0.31	
v/c Ratio	0.15		0.65		0.62	0.22
Uniform Delay, d1	21.1		11.5		4.0	1.9
Progression Factor	1.00		1.00		1.00	1.00
Incremental Delay, d2	1.0		2.2		2.0	0.1
Delay (s)	22.1		13.7		6.0	2.0
Level of Service	C		B		A	A
Approach Delay (s)	22.1		13.7			4.3
Approach LOS	C		B			A

Intersection Summary			
HCM Average Control Delay	9.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	45.8	Sum of lost time (s)	10.0
Intersection Capacity Utilization	58.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	0	40	383	0	26	224
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	43	416	0	28	243
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						189
pX, platoon unblocked	1.00					
vC, conflicting volume	716	416			416	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	715	416			416	
tC, single (s)	6.4	7.2			5.1	
tC, 2 stage (s)						
tF (s)	3.5	4.2			3.1	
p0 queue free %	100	91			96	
cM capacity (veh/h)	382	471			766	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	43	416	28	243
Volume Left	0	0	28	0
Volume Right	43	0	0	0
cSH	471	1700	766	1700
Volume to Capacity	0.09	0.24	0.04	0.14
Queue Length 95th (ft)	9	0	3	0
Control Delay (s)	13.4	0.0	9.9	0.0
Lane LOS	B		A	
Approach Delay (s)	13.4	0.0	1.0	
Approach LOS	B			

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	30.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	13	54	612	9	573	255
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	12	16	12	12	12
Grade (%)	0%		0%			0%
Storage Length (ft)	0	0		0	0	
Storage Lanes	1	0		0	1	
Taper Length (ft)	25	25		25	25	
Right Turn on Red		Yes		Yes		
Link Speed (mph)	30		30			30
Link Distance (ft)	314		198			224
Travel Time (s)	7.1		4.5			5.1
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	20%	25%	13%	55%	14%	8%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%		0%			0%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	73	0	675	0	623	277
Turn Type					pm+pt	
Protected Phases	8		2		1	6
Permitted Phases					6	
Detector Phase	8		2		1	6
Switch Phase						
Minimum Initial (s)	4.0		4.0		4.0	4.0
Minimum Split (s)	9.0		9.0		9.0	9.0
Total Split (s)	9.0	0.0	24.0	0.0	27.0	51.0
Total Split (%)	15.0%	0.0%	40.0%	0.0%	45.0%	85.0%
Yellow Time (s)	4.0		4.0		4.0	4.0
All-Red Time (s)	1.0		1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	4.0	5.0	4.0	5.0	5.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None		Min		None	Min
v/c Ratio	0.42		0.97		0.92	0.18
Control Delay	19.5		52.2		33.3	1.9
Queue Delay	0.0		0.0		0.0	0.0
Total Delay	19.5		52.2		33.3	1.9
Queue Length 50th (ft)	6		~329		173	21
Queue Length 95th (ft)	#49		#537		#393	37
Internal Link Dist (ft)	234		118			144
Turn Bay Length (ft)						
Base Capacity (vph)	173		695		777	1513
Starvation Cap Reductn	0		0		0	0
Spillback Cap Reductn	0		0		0	0

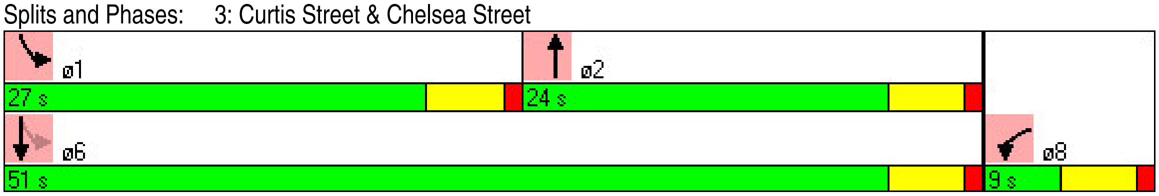
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Storage Cap Reductn	0		0		0	0
Reduced v/c Ratio	0.42		0.97		0.80	0.18

Intersection Summary	
Area Type:	Other
Cycle Length: 60	
Actuated Cycle Length: 53.2	
Natural Cycle: 90	
Control Type: Actuated-Uncoordinated	

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Curtis Street & Chelsea Street



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	13	54	612	9	573	255
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	16	12	16	12	12	12
Total Lost time (s)	5.0		5.0		5.0	5.0
Lane Util. Factor	1.00		1.00		1.00	1.00
Frt	0.89		1.00		1.00	1.00
Flt Protected	0.99		1.00		0.95	1.00
Satd. Flow (prot)	1532		1891		1583	1759
Flt Permitted	0.99		1.00		0.16	1.00
Satd. Flow (perm)	1532		1891		270	1759
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	14	59	665	10	623	277
RTOR Reduction (vph)	57	0	1	0	0	0
Lane Group Flow (vph)	16	0	674	0	623	277
Heavy Vehicles (%)	20%	25%	13%	55%	14%	8%
Turn Type					pm+pt	
Protected Phases	8		2		1	6
Permitted Phases					6	
Actuated Green, G (s)	2.1		19.7		43.3	43.3
Effective Green, g (s)	2.1		19.7		43.3	43.3
Actuated g/C Ratio	0.04		0.36		0.78	0.78
Clearance Time (s)	5.0		5.0		5.0	5.0
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Lane Grp Cap (vph)	58		672		652	1375
v/s Ratio Prot	c0.01		0.36		c0.32	0.16
v/s Ratio Perm					c0.43	
v/c Ratio	0.28		1.00		0.96	0.20
Uniform Delay, d1	25.9		17.8		13.5	1.6
Progression Factor	1.00		1.00		1.00	1.00
Incremental Delay, d2	2.6		35.6		24.5	0.1
Delay (s)	28.5		53.4		38.0	1.6
Level of Service	C		D		D	A
Approach Delay (s)	28.5		53.4			26.8
Approach LOS	C		D			C

Intersection Summary			
HCM Average Control Delay	37.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	55.4	Sum of lost time (s)	10.0
Intersection Capacity Utilization	81.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	0	43	578	0	8	260
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	47	628	0	9	283
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						198
pX, platoon unblocked	0.99					
vC, conflicting volume	928	628			628	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	920	628			628	
tC, single (s)	6.4	7.2			5.1	
tC, 2 stage (s)						
tF (s)	3.5	4.2			3.1	
p0 queue free %	100	86			99	
cM capacity (veh/h)	292	344			617	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	47	628	9	283
Volume Left	0	0	9	0
Volume Right	47	0	0	0
cSH	344	1700	617	1700
Volume to Capacity	0.14	0.37	0.01	0.17
Queue Length 95th (ft)	13	0	1	0
Control Delay (s)	17.1	0.0	10.9	0.0
Lane LOS	C		B	
Approach Delay (s)	17.1	0.0	0.3	
Approach LOS	C			

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	40.4%	ICU Level of Service	A
Analysis Period (min)	15		

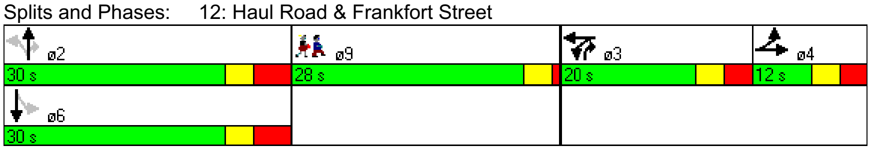
3. Southern Terminus Traffic Analysis

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	ø9
Lane Configurations													
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width (ft)	16	16	16	12	12	12	12	12	12	12	12	12	
Grade (%)		0%			0%			0%			0%		
Storage Length (ft)	0		0	0		0	0		0	0		0	
Storage Lanes	0		0	0		0	0		1	0		0	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Leading Detector (ft)	50	50		50	50		50	50	50	50	50		
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0		
Turning Speed (mph)	15		9	15		9	15		9	15		9	
Right Turn on Red			No			Yes			No			Yes	
Link Speed (mph)		30			30			30			30		
Link Distance (ft)		366			643			160			601		
Travel Time (s)		8.3			14.6			3.6			13.7		
Volume (vph)	2	3	64	142	10	52	47	201	137	41	76	120	
Confl. Peds. (#/hr)													
Confl. Bikes (#/hr)													
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.79	0.92	0.92	0.86	0.92	
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
Heavy Vehicles (%)	50%	33%	30%	20%	60%	20%	68%	14%	20%	25%	67%	8%	
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0	
Parking (#/hr)													
Mid-Block Traffic (%)		0%			0%			0%			0%		
Lane Group Flow (vph)	0	75	0	0	222	0	0	305	149	0	263	0	
Turn Type	Split			Split			Perm		pm+ov	Perm			
Protected Phases	4	4		3	3			2	3		6		9
Permitted Phases							2		2	6			
Detector Phases	4	4		3	3		2	2	3	6	6		
Minimum Initial (s)	6.0	6.0		6.0	6.0		10.0	10.0	6.0	10.0	10.0		4.0
Minimum Split (s)	12.0	12.0		13.0	13.0		17.0	17.0	13.0	17.0	17.0		28.0
Total Split (s)	12.0	12.0	0.0	20.0	20.0	0.0	30.0	30.0	20.0	30.0	30.0	0.0	28.0
Total Split (%)	13.3%	13.3%	0.0%	22.2%	22.2%	0.0%	33.3%	33.3%	22.2%	33.3%	33.3%	0.0%	31%
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0
All-Red Time (s)	3.0	3.0		3.0	3.0		4.0	4.0	3.0	4.0	4.0		1.0
Lead/Lag	Lag	Lag		Lead	Lead				Lead				
Lead-Lag Optimize?													
Recall Mode	None	None		None	None		C-Max	C-Max	None	C-Max	C-Max		None
v/c Ratio		0.59			0.71			0.42	0.14		0.45		
Control Delay		59.1			44.7			16.7	3.9		18.1		
Queue Delay		22.8			3.1			1.9	0.6		0.2		
Total Delay		81.9			47.9			18.7	4.4		18.3		
Queue Length 50th (ft)		42			105			94	7		65		
Queue Length 95th (ft)		#102			#236			137	54		#219		
Internal Link Dist (ft)		286			563			80			521		
Turn Bay Length (ft)													
Base Capacity (vph)		128			322			731	1056		581		
Starvation Cap Reductn		0			0			280	620		0		
Spillback Cap Reductn		42			41			0	0		42		
Storage Cap Reductn		0			0			0	0		0		
Reduced v/c Ratio		0.87			0.79			0.68	0.34		0.49		

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green, Master Intersection
Natural Cycle: 90
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 12: Haul Road & Frankfort Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	16	16	16	12	12	12	12	12	12	12	12	12
Total Lost time (s)		4.0			4.0			4.0	4.0		4.0	
Lane Util. Factor		1.00			1.00			1.00	1.00		1.00	
Frt		0.87			0.97			1.00	0.85		0.93	
Flt Protected		1.00			0.97			0.99	1.00		0.99	
Satd. Flow (prot)		1439			1453			1532	1346		1346	
Flt Permitted		1.00			0.97			0.91	1.00		0.90	
Satd. Flow (perm)		1439			1453			1406	1346		1228	
Volume (vph)	2	3	64	142	10	52	47	201	137	41	76	120
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.79	0.92	0.92	0.86	0.92
Adj. Flow (vph)	2	3	70	154	11	57	51	254	149	45	88	130
RTOR Reduction (vph)	0	0	0	0	14	0	0	0	0	0	28	0
Lane Group Flow (vph)	0	75	0	0	208	0	0	305	149	0	235	0
Heavy Vehicles (%)	50%	33%	30%	20%	60%	20%	68%	14%	20%	25%	67%	8%
Turn Type	Split			Split			Perm		pm+ov	Perm		
Protected Phases	4	4		3	3			2	3		6	
Permitted Phases							2		2	6		
Actuated Green, G (s)		4.8			16.5			40.9	57.4		40.9	
Effective Green, g (s)		6.8			18.5			43.9	62.4		43.9	
Actuated g/C Ratio		0.08			0.21			0.49	0.69		0.49	
Clearance Time (s)		6.0			6.0			7.0	6.0		7.0	
Vehicle Extension (s)		2.0			2.0			2.0	2.0		2.0	
Lane Grp Cap (vph)		109			299			686	933		599	
v/s Ratio Prot		c0.05			c0.14				0.03			
v/s Ratio Perm								c0.22	0.08		0.19	
v/c Ratio		0.69			0.70			0.44	0.16		0.39	
Uniform Delay, d1		40.6			33.2			15.1	4.8		14.6	
Progression Factor		1.00			1.00			0.80	0.94		1.00	
Incremental Delay, d2		13.4			5.6			2.0	0.0		1.9	
Delay (s)		54.0			38.8			14.1	4.5		16.5	
Level of Service		D			D			B	A		B	
Approach Delay (s)		54.0			38.8			10.9			16.5	
Approach LOS		D			D			B			B	

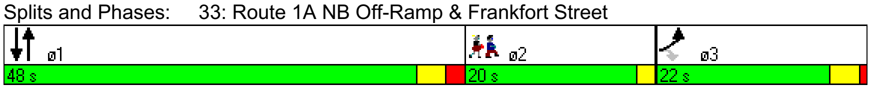
Intersection Summary			
HCM Average Control Delay	21.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.8
Intersection Capacity Utilization	55.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR	ø2
Lane Configurations	↰	↱		↑	↑		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Lane Width (ft)	12	12	12	12	12	12	
Grade (%)	0%			0%	0%		
Storage Length (ft)	0	0	0			0	
Storage Lanes	1	1	0			0	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	
Leading Detector (ft)	50	50		50	50		
Trailing Detector (ft)	0	0		0	0		
Turning Speed (mph)	15	9	15			9	
Right Turn on Red		Yes				Yes	
Link Speed (mph)	30			30	30		
Link Distance (ft)	499			1394	160		
Travel Time (s)	11.3			31.7	3.6		
Volume (vph)	74	8	0	311	278	0	
Confl. Peds. (#/hr)							
Confl. Bikes (#/hr)							
Peak Hour Factor	0.93	0.93	0.91	0.91	0.88	0.88	
Growth Factor	100%	100%	100%	100%	100%	100%	
Heavy Vehicles (%)	18%	0%	0%	20%	15%	0%	
Bus Blockages (#/hr)	0	0	0	0	0	0	
Parking (#/hr)							
Mid-Block Traffic (%)	0%			0%	0%		
Lane Group Flow (vph)	80	9	0	342	316	0	
Turn Type		Perm					
Protected Phases	3			1	1		2
Permitted Phases		3					
Detector Phases	3	3		1	1		
Minimum Initial (s)	8.0	8.0		8.0	8.0		1.0
Minimum Split (s)	12.0	12.0		13.0	13.0		20.0
Total Split (s)	22.0	22.0	0.0	48.0	48.0	0.0	20.0
Total Split (%)	24.4%	24.4%	0.0%	53.3%	53.3%	0.0%	22%
Yellow Time (s)	3.0	3.0		3.0	3.0		2.0
All-Red Time (s)	1.0	1.0		2.0	2.0		0.0
Lead/Lag				Lead	Lead		Lag
Lead-Lag Optimize?							
Recall Mode	None	None		C-Max	C-Max		None
v/c Ratio	0.49	0.05		0.27	0.24		
Control Delay	47.5	19.5		5.7	9.8		
Queue Delay	0.9	0.0		0.0	1.4		
Total Delay	48.4	19.5		5.7	11.2		
Queue Length 50th (ft)	44	0		33	48		
Queue Length 95th (ft)	86	14		168	250		
Internal Link Dist (ft)	419			1314	80		
Turn Bay Length (ft)							
Base Capacity (vph)	306	330		1259	1313		
Starvation Cap Reductn	0	0		0	791		
Spillback Cap Reductn	94	0		30	0		
Storage Cap Reductn	0	0		0	0		
Reduced v/c Ratio	0.38	0.03		0.28	0.61		

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 12 (13%), Referenced to phase 1:NBSB, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated

Splits and Phases: 33: Route 1A NB Off-Ramp & Frankfort Street



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	
Frt	1.00	0.85		1.00	1.00	
Flt Protected	0.95	1.00		1.00	1.00	
Satd. Flow (prot)	1530	1615		1583	1652	
Flt Permitted	0.95	1.00		1.00	1.00	
Satd. Flow (perm)	1530	1615		1583	1652	
Volume (vph)	74	8	0	311	278	0
Peak-hour factor, PHF	0.93	0.93	0.91	0.91	0.88	0.88
Adj. Flow (vph)	80	9	0	342	316	0
RTOR Reduction (vph)	0	8	0	0	0	0
Lane Group Flow (vph)	80	1	0	342	316	0
Heavy Vehicles (%)	18%	0%	0%	20%	15%	0%
Turn Type		Perm				
Protected Phases	3			1	1	
Permitted Phases		3				
Actuated Green, G (s)	8.1	8.1		67.3	67.3	
Effective Green, g (s)	8.1	8.1		68.3	68.3	
Actuated g/C Ratio	0.09	0.09		0.76	0.76	
Clearance Time (s)	4.0	4.0		5.0	5.0	
Vehicle Extension (s)	2.0	2.0		2.0	2.0	
Lane Grp Cap (vph)	138	145		1201	1254	
v/s Ratio Prot	c0.05			c0.22	0.19	
v/s Ratio Perm		0.00				
v/c Ratio	0.58	0.01		0.28	0.25	
Uniform Delay, d1	39.3	37.3		3.3	3.2	
Progression Factor	1.00	1.00		1.00	1.88	
Incremental Delay, d2	3.6	0.0		0.6	0.4	
Delay (s)	43.0	37.3		3.9	6.5	
Level of Service	D	D		A	A	
Approach Delay (s)	42.4			3.9	6.5	
Approach LOS	D			A	A	

Intersection Summary			
HCM Average Control Delay	9.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	13.6
Intersection Capacity Utilization	29.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Intersection: 12: Haul Road & Frankfort Street

Movement	EB	WB	NB	NB	SB
Directions Served	LTR	LTR	LT	R	LTR
Maximum Queue (ft)	149	266	120	82	235
Average Queue (ft)	79	139	87	25	110
95th Queue (ft)	152	240	141	66	221
Link Distance (ft)	336	603	104	104	536
Upstream Blk Time (%)			12	0	
Queuing Penalty (veh)			24	0	
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 33: Route 1A NB Off-Ramp & Frankfort Street

Movement	EB	EB	NB	SB
Directions Served	L	R	T	T
Maximum Queue (ft)	146	30	172	134
Average Queue (ft)	65	6	74	65
95th Queue (ft)	127	24	167	149
Link Distance (ft)	465	465	1355	104
Upstream Blk Time (%)				6
Queuing Penalty (veh)				16
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Nework Summary

Network wide Queuing Penalty: 40

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	ø9
Lane Configurations													
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width (ft)	16	16	16	12	12	12	12	12	12	12	12	12	
Grade (%)		0%			0%			0%			0%		
Storage Length (ft)	0		0	0		0	0		0	0		0	
Storage Lanes	0		0	0		0	0		1	0		0	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Leading Detector (ft)	50	50		50	50		50	50	50	50	50		
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0		
Turning Speed (mph)	15		9	15		9	15		9	15		9	
Right Turn on Red			No			Yes			No			Yes	
Link Speed (mph)		30			30			30			30		
Link Distance (ft)		423			1116			160			600		
Travel Time (s)		9.6			25.4			3.6			13.6		
Volume (vph)	0	4	55	234	4	31	53	401	259	36	14	130	
Confl. Peds. (#/hr)													
Confl. Bikes (#/hr)													
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.95	0.95	0.95	0.92	0.69	0.92	
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
Heavy Vehicles (%)	0%	0%	36%	20%	50%	20%	72%	4%	15%	25%	4%	8%	
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0	
Parking (#/hr)													
Mid-Block Traffic (%)		0%			0%			0%			0%		
Lane Group Flow (vph)	0	64	0	0	292	0	0	478	273	0	200	0	
Turn Type	Split			Split			Perm		pm+ov	Perm			
Protected Phases	4	4		3	3			2	3		6		9
Permitted Phases							2		2	6			
Detector Phases	4	4		3	3		2	2	3	6	6		
Minimum Initial (s)	6.0	6.0		6.0	6.0		10.0	10.0	6.0	10.0	10.0		1.0
Minimum Split (s)	12.0	12.0		13.0	13.0		17.0	17.0	13.0	17.0	17.0		28.0
Total Split (s)	12.0	12.0	0.0	24.0	24.0	0.0	36.0	36.0	24.0	36.0	36.0	0.0	28.0
Total Split (%)	12.0%	12.0%	0.0%	24.0%	24.0%	0.0%	36.0%	36.0%	24.0%	36.0%	36.0%	0.0%	28%
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0
All-Red Time (s)	3.0	3.0		3.0	3.0		4.0	4.0	3.0	4.0	4.0		1.0
Lead/Lag	Lag	Lag		Lead	Lead				Lead				
Lead-Lag Optimize?													
Recall Mode	None	None		None	None		C-Max	C-Max	None	None	None		None
v/c Ratio		0.57			0.71			0.61	0.24		0.43		
Control Delay		65.2			43.5			21.1	4.0		12.0		
Queue Delay		22.8			2.8			10.9	0.9		0.8		
Total Delay		88.0			46.3			32.0	4.9		12.9		
Queue Length 50th (ft)		40			155			176	9		25		
Queue Length 95th (ft)		#97			#352			m#472	m136		58		
Internal Link Dist (ft)		343			1036			80			520		
Turn Bay Length (ft)													
Base Capacity (vph)		112			413			787	1134		469		
Starvation Cap Reductn		0			0			280	599		0		
Spillback Cap Reductn		37			52			0	0		99		
Storage Cap Reductn		0			0			0	0		0		
Reduced v/c Ratio		0.85			0.81			0.94	0.51		0.54		

Intersection Summary

Area Type: Other

Cycle Length: 100

Actuated Cycle Length: 100

Offset: 0 (0%), Referenced to phase 2:NBTL, Start of Green, Master Intersection

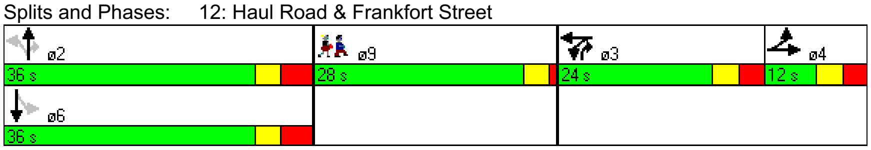
Natural Cycle: 90

Control Type: Actuated-Coordinated

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 12: Haul Road & Frankfort Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	16	16	16	12	12	12	12	12	12	12	12	12
Total Lost time (s)		4.0			4.0			4.0	4.0		4.0	
Lane Util. Factor		1.00			1.00			1.00	1.00		1.00	
Frt		0.87			0.98			1.00	0.85		0.90	
Flt Protected		1.00			0.96			0.99	1.00		0.99	
Satd. Flow (prot)		1406			1488			1687	1404		1535	
Flt Permitted		1.00			0.96			0.94	1.00		0.81	
Satd. Flow (perm)		1406			1488			1596	1404		1254	
Volume (vph)	0	4	55	234	4	31	53	401	259	36	14	130
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.95	0.95	0.95	0.92	0.69	0.92
Adj. Flow (vph)	0	4	60	254	4	34	56	422	273	39	20	141
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	0	0	70	0
Lane Group Flow (vph)	0	64	0	0	288	0	0	478	273	0	130	0
Heavy Vehicles (%)	0%	0%	36%	20%	50%	20%	72%	4%	15%	25%	4%	8%
Turn Type	Split			Split			Perm		pm+ov	Perm		
Protected Phases	4	4		3	3			2	3		6	
Permitted Phases							2		2	6		
Actuated Green, G (s)		4.8			25.4			42.0	67.4		42.0	
Effective Green, g (s)		6.8			27.4			45.0	72.4		45.0	
Actuated g/C Ratio		0.07			0.27			0.45	0.72		0.45	
Clearance Time (s)		6.0			6.0			7.0	6.0		7.0	
Vehicle Extension (s)		2.0			2.0			2.0	2.0		2.0	
Lane Grp Cap (vph)		96			408			718	1016		564	
v/s Ratio Prot		c0.05			c0.19				0.07			
v/s Ratio Perm								c0.30	0.12		0.10	
v/c Ratio		0.67			0.71			0.67	0.27		0.23	
Uniform Delay, d1		45.5			32.7			21.6	4.7		16.9	
Progression Factor		1.00			1.00			0.76	1.01		1.00	
Incremental Delay, d2		12.7			4.5			3.8	0.0		0.1	
Delay (s)		58.2			37.2			20.2	4.8		17.0	
Level of Service		E			D			C	A		B	
Approach Delay (s)		58.2			37.2			14.6			17.0	
Approach LOS		E			D			B			B	

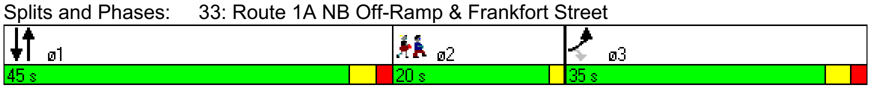
Intersection Summary			
HCM Average Control Delay	22.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.8
Intersection Capacity Utilization	66.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR	ø2
Lane Configurations							
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Lane Width (ft)	12	12	12	12	12	12	
Grade (%)	0%			0%	0%		
Storage Length (ft)	0	0	0			0	
Storage Lanes	1	1	0			0	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	
Leading Detector (ft)	50	50		50	50		
Trailing Detector (ft)	0	0		0	0		
Turning Speed (mph)	15	9	15			9	
Right Turn on Red		Yes				Yes	
Link Speed (mph)	30			30	30		
Link Distance (ft)	499			1394	160		
Travel Time (s)	11.3			31.7	3.6		
Volume (vph)	291	14	0	422	302	0	
Confl. Peds. (#/hr)							
Confl. Bikes (#/hr)							
Peak Hour Factor	0.80	0.80	0.90	0.90	0.74	0.74	
Growth Factor	100%	100%	100%	100%	100%	100%	
Heavy Vehicles (%)	4%	1%	0%	15%	18%	0%	
Bus Blockages (#/hr)	0	0	0	0	0	0	
Parking (#/hr)							
Mid-Block Traffic (%)	0%			0%	0%		
Lane Group Flow (vph)	364	18	0	469	408	0	
Turn Type		Perm					
Protected Phases	3			1	1		2
Permitted Phases		3					
Detector Phases	3	3		1	1		
Minimum Initial (s)	6.0	6.0		10.0	10.0		1.0
Minimum Split (s)	11.0	11.0		24.0	24.0		20.0
Total Split (s)	35.0	35.0	0.0	45.0	45.0	0.0	20.0
Total Split (%)	35.0%	35.0%	0.0%	45.0%	45.0%	0.0%	20%
Yellow Time (s)	3.0	3.0		3.0	3.0		2.0
All-Red Time (s)	2.0	2.0		2.0	2.0		0.0
Lead/Lag				Lead	Lead		Lag
Lead-Lag Optimize?							
Recall Mode	None	None		C-Max	C-Max		None
v/c Ratio	0.84	0.04		0.45	0.40		
Control Delay	53.1	11.0		14.4	18.0		
Queue Delay	1.4	0.0		0.1	2.7		
Total Delay	54.6	11.0		14.6	20.8		
Queue Length 50th (ft)	219	0		125	66		
Queue Length 95th (ft)	260	13		361	254		
Internal Link Dist (ft)	419			1314	80		
Turn Bay Length (ft)							
Base Capacity (vph)	538	508		1043	1017		
Starvation Cap Reductn	0	0		0	480		
Spillback Cap Reductn	60	0		101	0		
Storage Cap Reductn	0	0		0	0		
Reduced v/c Ratio	0.76	0.04		0.50	0.76		

Intersection Summary

Area Type: Other
Cycle Length: 100
Actuated Cycle Length: 100
Offset: 31 (31%), Referenced to phase 1:NBSB, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated

Splits and Phases: 33: Route 1A NB Off-Ramp & Frankfort Street



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	
Frt	1.00	0.85		1.00	1.00	
Flt Protected	0.95	1.00		1.00	1.00	
Satd. Flow (prot)	1736	1599		1652	1610	
Flt Permitted	0.95	1.00		1.00	1.00	
Satd. Flow (perm)	1736	1599		1652	1610	
Volume (vph)	291	14	0	422	302	0
Peak-hour factor, PHF	0.80	0.80	0.90	0.90	0.74	0.74
Adj. Flow (vph)	364	18	0	469	408	0
RTOR Reduction (vph)	0	14	0	0	0	0
Lane Group Flow (vph)	364	4	0	469	408	0
Heavy Vehicles (%)	4%	1%	0%	15%	18%	0%
Turn Type		Perm				
Protected Phases	3			1	1	
Permitted Phases		3				
Actuated Green, G (s)	23.8	23.8		60.6	60.6	
Effective Green, g (s)	24.8	24.8		61.6	61.6	
Actuated g/C Ratio	0.25	0.25		0.62	0.62	
Clearance Time (s)	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.0	2.0		2.0	2.0	
Lane Grp Cap (vph)	431	397		1018	992	
v/s Ratio Prot	c0.21			c0.28	0.25	
v/s Ratio Perm		0.00				
v/c Ratio	0.84	0.01		0.46	0.41	
Uniform Delay, d1	35.8	28.4		10.3	9.9	
Progression Factor	1.00	1.00		1.00	1.36	
Incremental Delay, d2	13.5	0.0		1.5	1.1	
Delay (s)	49.3	28.4		11.8	14.5	
Level of Service	D	C		B	B	
Approach Delay (s)	48.3			11.8	14.5	
Approach LOS	D			B	B	

Intersection Summary			
HCM Average Control Delay	23.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	13.6
Intersection Capacity Utilization	45.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Intersection: 12: Haul Road & Frankfort Street

Movement	EB	WB	NB	NB	SB
Directions Served	LTR	LTR	LT	R	LTR
Maximum Queue (ft)	174	350	123	107	255
Average Queue (ft)	110	204	110	35	91
95th Queue (ft)	202	331	133	90	216
Link Distance (ft)	391	1076	103	103	535
Upstream Blk Time (%)			37	1	
Queuing Penalty (veh)			131	3	
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 33: Route 1A NB Off-Ramp & Frankfort Street

Movement	EB	EB	NB	SB
Directions Served	L	R	T	T
Maximum Queue (ft)	313	30	1123	134
Average Queue (ft)	179	7	566	79
95th Queue (ft)	300	27	1060	148
Link Distance (ft)	465	465	1355	103
Upstream Blk Time (%)				12
Queuing Penalty (veh)				35
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Nework Summary

Network wide Queuing Penalty: 169

Appendix D
Natural Heritage and Endangered Species Program Correspondence

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

September 7, 2010

Ms. Amy Coman
Endangered Species Review Assistant
Natural Heritage and Endangered Species Program
MA Division of Fisheries and Wildlife
North Drive, Rte. 135
Westborough, MA 01581

Re: Proposed East Boston-Chelsea Bypass, East Boston, Massachusetts

Dear Ms. Coman,

The Massachusetts Port Authority is planning for construction and operation of a new limited access roadway designed to remove airport traffic from local roads, thereby reducing congestion in East Boston, MA. This project includes construction of a new roadway between Lovell Street and Chelsea Street, just east of the Chelsea River in East Boston. The principal road alignment is an abandoned CSX rail corridor that runs in a depressed cut between Lovell Street at the airport boundary and Chelsea Street near the new Chelsea Street Bridge. The approximate boundaries of this site are identified on the attached copy of the USGS Quadrangle sheet (1:25,000 scale).

The new two-lane roadway will be approximately 2,225 feet long on a project site totaling approximately 4.4 acres. The average width of the corridor is approximately 32-feet. Sections of the rail road track, ties and track ballast are still present along the roadway, however much of the corridor is covered with debris.

The MA Natural Heritage Atlas, 13th Edition, October 2008 indicates that no portion of the project site occurs within Estimated Habitat of Rare Wildlife or Priority Habitat of Rare Species. Accordingly, the project would not be required to be reviewed for compliance with the rare wildlife species section of the MA Wetland Protection Act Regulations or the MA Endangered Species Act Regulations.

We would appreciate your concurrence that no further review from the Massachusetts Natural Heritage and Endangered Species Program is required for this project.

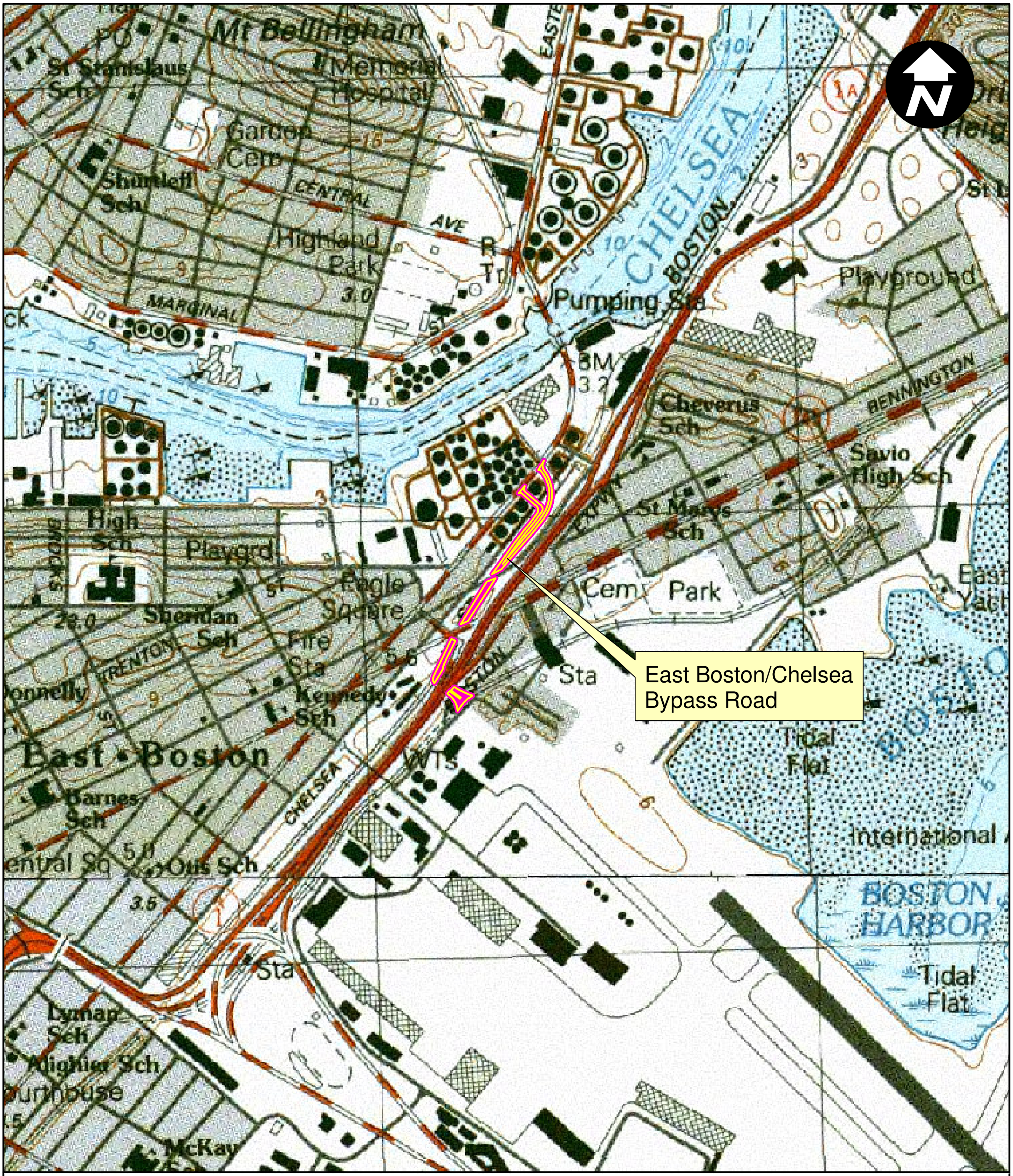
Please contact me at (617) 568-3524 if you have any questions or require any additional information.

Sincerely,

MASSACHUSETTS PORT AUTHORITY

Stewart Dalzell
Deputy Director of Environmental Planning and Permitting

Enclosures



massport

Map Source: Office of Geographic Information (MassGIS), Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs

Locus Map

MPA Project No. L-932

East Boston/ Chelsea Bypass Road

From: Coman, Amy (FWE) [mailto:Amy.Coman@state.ma.us]
Sent: Wednesday, September 22, 2010 3:37 PM
To: Dalzell, Stewart
Subject: RE: Massport - Proposed Eat Boston-Chelsea Bypass Road

September 22, 2010

RE: Massport Proposed East Boston-Chelsea Bypass Road, CSX Rail ROW, between Bremen Street & East Boston Express Way
NHESP Tracking No. 10-28645

Dear Mr. Dalzell:

Thank you for submitting your letter dated September 7, 2010 regarding above referenced project to the Natural Heritage & Endangered Species Program (NHESP) of the Massachusetts Division of Fisheries & Wildlife.

Based on a review of the information that was provided and the information that is currently contained in our database, the NHESP has determined that this project, as currently proposed, **does not occur within Estimated Habitat of Rare Wildlife or Priority Habitat** as indicated in the *Massachusetts Natural Heritage Atlas* (13th Edition). Therefore, the project is not required to be reviewed for compliance with the rare wildlife species section of the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.37, 10.59 & 10.58(4)(b)) or the MA Endangered Species Act Regulations (321 CMR 10.18).

Please do not hesitate to contact our office should you have questions regarding this response.

Thank you,

Amy Coman | Endangered Species Review Assistant
Natural Heritage & Endangered Species Program
MA Division of Fisheries & Wildlife
1 Rabbit Hill Rd | Westborough, MA 01581
tel: 508.389.6364 | fax: 508.389.7891